Animals in Roman Spectacles: A Study of the Interplay Between Spectacle Design and Animal Behaviour

by

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Kathryn Elizabeth LaPenna
June 2024

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SUMMARY

This thesis explores the active role that animals played in influencing the design of hunting spectacles (*venationes*) that were staged in Rome and throughout the Empire from the end of the 1st century BCE to the early 6th century CE. It starts with the premise that animals were not simply cultural objects, but also sentient beings with a specific set of biological characteristics and behavioural repertoires that informed how the Romans used and interacted with animals inside the arena. This confluence of animal behaviour and spectacle design shapes the central questions underlying this study: 1) What behavioural affordances and demands did animals offer, and impose on, the production of *venationes*? 2) What knowledge did the Romans bring to bear in their responses to animal participants, and how was this informed by human-animal interactions beyond the arena? 3) Are new historical interpretations of *venationes* made possible by considering the animals' perspective? Specifically: 3a) What does the evidence say about the animals' lived experiences in the arena? 3b) How does this exposure of the animals' lived experiences provide a new perspective and interpretation of the history of *venationes* that is beyond the human and inclusive of the animals? Over the course of four chapters, I explore the influence of animal behaviour on the design of *venationes* and the relational manner in which the Romans responded to, and accommodated the natural propensities of, the animals they displayed. Modern animal science knowledge, together with my empirical observations of modern zoo management, are used to help expose and explain the practicalities of spectacle design.

Chapter 1 examines the design components of Roman entertainment buildings that met the operational needs of the *venationes.* The range of safety barriers and holding facilities used to accommodate and confine particular animals are described, with reference to the locomotor capability of each animal. As a point of comparison, the design of modern zoo exhibits is also considered. It is shown in chapter 1 that the Romans drew from existing methods of hunting and capturing animals in the wild to develop flexible safety provisions that could be adapted for a wide range of species, performances, and venues. It is also observed that the design of these provisions took into consideration the needs of the human performers and spectators, in addition to the animals. An integrated approach to facility design is proposed for future research.

Chapter 2 investigates the casting process where animals were chosen to play particular roles in the arena. The nature of roles such as "quarry", "combatant" and "hunting aid" are explored, along with others such as "curiosity", "executioner" and "trained performer". It is shown in chapter 2 that when animals entered the arena, they did so as both cultural *and* biological beings. Further is shown that the animals' characteristic affordances

and cultural significance in Roman society created opportunities for *editores* to exploit animals in myriad roles in pursuit of maximum display impact. Overall, this chapter highlights the potential of animal behaviour to influence the choreography of *venationes* and facilitate performances that were of historical and cultural significance to the spectators.

Chapter 3 explores the design and manipulation of stimuli used in human-animal interactions in the *venationes.* The stimuli were associated with the senses of touch, sight, sound, smell, and taste. Using environmental enrichment (EE) as a model for animal stimulation, this chapter discusses the many and varied ways in which animals may have responded to sensory cues. The chapter then examines how human performers benefited from these animal responses, along with the question of how the responses affected the animals' experiences inside the arena. I argue that the Romans were mindful of the different sensory orientations of animals and used techniques drawn from agriculture and hunting contexts to stimulate the animals in ways that were appropriate to their performing roles.

Chapter 4 focuses on practical considerations governing the *venationes* staged from the late 3rd century CE until their cessation in the early 6th century CE. It begins with an examination of what I term 'games of evasion', where human performers evaded animals (most commonly bears) using a variety of non-lethal apparatuses that were designed to excite frustration in the animals, rather than maim them. The context in which these displays found popularity is then discussed, followed by an investigation of the bear's popularity in these displays. I argue that growing disruptions to the wild beast trade, caused by inflation, political unrest, and agricultural intensification, influenced *editores* to reuse animals as a cost-saving measure. Bears emerged as the preferred candidates for these displays on account of the species' widespread availability, comparatively low costs, tractability, and behavioural flexibility. This chapter demonstrates how the bear's affordances enabled the Romans to make adaptations to the design of *venationes* that ensured their continuation as a formal institution.

This thesis makes three important contributions to the study of Roman *venationes.* Firstly, it sets out new interpretations of the ancient evidence to expose and explain the practicalities of spectacle design as viewed through an animal behavioural lens. It is recommended that animal science be used in future research to help elucidate the behavioural affordances and demands of animals in other aspects of Roman life where animals were encountered, exploited, or otherwise engaged. Secondly, the study illustrates the dynamic process of knowledge exchange and decision making that informed the exploitation of animals in pursuit of maximum display impact. Thus the study offers much more than simply the objective details of spectacle design. It provides a considerably richer analysis of the multifarious experiences that Romans shared with animals both within and

outside the arena. Thirdly, and significantly, the question of historical perspectives is addressed. By considering how the animal participants might have experienced the *venationes,* the study offers a more inclusive narrative of spectacle design that integrates the animal participants in an active, history-shaping way.

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Abbreviations

Abbreviations for ancient Greek and Roman authors follow the conventions of the fourth edition of the *Oxford Classical Dictionary*, edited by Hornblower, S., Spawforth, A., and Eidinow, E. Oxford, 2012. The following abbreviations are also employed:

AE *L'Année épigraphique.* Paris, 1975.
CIL *Corpus Inscriptionum Latinarum.* Berlin. 1975.
CTh. *Codex Theodosianus.* English translation by C. Pharr, New York, 1952.
IGGR *Inscriptiones graecae ad res romanas pertinentes auctoritate et impensis Academiae inscriptionum et litterarum humaniorum collectae et editae,* 4 vols. G. Lafaye (ed.) Paris, 1901.
ILS *Inscriptiones Latinae Selectae.* H. Dessau (ed.) 3 vols. Berlin, 1892-1914.

INTRODUCTION

In the Autumn of 2000, a 24-year-old lowland gorilla named Evelyn gained worldwide attention after she reportedly escaped from her enclosure at the Los Angeles Zoo for what was the fourth or fifth time in recent years. At the time, curator of the zoo, Michael Dee, reported to ABC News that Evelyn had used a vine to make the escape across a 3.6-metre-wide moat.[1] Once outside her enclosure, Evelyn visited the giraffes, reportedly swatting bystanders as she went along her way. In an attempt to lure Evelyn back into her enclosure the zookeepers used snacks. When those efforts failed, zoo staff shot Evelyn with a tranquilizer dart and the escapee fell unconscious in the men's restroom. On a previous occasion Evelyn had jumped onto the back of 12-year-old gorilla Jim (who had broken out of the enclosure numerous times himself) in an attempt to climb over a 3.6-metre-high exhibit wall.

Jane Ballentine, a spokeswoman for the American Association of Zoos and Aquariums, attributed Evelyn's escapades to the inadequate provisions of her enclosure. The spokeswoman advised that the enclosure "wasn't built for gorillas" and was in fact formerly used as a habitat for bears.[2] As with primates, bears are exceptionally adept at climbing and have been known to manipulate objects while in captivity in order to break out of their habitats. Just recently in February 2023, a young Andean bear named Ben reportedly escaped from Saint Louis Zoo in Missouri after meddling with the steel mesh in an obscure spot of his outdoor habitat.[3] Despite the shared ability of gorillas and bears to climb and manipulate objects, these two animals require vastly different safety provisions while in captivity. Gorillas, for instance, specialise in arboreal locomotion like swinging (brachiation). It was this swinging action that enabled Evelyn to make her escape using the vine. Gorillas are also far more social creatures than bears. Evelyn and Jim worked together to find a creative way to clear the exhibit wall. Thus, while the enclosure may have been appropriate for bears, it was not suitable for gorillas.

According to The Associated Press, the zookeepers at Los Angeles Zoo raised the containment wall of the gorilla enclosure on several occasions as a deterrent to prevent the

[1] ABC News (2000) https://abcnews.go.com/US/story?id=94673&page=1&fbclid=IwAR1U40S5Am9hEsnEB3V_zNuZdk0ipHGf74zf-bWwrIkr_eV6pIZYCWuMTuk#.Ucn5uZzi530

[2] ABC News (2000).

[3] In response to Ben's escape, zookeepers added "stainless steel cargo clips rated at 450 pounds tensile strength" to his habitat; however, later that month Ben escaped for a second time. See Kim (2023).

animals from climbing out again.[4] Evidently, this particular initiative was not very effective. Nevertheless, Evelyn's multiple breakouts *moved* her keepers to think about the inadequacies of her exhibit design and consider alternatives. They then made design changes to the enclosure that considered Evelyn's behaviour and her ability to act with agency (i.e., attempt escape).

Evelyn's story is a modern example of the challenges of keeping animals in captivity. Such challenges were also evident in Roman times. The question of how best to safely contain wild beasts was a matter of great importance to the Romans in their dealings with animals in spectacles called *venationes.* While the term *venationes* translates as "hunts", in the arena context it is more broadly used by modern scholarship (and throughout this study) to include a variety of animal displays. The sponsor (*editor*) of the show carried the responsibility of ensuring the safety of the spectators. Importantly, this entailed provisioning the arena with appropriate safety measures to prevent incidents like Evelyn's breakouts. Ancient literature provides evidence of at least one abortive attempt by animals (specifically elephants) to break out of an arena in Rome.[5] However, it is reasonable conjecture that animal escapes were more common than might be thought from the sparse evidence available. As will be seen in chapter 1, the archaeological remains of entertainment buildings and the safety provisions employed therein indicate that significant resources were poured into trying to accommodate the disparate behavioural capabilities and needs of different species. The production of *venationes* was thus intimately affected by the way animals behaved and their response to the arena environment and their human exploiters.

The influence of animal behaviour on the design of *venationes* has been largely overlooked in existing published literature. Historians have long recognised the symbolic and political role that animals, especially exotic species, played in the production and reception of *venationes*.[6] In Rome, the exhibition or destruction of such species signified the political authority of the *editor* in being able to obtain animals from distant origins. At a macro level, the extraction of exotic beasts from across the Mediterranean and beyond also demonstrated the extent of Roman power. Wiedemann, for instance, argued that lions and leopards were particularly prized participants in the late Republican games because their exploitation

[4] This information came from the former curator of the Los Angeles Zoo, Ed Alonso, in response to one of Evelyn's earliest escapes in the 1980s. The Associated Press (1986) https://apnews.com/article/a0e7ec9e9b07d697edfb0fcfac9f4143

[5] Cic. *Fam.* 7.1; Sen. *Brev. Vit.* 13.6-7; Plin. *NH* 8.7; Plut. *Pomp.* 52.4; Cass. Dio 39.38. This incident is discussed in greater detail in chapter 1 section 1.2.2.

[6] Studies on the symbolic and political role of exotic animals in *venationes* are too numerous to list here. However, particularly notable works, some of which will be discussed below, include Ville (1981); Hopkins (1983) esp. pp. 1-30; Coleman (1990); Brown (1992); Wiedemann (1992); Plass (1995); Gunderson (1996); Edmondson (1996); Futrell (1997); Kyle (1998) esp. pp. 184-212; Epplett (2001a); Kalof (2007) esp. pp. 27-39; Fagan (2011a); Shelton (2014); Sparreboom (2016).

proclaimed the *editor*'s wealthy connections with overseas sources, specifically in North Africa.[7] Indeed, such was the popularity of African felines that following their first recorded appearance in Rome (at the games given by M. Fulvius Noblior in 186 BCE) the Senate imposed a ban on their importation. This was allegedly from concerns that the animals' popularity could be exploited by prospective magistrates for the purposes of political advancement (Livy 39.22; Plin. *NH* 8.24). Modern scholars have generally argued that for such a ban to have been necessary exotic animals must have been influential tools in the struggle for political power in the Republican period.[8]

While symbolic and political interpretations of the exploitation of animals are undeniably valuable to the study of *venationes*, these arguments offer only a glimpse into the complex and highly dynamic relationship which existed between the Romans and animals. Certainly, animals are deeply cultural and symbolic beings and this shapes an engagement with humans that is of historical significance. Nevertheless, animals are also sentient beings with the capacity to drive and experience history themselves.[9] As Evelyn's story demonstrates, animals are responsive to the environments they inhabit and to those with whom they share them. They are not passive objects but active participants in the histories and relationships they share with humans, however unequal the power relations between humans and animals may be. In other words, when the Romans staged *venationes* they were not simply dealing with cultural objects or symbols (although arguably the animals were those too), but also living specimens with a set of biological demands and behavioural repertoires. These biological and behavioural characteristics informed how the Romans used and engaged with animals inside the arena. Although it is known the Romans had this knowledge, few scholars have used it to study animals in their analyses of the *venationes.*

This thesis aims to identify the influence of animal behaviour on the design of *venationes* by examining the relational manner in which the Romans responded to, and accommodated the natural propensities of, the animals they displayed. This confluence of animal behaviour and spectacle design shapes the central questions underlying this study: 1) What behavioural affordances and demands did animals offer, and impose on, the production of *venationes*? 2) What knowledge did the Romans bring to bear in their responses to animal participants, and how was this informed by human-animal interactions beyond the arena? 3) Are new historical interpretations of *venationes* made possible by considering the animals' perspective? Specifically: 3a) What does the evidence say about the animals' lived

[7] Wiedemann (1992) 59.
[8] Jennison (1937) 47-48; Epplett (2016) 7-8; Ferris (2018) 115-16. According to Pliny the Elder (*NH* 8.24), the decree of the Senate was repealed in 170 BCE by Gnaeus Aufidius as Tribune. Subsequently, this allowed for *Africanae* to be imported to Italy for the public shows.
[9] Walker (2013) 50.

experiences in the arena? 3b) How does this exposure of the animals' lived experiences provide a new perspective and interpretation of the history of *venationes* that is beyond the human and inclusive of the animals? In answering these questions, this study will focus on four key themes across four chapters. Chapter 1 describes the design of safety provisions to meet the operational needs of *venationes,* with particular emphasis on the containment of animals. Chapter 2 addresses the casting of animals to play particular roles in the arena. Chapter 3 examines the strategies used by beast fighters, attendants, and animal handlers to interact with the animals. Chapter 4 is a study of adaptations to the choreography of *venationes* in Late Antiquity. An overarching focus of these discussions is the *sentience* of animal participants. In giving significance to sentience, this thesis aims to come to a better understanding of the active part that animals played in the *venationes.* This novel approach also aims to draw attention to the attractive value of animal behaviour and the sociocultural significance of Roman-animal relationships within the arena context. This will provide a more holistic picture of the events and composite processes that contributed to the design and production of *venationes* in the Roman world.

This chapter will introduce the study by first providing historical context and a review of earlier approaches to animals in Roman spectacles in secondary literature. A few particular events will be highlighted to illustrate some of the practical considerations of spectacle design and how animal behaviour both complicated and aided in this process. One of the greatest challenges of studying *venationes* is the diverse and often fragmentary nature of the ancient evidence. The available sources and the complications they entail will thus be addressed, with consideration of what aspects of the games the Romans chose to represent, what they excluded, and why. A survey of the contribution of naturalist George Jennison, the first author to have devoted a book-length study to Roman spectacles from a zoological perspective and whose work this study takes as its cue, will then be presented, followed by an outline of my methodology. The chapter concludes with a reflexive statement on how my work experience in zoos informed my engagement with the historical sources throughout the project. The enduring importance of integrating knowledge of animal behaviour into the design and daily management of modern-day zoos will be highlighted.

Setting the Scene: Hunting Spectacles in Roman Society

The hunting and/or exhibition of exotic animals as a public spectacle in Rome is first attested during the period of the First Punic War (264-241 BCE). In 250 BCE the Roman general L. Caecilius Metellus defeated Hasdrubal at the Battle of Panormus in Sicily and returned to Rome with a large band of Carthaginian war elephants that had been captured in the battle

(Polyb. 1.40; Diod. Sic. 23.21; Sen. *Dial.* 10.13.8). Upon his arrival at Rome, Metellus displayed the elephants in a triumphal parade and subsequently, according to Pliny the Elder, in the Circus Maximus. However, there is uncertainty in the literature about what became of the elephants afterwards. According to Verrius the elephants were hunted in the Circus, since the Romans at that time were unsure of what to do with the animals. Neither did they wish to keep the elephants, nor did they wish to offer them as gifts to client kings (Plin. *NH* 8.6). Unlike many other Mediterranean armies in the Hellenistic world, the Romans chose not to deploy elephants regularly in military operations, in part because of the animal's enormous expense, and in part due to its habit of turning against its own troops in battle.[10] This rendered the animal a liability. On the other hand, the act of gifting elephants was a behaviour associated with monarchies. For this reason, Metellus may not have felt it would be appropriate to dispose of the animals in this manner either.[11] Another source, Lucius Piso, claims that the Romans were more interested in provoking the elephants with blunt spears in the Circus as this would increase the spectators' contempt towards the animals (*…ut contemptus eorum incresceret*, Plin. *NH* 8.6), whom they considered to be a serious threat to Rome's security. Whether the elephants were then hunted or exploited in another capacity is not indicated.

Whatever became of the elephants, the question of what to do with them was clearly a matter of both practical and political concern. Prior to Metellus' triumph, the elephant had only been displayed in Rome on one other occasion, this being the triumph of M. Curius Dentatus in 275 BCE following his victory over Pyrrhus of Epirus and his army of Indian elephants (Sen. *Dial.* 10.13.3; Plin. *NH* 8.6.16; Eutr. 2.14.3). Curiously, none of the ancient sources mention what happened to those elephants either. One might suppose that the Romans still regarded the elephant as a novelty at the time of these respective triumphs, thus were unaccustomed to its needs in captivity. Moreover, keeping them alive would have involved significant long-term investments. Owing to their large body, the cost of feeding a group of megaherbivores would have been astronomical.[12] Drawing from modern-day data,

[10] Elephants fought alongside the Romans at Athacus, 200 BCE (Livy 31.35-36); Cynoscephalae, 197 BCE (Polyb. 18.19-26); Numantia, 153 BCE (App. *Iber.* 46); Vindalium, 121 BCE (Strab. 4.1.11); and Thapsus, 46 BCE (Caes. *BAfr.* 79-86). Considering that the Romans never established a permanent elephant corps in the Republican army, we should view these battles as exceptions. On the logistical challenges imposed by elephants on the Carthaginian army during the Punic Wars, see Shean (1996) and Prevas (1998) 83-120. On the tactical handling of elephants in warfare, see Glover (1948) and Scullard (1974).

[11] In 190 BCE, Manlius Vulso bestowed upon King Eumenes of Pergamon some of the captured elephants from Antiochus' army following the Battle of Magnesia (Livy 38.39.5). Ostenberg (2009, 179) suggested that this gesture may have ensured that Rome could rely on a supply of elephants from the East if they were required in battle.

[12] According to the Performing Animal Welfare Society, the general care and feeding of one captive elephant costs approximately $74,000 USD annually. For a comparison of the costs for other captive animals, see https://www.pawsweb.org/care_and_management.html.

in the wild an elephant can consume as much as 270 kilograms of food in a single day, although between 45 and 180 kilograms is a more typical amount for captive elephants.[13] While the majority of that produce is hay, grass, and 'browse' (i.e., branches, twigs, foliage, bark), the sheer bulk of food required by an elephant to receive adequate nutrition means that it is still expensive to feed. Additional maintenance costs were likely incurred for the provision of permanent housing and specialist handlers to care for the animals. Thus, for logistical and economic reasons, it might have been more feasible to have the elephants killed in the arena.

Alternatively, by ordering the animals to be hunted, spectators may have been reassured that the formidable beast could be made powerless under Roman control.[14] Sending the elephants into a violent rage would have also showcased the true nature of the African beast and, by implication, of the peoples they represented. What can be said about the earliest attested *venatio* is that the animals were spoils of war and thus advertised the power of the state that put them on display. Indeed, later generations of the *gens Caecilia* regarded Metellus' victory with such reverence that they minted coins bearing the image of an elephant to remind the Roman people of his achievement.[15]

In the decades following Metellus' triumphal celebrations, spectacles featuring exotic animals became increasingly popular events in venues such as the Circus Maximus. To judge from the plays of Plautus (ca. 254-184 BCE), ostriches, among other African animals, may have been common sightings in the Circus by the late 3rd century BCE.[16] By the end of the 2nd century BCE, *venationes* are attested as a regular component of the *ludi* that Roman aediles were expected to produce during their year in office. In this competitive climate, exotic

[13] For discussion of the feeding behaviours of captive Asian and African elephants in modern zoos, see Hatt and Clauss (2006) esp. pp. 90-91 on diet composition.

[14] Arguably, the elephant's 'killability' (i.e., susceptibility to being killed) in this context was influenced by its marked association with hostile forces. For post-humanist discussions of the 'killability' of animals, see Fudge (2004) 149 and Haraway (2008) 80-81. See also the contributions of the study *Killing Animals* (2006) by The Studies Animal Group, especially chapters by Marvin (ch.1), Wilbert (ch.2), and Fudge (ch.5).

[15] Elephants are depicted on the *denarii* of G. Caecilius Metellus Caprarius (ca. 113 BCE), Q. Caecilius Metellus Pius (80 BCE), and Q. Caecilius Metellus Pius Scipio (52 BCE). See Scullard (1974) pl. XXIV a, b, c.

[16] The exhibition of ostriches in the Circus Maximus was common enough for Plautus to reference its behaviour in an exchange from his *Persa,* produced around 195 BCE: 'Toxilus: Do carry this out carefully. Fly running (*Vola curriculo*). Paegnium: That's what an ostrich does in the circus (*Istuc marinus passer per circum solet*)' (lines 197-98).

animals were appropriated by elites in Rome in increasingly larger numbers and varieties as currency to gain political favour.[17]

The demand for exotic animals, or "charismatic megafauna"[18], and the anxieties about procuring them are vividly expressed in a correspondence between M. Tullius Cicero and M. Caelius Rufus, the latter of whom was running for the aedileship in 51 BCE. In preparation for this office, Caelius wrote to Cicero (who was governor of Cilicia at the time) requesting a supply of local *pantherae* (most probably leopards[19]) for an upcoming *venatio* (Cic. *Fam.* 6.5, 8.2.2, 8.10, 9.3). When Caelius was continuously met with silence, he urged Cicero once more, indicating that his rival Curio had already received ten leopards from a certain Patiscus. Finally, in response to Caelius' desperate plea, Cicero professed that the leopards in his area were in terribly short supply since the animals had 'decided' to relocate to the neighbouring province of Caria in fear of the hunters. Cicero's ascription of agency to the animals may initially come across as sarcasm; however, it could also reflect a genuine concern for the disappearance of local animal populations. Considering that leopards are opportunistic predators, it is possible that some big cats in Cilicia did move territories in response to human-induced disturbances in their habitat, such as hunting pressure, altering prey populations, and agricultural production (see chapter 4 section 4.2.1 for discussion of wildlife depletion).[20] As a precondition, those tasked with the responsibility of capturing animals for the *venationes* required intimate knowledge of the spatial and temporal activity patterns of the species they pursued.[21]

[17] In 169 BCE the curule aediles of Rome gave a *venatio* with 63 *Africanae* (most likely lions), 40 bears, and an unknown number of elephants (Livy 44.18); in 99 BCE Gaius Claudius Pulcher staged the first elephant combat in the Circus during his aedileship (Plin. *NH* 8.7); in 93 BCE 100 lions were dispatched by javelin-throwers (*iaculatores*) sent by King Bocchus of Mauretania during Lucius Sulla's praetorship (Plin. *NH* 8.20; Sen. *Brev. Vit.* 13.5); in 79 BCE the aediles Lucius and Marcus Lucullus staged the first ever fight between elephants and bulls (Plin. *NH* 8.7); and in 58 BCE Marcus Aemilius Scaurus as aedile gave an unprecedented show of 150 leopards and displayed for the first time in Rome a hippopotamus in a temporary tank with 5 crocodiles (Plin. *NH* 8.24, 8.40; Amm. Marc. 22.15.24).

[18] Ferris (2018) 208.

[19] There remains some uncertainty over the terminology that Roman writers used for naming big spotted cats such as the leopard, cheetah, and lynx. There is some evidence to suggest that leopards were called *pantherae* at Rome in the Republican period. Livy referred to the big cats, who first appeared in Rome at the *venatio* given by M. Fulvius Nobilior in 186 BCE, as *leones* and *pantherae* (39.22.2). In the imperial period, the Latin words *varia* and *pardus* were used more widely for any big spotted feline, while *panthera* came to bear the meaning cheetah (e.g., Plin., *NH* 8.17, 8.23, 8.24, 8.28; SHA *Elag.* 25.1; *Digest* 39.4.16.7). For a discussion of terminology associated with big cats in Greek and Latin literature, see Jennison (1937) 183-87.

[20] For recent studies on the effects of human-induced changes to ecosystems containing predators, see Parsons et al. (2022) on coyotes; Stillfried et al. (2015) on black bears. On herbivores, see the study by Thurfjell et al. (2013) which explores the effects of hunting on wild boar space use.

[21] For example, a passage from Julius Africanus' *Cestes,* dated to the early 3rd century CE, specifies that trackers who were experts in dealing with big cats were necessary for locating the lairs of lions in the deserts of Egypt. For discussion see Epplett (2001b) 217.

Cicero reassured Caelius that his friend's political career would not be hampered by the animals' disappearance. Evidently, such uncertainties would have caused considerable anxiety in the lead up to a *venatio.*[22] This shows that decisions relating to the selection of species for display may have been informed, to some extent, by human-animal interactions that simultaneously took shape beyond the arena as in the hunting fields. The correspondence between Caelius and Cicero also suggests that the procurement of wild beasts in the Republican period was an impromptu affair whereby the services of hunters and traders were acquired through provincial contacts, such as the likes of Cicero.[23]

The extravagance of *venationes* in Rome reached new heights in the last decades of the Republic during the rivalry between Pompey the Great and Julius Caesar. In the year 55 BCE, Pompey staged a large *venatio* in celebration of the inauguration of his theatre on the Campus Martius*.* Among the animals on display were 500 or 600 lions, 410 leopards, and about 20 African elephants.[24] The rarities at Pompey's spectacles included a one-horned rhinoceros (the Indian, as opposed to the two-horned African species), a Gallic lynx (*chama*), and monkeys from Ethiopia (probably baboons), which Pliny the Elder knew as *cepha* (Plin. *NH* 8.28-9).[25] Many of the animals that Pompey presented at these displays had likely been acquired during his years of campaigning, particularly in Ptolemaic Egypt, Africa, and the East.[26] It has been suggested that Ptolemy Auletes of Egypt, whom Pompey had helped restore to the throne in the same year as the games, supplied the animals (and possibly even the hunters) of African provenance.[27] The elephants, for instance, were hunted by specialist javelin-wielding Gaetulians from North Africa, who likely travelled to Rome with the elephants.[28] As will be discussed in subsequent chapters, a major attraction of the *venationes* was watching hunters pursue their traditional quarry.

Julius Caesar produced a series of spectacular games during his aedileship. His most famous spectacle was that which he gave in 46 BCE in celebration of his quadruple triumph that marked his victories in Gaul, Egypt, Pontus, and Africa (App. *BCiv.* 2.101; Plut. *Caes.*

[22] It is interesting to note that in the year of 51 BCE, a certain Octavius was also running for *aedile* and wrote to Cicero requesting leopards for his own *venatio*. It would seem that the expertise of Patiscus was in high demand that year; Cicero also consoles Caelius by saying that Patiscus was aware of his situation.

[23] On the importance of provincial connections in supplying Roman magistrates with animals for spectacles in the Republican period, see Deniaux (2000). Lindberg (2019) offers an interesting perspective on the emperor as a potential supplier of exotic beasts for wealthy Roman officials in Late Antiquity.

[24] Cic. *Fam.* 7.1; Sen. *Brev. Vit.* 13.6-7; Plin. *NH* 8.7, 8.20, 8.24; Plut. *Pomp.* 52.4; Cass. Dio 39.38.

[25] Epplett (2016, 23) suggested that the Gallic lynx, the anomaly within this group of animals, may have been gifted to Pompey by Julius Caesar from his campaign in Gaul.

[26] Epplett (2016) 22-23.

[27] Gowers (1950) 67; Coleman (2006) 103.

[28] Client kings, who were tied to the Romans under treaties, also sent elephants and trainers to aid them in military campaigns. For examples see App. *Hisp.* 46-48 and Livy 31.35.

56.55.1-2). This included gladiatorial displays, athletic contests, *venationes,* and the first recorded *naumachiae* (naval spectacle) in Rome. Our literary sources suggest that a variety of both species and types of performances were displayed on this occasion, including: a *venatio* with 400 lions; a combat or several combats in which elephants fought against cavalrymen and infantrymen; a torchlight parade involving trained elephants; a display of Thessalian bull-fighting (the first of its kind seen at Rome); and the first appearance of a giraffe at Rome.[29] As with Pompey, Caesar likely procured most of his animals from his victories abroad, and through foreign contacts.[30]

Thus, by the end of the Republic, *venationes* had expanded to include a wide variety of repertoires, including exhibitions of exotic curiosities, shows with trained animals performing specialty feats, hunts between wild beasts and professional beast fighters (*venatores/bestiarii*) (sometimes with the aid of dogs), and combats between animals.[31] As the design of *venationes* became more complex during this period, so must have the decisions pertaining to the animals' management and display. Being the first to exhibit a new *genus* in Rome brought incredible social and political prestige for the *editor,* but from a practical viewpoint there may have been additional precautions to take if existing provisions (such as a venue's containment barrier) did not meet the physical or behavioural needs of that animal. Yet those very characteristics which distinguished one species from another also afforded *editores* opportunities to display different animals in new and creative ways. These respective challenges and affordances present an unexplored opportunity to study how *editores* responded to *and* benefitted from the growing diversity of available animal participants.

From the early Principate, hunting spectacles and gladiatorial contests were gradually incorporated into a single, standardised program in Rome, the *munus legitimum,* which often comprised *venationes* in the morning and gladiatorial shows in the afternoon (Ov. *Met.* 11.26; Sen. *Ep.* 7.3-4; Mart. *Ep.* 8.67; Suet. *Claud.* 34.2). While the magistrates of Rome continued to give *ludi* on occasion, the responsibility now largely fell on the emperor, who used the

[29] Lions: Plin. *NH* 8.20; combat with war elephants: Plin. *NH* 8.7; Suet. *Iul.* 39; Cass. Dio 43.23; App. *BCiv.* 2.102; torchlight parade: Suet. *Iul.* 37.2; Cass. Dio 43.22.1; Thessalian bullfighters: Plin. *NH* 8.70; Cass. Dio 43.23; giraffe: Plin. *NH* 8.27.

[30] Jennison (1937, 59) suggested that the Thessalian bullfighters may have been sent to Caesar by Thessaly as a testimony of their gratitude for being granted privileges after Caesar defeated Pompey in Pharsalus, Thessaly.

[31] Animals also featured in public executions on occasion. Such displays will be referred to as *damnatio ad bestias* throughout this study. On animals as agents of executions see chapter 2 section 2.5.

venationes, and other types of spectacles, as a demonstration and celebration of his power.[32] With this direct focus now on the emperor, the arena became a space to glorify his omnipotence and imperatorial virtues. This involved showcasing the Empire's riches in order that his subjects could experience the expanse of his reign. In many respects, the emperor's *venationes,* and indeed the Republican shows, were a continuation of a widespread tradition of rulers in the Near East collecting and hunting large numbers of exotic animals to demonstrate their general worthiness to rule their respective states.[33]

As it was the emperor's duty to protect the community, the hunting of exotic and dangerous animals in the emperor's presence in Rome, or exceptionally by the emperor himself, also demonstrated his mastery over the natural world.[34] Although the Roman Empire may have been a predominantly urban culture, many spectators who travelled to the arenas from rural communities would have understood the physical threats that certain animals imposed on their livelihood.[35] Sparreboom (2016) argued that the public hunting of lions and leopards may have struck a particular chord with spectators who attended the provincial games in Roman North Africa, where big cats and human civilisations co-existed.[36] Martial alludes to this co-existence in an epigram where he compares the roar of a mighty lion in the arena with the sound of lions roaring in the African wilderness, where bulls and their herdsmen trembled with terror (Mart. *Ep.* 8.53). In this respect, some spectators may have been drawn to the *venationes* by the desire to see hunters exterminate animals that represented a genuine threat to them. Importantly, this may also suggest that spectators arrived at the games with preconceptions of certain species. Naturally, some animals would have been more evocative than others depending on the type of relationship they shared with the audience.

Mining a similar vein to Sparreboom, Wiedemann (1992) proposed that the arena was a symbolic meeting place where Roman society confronted and destroyed "categories of threats to civilised life", including wild beasts, criminals, and prisoners-of-war. That most

[32] By the reign of Domitian (81-96 CE) the production of public spectacles had become an imperial monopoly, meaning that Roman magistrates were now required to obtain imperial permission in order to stage a *venatio.* The tightening of control of public spectacles was a gradual process beginning in the late Republic. Augustus and later emperors continued to intervene by imposing regulations that limited the numbers and expense of performers at shows given by Roman magistrates. Cassius Dio (54.2.4) lists some of the regulations introduced by Augustus in 22 BCE, including a ban on women and members of the equestrian class from appearing on the public stage.

[33] The processions of exotic animals by Hellenistic monarchs, particularly the Ptolemies, almost certainly had an influence on the Republican and early imperial *venationes* in Rome. On the possible influence of these earlier displays see Jennison (1937) 28-41; Kalof (2007) 11-39; Dodge (2011) 47-50; Miziur (2012/13); Epplett (2016) 3-5.

[34] Hopkins (1983) 12; Wiedemann (1992) 64; Epplett (2016) 37.

[35] Bomgardner (1992) 162-63; Wiedemann (1992) 90-91; Fagan (2011a) 246-47.

[36] Sparreboom (2016) 154.

amphitheatres were built at the margins of the city suggests the arena represented the dividing line between civilisation and barbarism, order and chaos, culture and nature.[37] Notwithstanding the obvious threats of wild beasts, not all animals entered the arena as adversaries, and on some occasions such ideological boundaries were deliberately blurred (discussed further in chapter 2).

Between the 1st and 2nd centuries CE we have reports of extraordinary numbers of animals being hunted in the arenas across Rome: Augustus claims to have produced 26 *venationes* during his reign, in which 3,500 *Africanae* were killed (*RG* 22.3); under Titus, 9,000 wild and domestic animals were hunted across 100 days in celebration of the Colosseum's inauguration in 80 CE (Cass. Dio 66.25.1); and to mark his victory over the Dacians, Trajan allegedly had 11,000 animals hunted across 123 days of spectacles (Cass. Dio 68.15). Modern scholarship has often used these three examples as testimony to the magnitude and bloody nature of the imperial *venationes.* However, the preservation of such neatly rounded figures should be approached with some caution. Writing in the 3rd century CE, the historian Cassius Dio (although guilty of this tendency himself) remarked that, "…anyone who cared to record their number would find his task a burden being able, in all probability, to present the truth; for all such matters are regularly exaggerated in a spirit of boastfulness." (Cass. Dio 43.22.4). Although Cassius Dio was referring specifically to the number of animals and gladiators in Caesar's spectacles of 46 BCE, his warning is especially pertinent to the imperial shows. Indeed, some of the largest numbers of animal participants on record are found in the *Scriptores Historiae Augustae* (SHA), a collection of imperial biographies extending from the reign of Hadrian (117-138 CE) through to Carinus (283-285 CE). According to this source, the emperor Probus staged a massive spectacle inside the Circus Maximus in 281 CE, which involved 1000 ostriches, 1000 stags, and 1000 wild boars, in addition to other herbivores "as many as could be reared or captured" (SHA *Prob.* 19.3).

In recent years, several scholars have questioned the reality of 'rearing and capturing' such large numbers of animals for the games. MacKinnon (2006) investigated the archaeozoological evidence for exotic animals in Roman cities with arenas and found that the available evidence attests to less impressive numbers than those portrayed in the visual or literary sources.[38] However, using ethnozoological data of wildlife transportation procedures, he also concluded that the fatalities of animals during their capture and journeys to the games

[37] Wiedemann (1992) 46. Coleman's important study 'Fatal Charades' (1990) explored the symbolic protection of Roman society in the spectacular executions. Within such displays, Coleman argued, the violent deaths of criminals, prisoners-of-war and other condemned persons demonstrated and confirmed social hierarchy, law and order, and the emperor's power over life and death. See also Edmondson (1996) 81-4 and Fagan (2011a) 121-54, 141-42 on the arena as a symbolic space of group solidarity and identity.
[38] MacKinnon (2006) 19.

would have been significant. Without sedatives to calm the animals, many would have died from overstimulation, malnutrition, heat stroke, disease, or trauma.[39] These scenarios differ markedly from those represented in Roman art such as the famous 'Great Hunt' mosaic from the Villa Romana del Casale in Piazza Armerina, Sicily, which chiefly represents the acquisition of wild beasts as a successful endeavour (Fig. 1).[40] Focusing on the disposal of arena victims, Kyle (1998) suggested that the limited presence of exotic animals in the archaeozoological record may suggest that animal arena meat was distributed for consumption, which may account for its scattered deposition and sparse record.[41] In a resourceful and pragmatic society, dead arena animals were unlikely to have been wasted; the carcasses could have been fed to carnivores that were set to appear in the arena or to the people of Rome as a political device, or used commercially for profit.[42]

While some animals may have been consumed after the spectacles, there is still the question of where and how those animals were kept *before* the shows. Epigraphic evidence attests that the imperial bureaucracy maintained animal enclosures (*vivaria*) in and around the city of Rome for arena animals. A particularly large *vivarium* was known by Juvenal to have existed at Laurentum, which held an imperial herd of elephants from the mid-1st century CE (Juv. 12.102-107). A wealth of papyrological evidence also exists for *vivaria* that were maintained by Roman soldiers tasked with the responsibility of capturing animals from across the Empire for the emperor's *venationes.* A papyrus found in Egypt, dating to the late 1st or early 2nd century CE, attests to the capture of "all species of wild animals and birds" for an entire year under the orders of the prefects.[43] Epplett, a leading authority on imperial *vivaria,* argued that the duration of this activity, and the diversity of species being sourced, strongly suggest that the animals were intended for *venationes* rather than for consumption.[44] If this were the case, groups of animals may have been translocated to Rome on a rolling basis to ensure there was adequate space for new arrivals. Some amphitheatres in Italy (such as the Colosseum at Rome and the imperial amphitheatres at Capua and Puteoli) were built with

[39] MacKinnon (2006) 21.
[40] The details of this mosaic will be discussed further in chapter 4 section 4.2.1. On its representation, see Toynbee (1973) 27-29; Dunbabin (1999) 130 and (2016) 208-15; Christie (2011) 135-36; Epplett (2014) 512-13, (2016) 138; Harden (2013) 175.
[41] Kyle (1998) 187-90. See also Kyle's study on 'Meat and Meaning' (1995).
[42] Following Cassius Dio's figures, Kyle estimated that Titus may have killed on average 90 animals per day for the Colosseum inauguration games, while Trajan killed on average 89.4 per day which, Kyle argued, were practical limits to the daily disposal of animal carcases. See Kyle (1998) 198, note 18; cf. Hyland (1990) 249.
[43] Davies (1989) 193.
[44] Epplett (2001b) 211. See also Epplett 2001a, 2003 and 2016 for further discussions of *vivaria* maintained by the Roman imperial army.

sophisticated holding bays that may have also provided temporary accommodation for animals before their display (discussed further in chapter 1 section 1.3).

Notwithstanding the facilities mentioned above, it is highly improbable that thousands of animals could be held within them at any given time. Extensive provisions would have been necessary for keeping the animals alive and, importantly, to prevent the spread of diseases. To judge from our literary sources, it was not uncommon for some animals to be struck down with disease before a show. Apuleius' *Metamorphoses,* although a work of fiction, describes how a certain Democharesl lost a significant portion of his bears after they became emaciated in captivity (Apul. *Met.* 4.14). Symmachus reported similar problems with the animals he obtained for his son's quaestorian and praetorian games in the early 5th century CE (Symm. *Ep.* 2.76, 5.56, 6.43). Not all species fare well in captivity, and some would have been more susceptible to carrying diseases than others. Primates, for example, are known by modern zoologists to be especially sensitive to new environments due their highly complex psychosocial intelligence. Fatalities can occur from the animals becoming stressed, overstimulated, or from inflicting self-directed injuries (*per*s. *obv*.).[45] The physical *and* psychological components of captivity created different challenges for different species, perhaps rendering some undesirable to exploit for the games.

What can be said about the number of hunted animals alleged for such events as Trajan's victory games or the Colosseum's inauguration is that many would have been depleted en route to the arenas, and more still during the animals' captivity. This may have lessened the actual number of animals being displayed in the shows.[46] Therefore, while these figures are most likely exaggerations, we should not underestimate the scale of the imperial *venationes* in the high empire. The establishment of a sophisticated beast trade, and the deployment of the Roman army in this supply process, suggests that animals were being captured and displayed in significant numbers not previously seen in the Republican period.

As the frequency and scale of *venationes* grew over the course of the high empire, so too did the demand for new and dramatic methods of hunting, exhibiting, and interacting with animals. According to Suetonius, a herald from Claudius' reign was met with laughter from the people of Rome when he announced the emperor's games "which no one had ever seen or would ever see again", for some had witnessed them under Augustus (Suet. *Claud.* 21.2). Spectators expected variety and novelty and, as this study will demonstrate, *editores* often looked towards the behaviours of the animals for inspiration.

[45] For a recent study on behavioural abnormalities and psychopathology in captive great apes, see Brüne et al. (2006).

[46] Jennison (1937, 177) proposed that the figures preserved in ancient literature represent the total gathering of animals for the occasions, rather than the number of fatalities. Even if this were true, there would have still been the problem of maintaining such large numbers of animals in captivity.

The question of how to exploit animals for maximum display impact became increasingly a matter of economic concern for *editores* in the later Empire as the wild beast trade was disrupted by changes in the Empire's political and environmental climate. Consequently, new methods of displaying animals were devised that enabled some species to be reused for subsequent performances. The objectives and practical considerations of these types of displays will be discussed in greater detail in chapter 4. Here it will suffice to say that by the late Empire important adaptations to the choreography of *venationes* had been made to ensure the continuation of *venationes* as a formal institution. Exactly how the behaviour of different animal species influenced such adaptations will be our main concern.

The Ancient Sources

As stated earlier, this thesis aims to come to a better understanding of the influence of animal behaviour on spectacle design and the relational manner in which the Romans responded to the animals they displayed. The primary material that can provide insight into the design of *venationes* is incredibly diverse and often fragmentary, and therefore requires a combination of approaches.

Firstly, there is the literary evidence for *venationes.* This can provide the context for particular types of displays, in addition to more specific details such as the species of animals involved, their numbers, the kinds of behaviours they may have performed, and who they engaged with. Of particular importance to this study are the works of historians and moralists such as Livy, Seneca, Cassius Dio and Herodian; the natural histories of Pliny the Elder and Aelian; the hunting texts ascribed to Oppian; the epigrams of Martial; the Christian writings of Tertullian and Eusebius; and the letters of Cicero, Symmachus, and Cassiodorus. As Dodge (2011) has pointed out, it is important to keep in mind that our written sources took particular notice of *venationes* that were especially lavish, that featured the first appearance of a *genus*, the greatest variety of animals, and the largest number of a species to date.[47] For these reasons, we cannot be sure that the descriptions from the above authors are accurate representations of what actually went on in the arena.[48] Moreover, it is almost inevitable that some level of personal bias will have coloured these descriptions to a certain degree. The

[47] Dodge (2011) 51.

[48] In some instances, it is possible to verify reports from other contemporary writers. For example, although the numbers of animal participants provided by the SHA are generally regarded by modern scholars as unreliable, their context is sometimes provided by Cassius Dio and Herodian, at least for spectacles produced up until the first quarter of the 3rd century CE. Thereafter, we must be particularly careful of accepting the figures in the SHA at face value. Epplett (2016, 147) noted that such figures were presumably not so exaggerated as to be inconceivable to a contemporary readership. See also Wiedemann (1992, 61) on the reliability of the SHA.

challenge facing any historian is to filter out the effects which such biases may have imprinted upon the veracity of the accounts. The written sources are also far less informative about provincial *venationes*, although representations of these games do survive in a wide range of visual and material evidence (discussed below). Consequently, the literature considered throughout this thesis is biased towards spectacles staged in the city of Rome. Legal sources, such as the *Codex Theodosianus,* provide more concrete details of *venationes* throughout the Empire between the early 4th and late 5th century CE, a period when the surviving literature is very scanty.

Genre is another factor that must be considered when approaching ancient literature. Many of our sources were working within different literary traditions, and a considerable amount of the evidence is anecdotal. This evidence can still prove useful to our inquiry but must be treated carefully. Books 8-11 of Pliny the Elder's *Naturalis Historia* (ca. 23-79 CE) deal with the subject of zoology and are immensely valuable to this thesis. Although his discussions are loosely organised by species, Pliny often combines scientific exposition with anecdotal digressions about political and social aspects of Roman history, in particular the *venationes*.[49] His remarks on animal behaviour are thus frequently interrupted with examples from the arena that illustrate a species' physical and sensory faculties.[50] Such digressions can afford useful insights into how different animals may have applied their characteristic skills in the *venationes*. For example, the rhinoceros was known to employ its horn in combat to penetrate the elephant's stomach (Plin. *NH* 8.29), while the bear used its bulky weight to overcome the bull by dangling from its nose and horns (Plin. *NH* 8.54). Observations such as these can also shed light on the attractive value of the animals' behaviours which may have informed their respective performing roles.

Anecdotal and historical considerations of the *venationes* are also dispersed throughout Aelian's miscellany of animal lore, *De natura animalium* (ca. 175-235 CE). In contrast to Pliny the Elder, Aelian did not aim for a scientific zoology. Rather, Aelian collected stories about animals that he found interesting enough to relate, whether or not he believed or witnessed them himself.[51] Aelian's attention therefore turns persistently to the fantastic (*mirabilia*) and paradoxical rather than the ordinary, and to aspects of nature that were the

[49] On Pliny the Elder's treatment of animals in *venationes* across Books 8-11, see Beagon (1992) esp. ch. 4.

[50] By contrast, writers that generally dealt with the behaviours of domestic animals, such as Columella, were more concentrated on the presentation of facts and tend not to trail away into other topics. As we will see throughout the study, Columella's *De Re Rustica* is especially useful for extracting information about techniques and equipment that were used for managing animals, both in agricultural settings and in the arena.

[51] For an excellent comparison of the two authors and their treatment of animals within their natural histories, see Fögen (2007). On Aelian specifically, see Smith (2014) esp. pp. 80-86 on *venationes.*

subject of philosophical speculation. Working in the genre of paradoxography, Aelian was particularly drawn to reports of trained animals performing tricks in the arena or behaving in ways that starkly contrasted with their innate character (for example, the dancing elephants in Ael. *NA* 2.11; discussed in chapter 2 and chapter 3). It is conspicuous that, within these stories, Aelian often describes the animals in human terms; indeed, the elephant was widely considered among ancient writers to share a variety of moral and intellectual qualities with humans.[52] However, we should keep in mind that anthropomorphising animals was how many Romans likely made sense of the natural world, and how spectators presumably understood what they saw at the games. Thus, although a certain amount of caution must be exercised in reading Aelian's collection, it can afford insight into what the Romans knew about and thought about animals.

Martial's *Liber Spectaculorum,* a collection of epigrams that were probably inspired by the inaugural games of the Colosseum in 80 CE, is another tremendously valuable source for this thesis. The collection was composed as a panegyric to 'Caesar', and therefore aims to provide a glowing report of the emperor's generosity and mastery over the natural world.[53] Notwithstanding Martial's encomiastic agenda, his epigrams can still be read within a biological context, as Coleman (2006) demonstrated in her commentary on the collection.[54] Drawing from current zoological experts, Coleman explored why some of the animals behaved in the ways described as such by Martial.[55] By this means, she found that even the more unlikely human-animal interactions, such as the coupling of a bull with 'Pasiphae' (*Spect.* 6), could be illuminated by the animals' natural propensities.[56] Martial's refined focus on a few animal protagonists also affords unparalleled insight into their agency. Not all animals behaved as anticipated and Martial is not shy of highlighting incidents where individuals resisted their exploiters. Although these accounts should not be taken at face value, they likely reflect contemporary events in which the sight of animals refusing to cooperate was not uncommon.

Prose fiction is another promising genre from which to draw information about the production of *venationes* and Roman-animal relations more generally. Apuleius' *Metamorphoses* is an important text grounded in the real world of 2nd century imperial Rome.

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[52] For examples see Cic. *Fam.* 7.1; Strab. 15.42; Plin. *NH* 8.1-13; Plut. *Mor.* 968C; Mart. *Spect.* 20; Cass. Dio 39.38.3.

[53] Instances where animals behave contrary to their instincts are generally interpreted as proof of the emperor's divinity: an elephant spontaneously bows in humility before Caesar (*Spect.* 20); a pack of dogs withhold from attacking a doe who casts herself upon Caesar's mercy (*Spect.* 33); and a bull copulates with 'Pasiphae', certain proof of Caesar's power to vindicate myth (*Spect.* 6).

[54] See also the important works by Sullivan (1991) and Fitzgerald (2007) on Martial's epigrams.

[55] Coleman (2006) *Spect.* 6: pp. 62-68; *Spect.* 11: pp. 101-11.

[56] This interdisciplinary analysis represents the valuable application of modern animal science to the study of *venationes,* an approach which this thesis also adopts (discussed below Jennison's Trail).

As Millar (1981) and subsequent scholars have illustrated, Apuleius' novel can be mined for useful observations about the daily lives of ordinary people, and of the local officials who were responsible for putting on shows at their own expense.[57] Although the games in the novel are fictional, Apuleius provides realistic details of their infrastructure and the economic challenges faced by *editores*. Many of these challenges are echoed by Symmachus in his Letters, written just over a century later.[58] The *Metamorphoses* also affords insight into the lives of domestic animals. Apuleius pictures a world in which pack-animals (including the protagonist, who takes the form of an ass for most of the novel) are trapped in a constant cycle of exploitation based largely on their physical abilities and the value they brought to Roman society.[59] Apuleius' world reflects the harsh realities of animal exploitation in the arena, where even domestic animals were not exempted from display (Ael. *Met.* 10.34).

There is a wealth of epigraphic evidence that supplies further information on the production of *venationes.* Those responsible for presenting regular statutory games often commemorated their shows through public inscriptions. These records sometimes give details of the games staged, including their costs and provisions, the different 'acts', and the number of species involved. The distinction made between herbivores and *ferae dentatae* (wild beasts with teeth) in some of these inscriptions indicates that *editores* felt it was important to establish a hierarchy in the dangerousness and attraction of wild beasts. This is clearly illustrated in an inscription from Beneventum, which commemorates four days of games that starred 'four wild beasts (possibly big cats), sixteen bears, four *noxii,* and the rest being herbivores' (*ILS* 5063a).[60] Other epigraphic material provides the names and titles of those responsible for overseeing the care of arena animals in *vivaria*. For example, epigraphic evidence from Rome attests to a freedman called Tiberius Claudius Speclator, who held the position of *procurator Laurento ad elephantos* ('manager of the elephants at Laurentum') during the reign of Claudius and/or Nero (*ILS*: 1578).[61] Although the inscription affords no insight into what Tiberius' duties entailed, his explicit association with elephants suggests that Tiberius probably possessed specialist knowledge of the animal's husbandry

[57] Millar (1981); Knapp (2011) used Apuleius' *Metamorphoses* to extract information about the world of the 'invisible' including slaves, women, soldiers, gladiators, and other ordinary people in Roman society.
[58] For example, the challenge of keeping animals in an acceptable condition before a show and tending to their (potentially expensive) dietary needs. Discussed further in chapter 1 section 1.3, and chapter 4 section 4.2.1.
[59] For a socio-historical reading of the centrality of violence in Apuleius' *Metamorphoses,* see Fagan (2011b). See also Fitzgerald (2018) for a literary analysis of the representation of violence in Apuleius' novel. The use of violence by means of pain-induced stimulation to control animals in the arena is discussed further in chapter 3 section 3.2.1.
[60] *ILS* 5063a: *feris n*[*umero*] *IIII, ursis xvi, noxeis IIII et ceteris herbariis.*
[61] For more examples of animal keepers associated with this facility see Epplett (2016) 142-43.

requirements. As will be shown throughout the study, animal specialists may have played important roles in the design process of *venationes.*

The iconographic evidence for *venationes* is also immensely rich in detail and provides a visual record of their production, including preparatory activities such as the capture and transportation of wild beasts. The evidence ranges from floor mosaics and sculpture reliefs to wall paintings, coinage, ivories, gems, glass, and ceramics. As with our written sources, it is important to keep in mind that all representational materials were made for specific, often disparate reasons and cannot be regarded as direct reflections of the historical games. For example, big cats, bears, and elephants are among some of the most common animals depicted in artworks across the Empire; however, this may reflect the visual potency of these animals rather than their prevalence in the shows.[62] Nevertheless, there are a few examples, such as the Sofia relief from Bulgaria (Fig. 2), that appear to reflect contemporary preferences towards exploiting certain species (in this case bears; discussed further in chapter 4).

The exquisite floor mosaics of Roman North Africa and Sicily, many of which have been uncovered within the last sixty years and studied closely by Dunbabin (1978, 1999, 2016) and Brown (1992), offer rich insights into the attractive power of *venationes* to spectators, and to visitors who viewed the representations. Brown suggested that benefactors of the games used such mosaics as tools of self-representation and chose to depict sensational moments of a *venatio* that visitors would enjoy the most.[63] The predominance of representations showing fatalities, blood, panic and aggression may suggest that visitors (as with the spectators) were especially drawn to the violence of the shows which was, as Brown argued, "essential to the games, commonplace in its context, and directed against legitimate victims"[64]. The spectacularity of violence, as represented in Latin literature on *venationes,* may suggest that the ancient reader had similar interests.[65]

The *venationes* were also a rich and malleable context from which artists drew examples of the *varietas* of *Natura,* just as writers such as Pliny the Elder and Aelian had done in their natural histories.[66] Representations of exotic beasts inspired by the arena were often

[62] Dodge (2011) 51.
[63] Brown (1992) 183.
[64] Brown (1992) 208.
[65] On the representation of violence in Latin literature and its impact on the ancient reader, see the recent edited volume by Gale and Scourfield (2018), especially Gale's chapter (ch.2) on violence and power in Lucretius' *De rerum natura*, which draws attention to both the objectification and admiration of arena performers, such as the gladiators.
[66] Pliny the Younger, for example, called his uncle's *Naturalis Historia* "an expansive, learned work, not less various than nature herself": *opus diffusum eruditum, nec minus varium quam ipsa natura* (Plin. *Epist.* 3.5.6). See Fitzgerald (2016) for an excellent discussion of nature's variety as represented in artwork (ch.2 esp. pp. 70-76) and miscellaneous books (ch.5). See Beagon (1992, pp. 130-37) on the theme *varietas* of *Natura* in Pliny the Elder's *Natural History.*

composed in a way that accentuated their distinctive characteristics; different types of animals were isolated in compartments and medallions,[67] or categorically arranged by species (sometimes accompanied by inscriptions ascribing a number or name to the animal).[68] On an aesthetic level, these illustrations were appealing by virtue of the animals' diverse appearances but this diversity was also exploited by *editores* to advertise their power in being able to obtain a variety of animals (from a variety of places) for their games.[69] In many cases the immediate source of these reproductions were most likely pattern books, which enabled artists to portray species (especially exotic or rare animals) which they may not have seen before in real life. For this reason, it is often difficult to tell whether an illustration refers to a specific occasion or is a more general representation influenced by artistic licence and/or the patron's aesthetic preference.

Some artworks do, however, indicate an intention to present real events in the arena. One example is the Zliten mosaic from the Villa Bar Duc Amméra, near Lepcis Magna in Libya, which depicts gladiatorial combats, *venationes* of various kinds, criminals condemned *ad bestias,* and arena musicians, that run around a central panel in a frieze-like composition (Fig. 3).[70] It is not known for certain if these scenes were arranged to show a narrative succession of events. However, taken together, they provide an informative record of the different components that made up a program of mixed spectacles. Moreover, the realistic and detailed treatment of individuals (both human and animal) strongly suggests that the mosaicist was working off a special commission inspired by a historical event which the patron wanted to commemorate. We will return to the Zliten mosaic in more detail throughout this study. In sum, the iconography of *venationes* allows us to reconstruct many practical aspects of spectacle design that were of particular concern to the *editor* and to those who interacted with the animals on the arena floor.

The largest and most obvious body of evidence for *venationes* is the physical remains of the buildings that accommodated them. Owing to their considerable size and integration

[67] The medallions on the Nennig mosaic include individual representations of exotic beasts and scenes from the arena. See Appendix III Fig. 98 and 128 for examples. Discussed further in chapter 3.

[68] The Radès mosaic from Tunisia (Fig. 91) is a particularly good example of the 'animal-catalogue' type. A range of species including boars, ostriches, stags, and bears are depicted individually with no relation to one another. Seven of the bears have been inscribed with names. Discussed further in chapter 2 section 2.6.1. On the 'animal-catalogue' type see Dunbabin (1978) 71-74.

[69] Praise for the diversity of animal participants is also found in ancient literature. Cassius Dio (66.25) makes a point of noting that *both* tame *and* wild animals (καὶ βοτὰ καὶ θηρία) were hunted at the games staged by Titus in 80 CE; Herodian (1.15.3-6) remarks that the sheer variety of species hunted in Commodus' spectacles had only been seen by the historian in illustrations; Martial celebrates the hunting versatility of a *venator* called Carpophorus by listing all the species he fought, including their diverse origins (*Spect.* 17, 32, 26); and a shepherd in *Eclogues* 7 by Calpurnius Siculus boasts about seeing "beasts of every kind" in a large, wooden amphitheatre in Rome.

[70] The date of the Zliten mosaic is still debated among scholars though most argue the late 1st or early 2nd century CE.

with modern cities, very few entertainment buildings have been fully excavated or adequately published.[71] However, in the last two decades, there have been some exciting new discoveries in the Roman provinces which have shed light on the widespread popularity of *venationes*. Several important and, for this study, extremely timely discoveries of multipurpose venues have recently been made in the Roman East. One of these is a Herodian building at Caesarea Maritima in present-day Israel that takes the form of a circus, but also contains provisions for *venationes* (discussed further in chapter 1). The physical remains of these provisions give a relatively good sense of what safety measures were taken to mitigate animal escapes and how these were modified and improved over time. They can also indicate, to a certain degree, what types of animals were anticipated to appear in the arena and in what capacity they might have been used. In the absence of literary, epigraphic, or iconographic evidence, the ecological context of a building can offer further insight into what species were locally available for *editores* to exploit. Although animal populations have shifted to some extent since Roman times, the environments that surround the physical remains of entertainment buildings can still be mined for useful observations.

As we have seen, the evidence available for the study of *venationes* is immensely rich and geographically (as well as temporally) varied. Certainly, this presents enormous challenges, but there is much to be gained from taking an integrated approach. One strength of this approach is that it can facilitate a more holistic understanding of the *venationes* and the composite processes and events that contributed to their production. For example, many of the logistical steps that were taken to provision the *venationes,* such as erecting safety barriers, often go unrecorded in the literature. Epplett (2001a) argued that such "trivial" matters were evidently not interesting to the Romans compared to the games themselves.[72] However, for the *editores* involved in this process, the preparatory activities were certainly important. In this respect, the physical remains of entertainment buildings can prove most useful. Moreover, while few spectators would have "concerned themselves with the lives of beasts"[73], as Cartmill (1993) has argued, it would be a mistake to assume that those lives did not matter to the *editores* and other persons involved in their capture, transportation, and general care. Letters composed by *editores* like Symmachus offer an unparalleled insight into the challenges of keeping animals alive and in reasonable condition before a show. An

[71] This is particularly the case for Roman circuses. In addition, structures that were built of perishable materials, such as wood and earth, have left no trace in the archaeological record. Much of our understanding of their architectural form has been informed by artistic representations, literature, and epigraphic evidence. More recently, archaeologists have used typographical surveys and three-dimensional, archaeological reconstructions to help fill in the gaps and improve our knowledge of Roman architecture. See Vergnieux (2008) and Bell (2020) on the Circus Maximus specifically.
[72] Epplett (2001a) 210.
[73] Cartmill (1993) 40-41.

integrated approach therefore affords a more complete picture of the various components of spectacle design.

When studying the *venationes*, it is also important to be aware that the content of the evidence presents controversial challenges for the objective evaluation of activities that are generally unacceptable within modern Western attitudes. In the past, many historians were unable to look beyond the violence and gore of Roman spectacles, especially the gladiatorial contests. One scholar even suggested that the Roman gladiators and Nazism were "the two most quantitatively destructive institutions in History"[74]. Understandably, historians have also found it difficult to grasp the mass killings of animals in the *venationes*.[75] Toynbee (1974), for instance, struggled with the discrepancy between the Romans' pleasure in watching the deaths of wild beasts and their intimate relationship with companion animals. She argued that the spectators' enthusiasm for the courage and skill of *venatores* can partially explain their popularity, though not why they were staged on such a large scale.[76] Ferris (2018), who is a trustee of a local animal charity, also admitted the difficulty of coming to terms with "the appeal of animal suffering, and images of animal suffering"[77] in the arena. Wild animals were admired in the Roman world, but they were also perceived as predators, sources for materials, food, and game.[78] As with most other pre-modern societies, the Romans had no concept of 'animal rights', so it would be problematic to think of the animals as having rights that should be protected. As a precondition to studying the *venationes,* we must recognise this distinction between modern Western attitudes and customs towards animals and those held by the Romans.

Although more scholars are acknowledging this distinction in their research, the question of animal cruelty still looms very large in modern receptions of the *venationes.* This has led many scholars to select evidence that illustrates particularly violent aspects of the

[74] Grant (1967) 8. See also Kyle (1988, 174) for a discussion of this reception.
[75] For example, Auguet (1972, 81) and Cartmill (1993, 30) did not regard the *venationes* as 'true' hunts such as those conducted in the countryside for food, or as a form of sport. This argument will be contested in chapter 2 section 2.1.1.
[76] Toynbee (1973) 21: "All this serves to underline what is one of the outstanding paradoxes of the Roman mind – that a people that was so much alive to the interest and beauty of the animal kingdom, that admired the intelligence and skill to be found in so many of its representatives, that never seemed to tire of the sight of rare and unfamiliar specimens, that displayed such devotion to its pets, should yet have taken pleasure in the often hideous sufferings and agonizing deaths of quantities of magnificent and noble creatures."
[77] Ferris (2018) 12.
[78] Kyle (1998) 6.

games.[79] Within these receptions, animals are frequently described as 'victims' without the capacity to change or challenge the conditions of their exploitation.[80] The elephant in particular has been made out by some scholars to be an especial target of hatred from spectators on account of the animal's hostile relations with the Roman army (discussed further in chapter 2 section 2.6.1).[81] Such victimising has resulted in animal participants being largely stripped of a voice or agency in the historical narratives of *venationes*. To a large extent, this concern was the catalyst for this study.

Perspectives from a Naturalist: George Jennison (1937)

In 1937 George Jennison published his pioneering book *Animals for Show and Pleasure in Ancient Rome,* the first full-length study of the production of *venationes* that considered the roles played by animal participants.[82] Although Jennison's coverage of the primary evidence has now become outdated, his study remains an authoritative text on hunting spectacles. This is principally because Jennison wrote his book from the unique perspective of being a naturalist.

Born into a family of entrepreneurs, botany enthusiasts, and exotic animal collectors, Jennison developed an early interest in natural history and was consumed with the desire for collecting as well as displaying animal curiosities. In 1836 his grandfather John Jennison opened the Belle Vue Zoological Gardens in Manchester (Belle Vue), the first privately founded zoo in England. Belle Vue had a variety of exhibits and special features, including botanical gardens, a large zoo, an amusement park, an exhibition hall complex, and a speedway stadium. Around 1900 Jennison became superintendent of the zoological gardens. Some thirty years later in 1929 he composed a personal history of Belle Vue that included intriguing stories of animal exhibits that were not so different from those displayed in Roman times.[83] Jennison recalled how in the summer of 1922 a certain Mrs. Lambert succeeded in training a tigress and peacock to share the same enclosure, which attracted thousands of

[79] Perhaps the best example is the regurgitation of the three references mentioned above regarding the number of animals killed in the games produced by Augustus (*RG* 22.3: 3,500), Titus (Cass. Dio 66.25.1: 9000), and Trajan (Cass. Dio 68.15: 11,000). These figures are frequently cited by scholars in their introductory remarks on *venationes* without critique of their credibility. For example, see Ferris (2018) 108-09.
[80] Kyle (1998) 34, (2021) 256; Shelton (2006) 5, (2014) 469; Hopkins and Beard (2005) 100; Ferris (2018) 141.
[81] See especially Shelton (2004) 380-82, (2006) 6, 10, (2014) 473-74.
[82] The book was reissued by the University of Pennsylvania Press in 2005.
[83] Jennison composed a history of Belle Vue and a biography of his grandfather shortly after his family relinquished interest in the zoo in 1925. To avoid upsetting his family, Jennison requested for the publication to be delayed. In 2013, Zoe Wilock published Jennison's book, with annotated notes, as an e-book as part of her degree in History at Manchester Metropolitan University.

visitors to the zoo (Fig. 4).[84] Although acutely aware of the high risk of this unusual pairing, Jennison was nevertheless struck by the power that his keepers had over the animals. It is possible that he also recognised the parallels between the desire observed at Belle Vue to see animals displayed in novel ways and the desire for Romans to view unusual animal exhibits. Indeed, Martial once encouraged his readers to go visit a pen in Rome that held the unlikely couple of a lion and a ram (Mart. *Ep.* 9.71). Although there is no evidence to suggest this occurred it might be reasonable to expect that, if viewed in a public space, such curious pairings may have drawn large crowds of spectators. Indeed, *editores* may have used this kind of publicity to promote an upcoming *venatio*, just as Jennison had used the tigress and peacock exhibit to increase visitor attendance at Belle Vue.

Jennison's intimate knowledge of captive animal management put him in a unique position to pursue research on the Roman *venationes.* Most importantly, his profession enabled him to see past the inherent immorality embedded in the design and management of the games, which many subsequent scholars have wrestled with. As a naturalist, Jennison's concerns lay primarily in the practical handling of wild animals for display. He studied areas such as the live capture of animals, the transportation of animals from the wild, and methods of animal containment. Jennison's profession as a zoologist informed his approach to the ancient evidence, as shown in the preface to his study:

> To one who has spent a lifetime in practical contact with wild animals many things are clear and simple which are obscure to scholars, and many difficulties are apparent which scholars have not appreciated. Some of these can be **exposed and explained**. Even a poor book which could throw light from an unusual angle would not be useless.[85]

Jennison aimed to provide a new and deeper analysis of the ancient material by incorporating zoological insights that may have otherwise been difficult to gauge from the sources alone. Of particular interest to him was the evolving range and quantity of exotic animals for public exhibition in imperial Rome, a trend which Jennison argued was greatly influenced by the practice of amassing exotic animals for private collections and public processions in Hellenistic Egypt and elsewhere in the Greek world.[86] The first five chapters of his study therefore chart the development of spectacles in Antiquity that displayed exotic animals. Throughout these discussions Jennison makes extensive use of ancient literature. In comparison, the visual and cultural material is given minor attention, which naturally results

[84] Jennison (1929/2013) 70.
[85] Jennison (1937) xiii.
[86] Jennison (1937) 41.

in an overemphasis on the city of Rome.[87] One reason for this is that only in recent years has this kind of media been brought to light and studied. Thanks to recent discoveries like the 3rd century CE Magerius mosaic from Smirat in Tunisia (Fig. 5), we know significantly more about the provision of provincial *venationes* than what was available to Jennison in his own time.[88] Nonetheless, his chapters on the development of *venationes* are especially informative in their references to the range and exotic provenance of species that were procured for the emperor's shows.

Jennison's zoological expertise finds its greatest benefit in his chapters on the logistics of capturing, transporting, and handling animals for the arena games. Concerning the live capture of wild beasts, he remarked that "…the means of killing wild animals have changed far more than the means of taking them alive."[89] To Jennison, many of the technical aspects and difficulties relating to trapping procedures in Antiquity could be exposed and reconstructed using modern comparanda. He observed, for instance, that the types of cages used for transporting wild beasts in Roman art, such as those depicted on a late 3rd /early 4th century CE mosaic from the Maison d'Isguntus at Hippo Regius (modern Annaba in Algeria) (Fig. 6), would have been logistically unfeasible for long journeys owing to their lack of ventilation.[90] Jennison suggested that narrow and completely enclosed cages would have been necessary to subdue animals after the initial capture. However, such cages were hardly sufficient for longer journeys unless the animals were transferred to cages with iron bars. We do in fact read about barred cages (*ferreae caveae*) in ancient literature (Symm. *Ep.* 2.77), yet the significance of their design is better appreciated with knowledge of the animals' physical needs.

Another poignant observation from Jennison is the difficulty with which carnivores would have been made to exit their cages in the arena and attack a person or another animal in the presence of a shouting mob. Having dealt first-hand with the translocation of big cats, Jennison observed that "when done with care and in quietness" it is possible to move carnivores from their quarters into new surroundings within the zoo in "a matter of hours".[91] Since the Roman arena was neither a quiet environment, nor was it an occasion for lengthy delays, he suggested that fire or burning straw was most likely administered by *venatores* or handlers to prevent the animals from retreating into their cages.[92] Jennison's insightful

[87] Notwithstanding a brief chapter on 'Provincial Amphitheatres' (ch.11).
[88] Discovered in south-eastern Tunisia at Smirat in 1966 and studied by Tunisian epigraphist Azedine Beschaouch (1966) 134-57. See also Dunbabin (1978) 67-69, 268; Hanoune (2000) 1565-76; Bomgardner (2009) 165-77.
[89] Jennison (1937) 8.
[90] Jennison (1937) 148-49.
[91] Jennison (1937) 159.
[92] Jennison (1937) 160.

comments on animal behaviour provide a compelling argument for why the lions at the games of Probus (281 BCE) were reluctant to exit their cages in haste (SHA *Prob.* 19).[93] In addition to the cramped conditions of the lions' cages, the glare of the arena and continuous noise from the crowd were all powerful sensory stimuli that may have caused the animals to freeze.

One particular analysis that illustrates both the strengths and limitations of Jennison's application of captive animal management is his evaluation of the hyena. Having noted the unusual infrequency of this animal in the games at Rome, Jennison concluded that the hyena, "though easy to capture and even to tame, is cowardly and would be unsuited to a *venatio*"[94]. Interestingly, Jennison was writing at a time when the hyena was routinely characterised as a cowardly and deceitful creature with a tendency to avoid agonistic encounters. This partially came down to a common misunderstanding of the hyena's behaviour, in particular, its habit of 'mobbing' and then withdrawing from predators. Contemporary naturalists and big-game hunters of the 19th and early 20th century believed that such habits were comparable to human notions of cowardice.[95] However, in recent years, modern ethologists have come to understand this behaviour as an effective survival strategy known as 'testing'.[96] Despite this, and despite the fact that Roman attitudes towards the hyena reveal nothing of its perceived courage (or lack thereof), some scholars continue to regard the hyena as an undesirable candidate for the *venationes* on the grounds of Jennison's authority as a naturalist.[97] This misleading evaluation of the hyena serves as a reminder that, while modern comparanda can be used to help elucidate the practical handling of animals in Antiquity, they cannot provide hard evidence for Roman attitudes towards those animals. In other words, the natural demands of animals are transhistorical, but human *responses* to those demands are culturally

[93] In consequence of their hesitancy to leave the cages, the lions were immediately dispatched. According to the SHA, this displeased the spectators.

[94] Jennison (1937) 85. Jennison also contended that the Gallic Lynx at Pompey's games of 55 BCE would have been "too cowardly to show fight in the arena", though he did not explain why this might be so (p.54).

[95] Nott (1886, 106): "All writers agree that the hyena lacks courage, and is only ferocious when he himself is secure from harm"; Roosevelt and Heller (1915, 259): "The hyena is a singular mixture of abject cowardice and the utmost ferocity. Usually feeding on carrion, and often hesitating to attack even the weakest animal if it is unhurt…"; Walker and Nowak (1968, 1265): spotted hyenas "…are cowardly and will not fight if their prospective victim defends itself."; Hemingway (1936, 42-44) provides a detailed discussion on why hyenas are bad sport, though amusing, to kill.

[96] Glickman (1995) 524. For ethological studies on hyena behaviour, see Kruuk (1972) and Schaller (1972). This behaviour has also been observed in wolves. Trinquier (2009, 30) argued that it was for this reason that the wolf was rarely used in the *venationes* at Rome.

[97] For example, Epplett (2001a) 334. Of far more interest to Greek and Roman writers was the hyena's biology, especially its sex organs, its ability to mimic human speech, and its medicinal properties: Diod. Sic. 3.35.10; Ov. *Met.* 15.408-410; Plin. *NH* 8.44, 27.92-106. Aristotle believed that an animal's temperament was influenced by its heart size. Accordingly, animals with a larger heart were cowardly. This included the hare, deer, mouse, hyena, ass, leopard, and marten (Arist. *Part. an.* 667a 10-23).

and historically contingent. A central aim of this thesis, then, is to reduce the possibility of cultural bias in interpretations of animal behaviour (discussed below Jennison's Trail).

While Jennison's work has its limitations, it makes significant contributions to the study of Roman *venationes* that continue to influence the evaluation of animal participants and their role in spectacle design. As a naturalist and superintendent of Belle Vue, Jennison had the authority to make important managerial decisions that related to the animals' display. He considered, for instance, what the public might want to see, what kinds of exhibits lured them in, and how the animals' behaviours and exotic provenance could influence public interest in the natural world. Careful thought was thus given to what the animals represented in the zoo context (the cultural animal) and what they were behaviourally capable of doing (the sentient animal). Moreover, Jennison understood many of the practical and administrative difficulties of handling wild animals in captivity, such as their capture and transportation. He was also aware of the various biological demands that each animal imposed on their exploitation, such as their specific dietary requirements and the types of safety provisions that were necessary to contain them.[98] The fact that many of these challenges are recorded in his personal history of Belle Vue indicates just how important it was for the zoo to understand and accommodate the different species under its care. It is because of Jennison's unique zoological background that animals are given primary focus in his analysis of the Roman *venationes.* They are viewed as sentient beings with specific needs that required a response from the *editor,* as the organiser of the games, and from the *venatores,* handlers, and attendants, who physically interacted with them inside the arena.

Jennison was decades ahead of his time in anticipating the influence of animals in the Roman period. Until very recently, the extent to which animals actively shaped and impacted the daily lives and cultural practices of ancient civilisations had been largely excluded from consideration in the fields of ancient history and classical studies owing to the persistence of anthropocentricism. To a degree, this began to change around the early 2000s when animal-centred histories received more critical attention in response to a wider ecological movement within the humanities, often dubbed the 'animal-turn'.[99] From this movement emerged a host of substantial works that explored the multidimensional relationships between humans and other animals in various aspects of daily life in Antiquity, such as religion, warfare,

[98] In his history of Belle Vue, Jennison recalls the tragedy of an orangutan that died no more than 6 weeks after arriving at Belle Vue. Jennison observed that the animal had become depressed after its traveling box, which it used to escape from the public gaze, was removed from its new enclosure: "The box was replaced but it was too late. Experience is a hard and very often expensive teacher." Jennison (1929/2013) 63.

[99] For a brief survey of the emergence of histories that consider the roles played by animals in the past and present, see Shaw (2013a) 3-5.

agriculture, politics, hunting, entertainment, art and literature.[100] Gordon Campbell's edited volume *Animals in Classical Thought and Life* (2014) reflects the explosion of interest in the study of animals in the ancient Mediterranean, with thirty-three short essays that discuss not only animals' appearance in literary, philosophical, or artistic contexts, but also how they shaped the lives of humans through aspects like medicine and pet-ownership.[101] Although the study is generally more descriptive in nature, it begins with the premise that 'animals are good to think with' and thus follows with an extensive examination of how the ancients 'thought with', as well as 'about', animals in all their dealings with them.

Since the publication of Jennison's interdisciplinary study, several scholars have brought the animal figure more into focus by attending to the *interactions* between humans and performing animals, rather than their *boundaries*. Most of these studies have concentrated on interactions that took shape outside the physical space of the arena, such as in the hunting fields, on the animals' journeys to the arenas, and in the stockyards where different species were housed.[102] For example, both MacKinnon (2006) and Epplett (2001a) have used comparative ethnozoology to help elucidate the logistics of managing wild beasts during these activities. However, in general, this interdisciplinary approach has not been adopted to explore interactions that took shape *within* the games themselves.[103] Part of this comes down to the persistent scholarly perception of animals as cultural objects "without agency or protection"[104] once they entered the arena.

As animal-centred studies continue to expand within the broader fields of ancient history and classical studies, it is imperative to think critically about the roles that animals might have played in the production of *venationes.* Scholarship should mine every facet of spectacle design for details, and this extends to the animal participants. With new and exciting evidence being brought to light in recent years (not only in the field of spectacle studies but

[100] A comprehensive list of these studies would be almost impossible. However, several notable and, at least for this project, influential works on the human-animal relationship in Antiquity warrant mention. These include Kalof's edited volume *A Cultural History of Animals in Antiquity* (2011) with discussions of the appearance of animals in philosophical, artistic, scientific, and performative contexts; the numerous writings of Newmyer (2006, 2011a, 2011b, 2016) on ethical debates across philosophical schools in Antiquity, particularly regarding the question of rationality and reason among animals; Harden's *Animals in the Classical World* (2013) which mines a similar vein to Newmyer's work on the place of animals in the moral consciousness of ancient societies; the essays collected in Campbell's *Animals in Classical Thought and Life* (2014); Kitchell's taxonomy of *Animals in the Ancient World from A to Z* (2014); and Fögen and Thomas' edited volume *Interactions Between Animals and Humans in Graeco-Roman Antiquity* (2017) which explores the interconnectivity of human and animal lives of the past through the analytical lens of Human-Animal Studies (HAS).

[101] Each chapter provides a comprehensive bibliography for its topic which makes this study an excellent tool and guide for further investigation into human-animal relationships in Antiquity.

[102] See especially, MacKinnon (2006); Epplett (2001a); Sparreboom (2016); Houston (2021).

[103] Notwithstanding Coleman's (2006) commentary on *Spect.* 6 and *Spect.* 11 of Martial's *Liber Spectaculorum.*

[104] Ferris (2018) 141.

also in animal science), the time is now ripe to revive the animal participants and integrate them into the historical narratives of *venationes* in an active way. A central aim of this thesis is to build on the groundwork laid by Jennison's study by introducing current zoological and ancient material that will provide new insights into spectacle design.

Jennison's Trail: Approach, Aims and Research Questions

This thesis takes its cue from Jennison's preface by drawing from modern animal science to help 'expose and explain' how animal behaviour influenced the design of Roman *venationes.* Animal science offers a promising tool for the inquiry that follows as it can provide empirical data on animal behaviour in both natural and captive environments. This type of evidence is instrumental in answering the first research question: what behavioural affordances and demands did animals offer, and impose on, the production of *venationes*?

Firstly, what is meant by the affordances and demands of animals? The notion of *affordance,* as it has been defined by Gibson (1979) and his school of ecological psychology, relates to the perception of what an object, creature, or environment can offer to another subject.[105] To use one of Gibson's examples, a terrestrial environment with a relatively horizontal, flat, and rigid surface *affords support* and locomotion for terrestrial animals such as quadrupeds and bipeds. Terrestrial surfaces can also be climbable, and this affords different behaviours and mechanical encounters for different animals. On a micro level, the substances of the surface, for instance fruits and vegetables, afford some animals nutrition, but the value of nutrition will depend on the species of animal and their unique digestive systems. The affordances of the environment are therefore the properties or *ecological information* that it offers an organism.[106]

In the specific case concerning animals, we might see their set of biological characteristics and behavioural repertoires as affordances that offer opportunities to obtain certain resources from them (e.g., ivory, meat, fur) or use them in particular ways (e.g., to perform tricks for entertainment). For example, the gorilla's dexterous appendages (its hands and feet) afford modern zookeepers opportunities to provision exhibits with novel tools and furnishings that the animals can manipulate and interact with in ways that are both educational and interesting for zoo visitors.[107] However, as Evelyn's story earlier illustrated,

[105] Gibson (1979) 127-37.
[106] Gibson (1979) 127. See also Reed (1998) 112-113 on the detection of ecological information and the affordances of interactions by animate objects.
[107] Following Gibson's theory of affordances, one can argue that the design of these tools and furnishings afford an astonishing variety of behaviours to animals with dexterous appendages, like object manipulation.

the gorilla's dexterity also creates challenges for its containment in captivity. Exhibit barriers must be sufficiently complex in design to prevent gorillas from using their object manipulation skills to breach them. The affordances of animals can therefore simultaneously create demands or hindrances for those engaging with them.

Animals also *afford interactions.* Unlike inanimate objects, animals can act on their surroundings, giving their own responses and being aware of the process of realisation that is taking place.[108] Different species afford different kinds of interactions depending on their natural propensities. Semi-aquatic animals, like crocodiles and hippopotami, afford interactions in water, while arboreal animals, like primates, afford interactions in trees. Large predators, such as big cats, might afford hunters greater challenges and thus greater opportunities to demonstrate their alleged prowess, strength, and bravery. The interactional dimension between humans and animals is therefore intricately linked with the unique characteristics of the animal. The first goal of this study, then, is to identify what kinds of affordances and demands animal species may have offered, and imposed on, the production of *venationes,* how the Romans benefited from these particular characteristics, and negotiated them in the staging process.

Animal science can aid in accomplishing this goal in several ways. As we have briefly seen, many of the difficulties relating to the practical handling of animals in Antiquity are still relevant today in zoos, aquariums, and recreation facilities (e.g., circuses, rodeos, bullfights). For this reason, animal science can be used to ask questions of the ancient evidence, such as an animal's husbandry requirements, that have already been considered in these modern environments. Jennison's study on *venationes* also demonstrated the value of animal science for evaluating the credibility of human-animal interactions represented in the ancient sources. A section of the 'Great Hunt' mosaic at Piazza Armerina in Sicily, which depicts the transportation of ostriches, illustrates this well (Fig. 1a). The scene shows two ostriches being led up the gangway of a ship by two handlers, who each have their arms wrapped around the birds. Several scholars have interpreted this scene to suggest that ostriches were fairly easy to transport, for "they had only to be tucked under an arm"[109] and carried. However, considering that an ostrich can stand up to 2.7 metres tall, weigh around 130 kilograms, and possess fatally sharp 10cm-long talons, the feat of several handlers, let alone one, carrying an ostrich would not have been possible. A far more complex procedure would have been

[108] Reed (1998) 112. Gibson referred to such interactions as *mutual affordances* (1979, 135). See Vespa (2017) on a particular interactional practice in human-animal relations called *avoidance of interaction.* Specifically, Vespa investigates the *intermittent avoidance* of the ancient Greeks and Romans with monkeys, as observed in Galen's *Anatomicae administrationes*.

[109] Auguet (1972) 110. See also Toynbee (1973) 28, 238; Dunbabin (2016) 213; Ferris (2018) fig. 62 caption.

required to board the birds without endangering the handlers or animals. Placing the biological, sentient animal at the centre of our analysis can therefore help expose and explain the full complexity of the activities associated with the *venationes,* thus leading to new interpretations of the ancient evidence.

The scientific material utilised throughout this study includes literature and visual material from zoo manuals, veterinary and zoological databases, natural histories, and ethograms of captive and wild animals. Not only do these resources provide empirical data on the repertoire of different animal species, but they also offer critical insights into the psychology of animal behaviour. This branch of zoology is rapidly developing as efforts to provide enriching environments for captive wildlife continue to grow in response to the current biodiversity crisis. The works of Swiss zoologist and animal psychologist Heini Hediger, published in the mid-20th century, are invaluable to this study and offer important insights into the effects of captivity on animal behaviour, especially in zoos and circuses. Empirical observations of zoo management and practice, drawn from my experiences working at zoos in New Zealand and Ireland, have also been incorporated throughout this study to supplement the above resources (discussed below Author's Reflexive Statement).

It is important to clarify here that I am acutely aware of the significant variation in behaviour that can be observed in captive versus wild or wild-caught animals. Some scientists argue that such variation limits the value of studying the behaviour of captive individuals in zoo settings.[110] To navigate this challenge, this study draws only from AZA-accredited zoos that have implemented measures to simulate natural habitats and thus promote natural behaviours from their animals.[111] On the other end of the spectrum, animal circuses can provide useful examples of behavioural abnormalities. Finally, it should be noted that, as with any other scientific discipline, animal science is constantly evolving. This means some of the data in this study may be further developed or even challenged in years to come due to new scientific discoveries. As stated earlier, a central aim of this thesis is to bring Jennison's zoological (and ancient) material more up to date and reduce bias in interpretations of animal behaviour. A glossary of zoological terminology used throughout this study is provided in Appendix I.

The second research question investigates the knowledge that Romans brought to bear in their responses to the animal participants and how this was informed by human-

[110] For an excellent response to this concern see Chepko-Sade (2013), which discusses the importance of behavioural research in zoos and aquariums. Much of what we know about the behaviour of exotic species has been learned by studying captive individuals.

[111] AZA (Association of Zoos and Aquariums) is a nonprofit accrediting body for zoos and aquariums dedicated to the advancement of accredited facilities in the areas of conservation, education, science, and recreation. See chapter 3 for discussion of the measures taken by these zoos to simulate natural habitats.

animal interactions beyond the arena. While animal science can offer insights into why a particular action was required, for instance, erecting a tall barrier to prevent a lion from escaping the arena, it cannot reveal exactly where the Romans acquired knowledge of lion locomotion that informed this action. Certainly, one might assume that such knowledge was gained from observing lion behaviour in the arena, but I suspect this focus is far too narrow.

Let us return to an example provided by Jennison. It was argued that fire may have been used as a goading mechanism to force animals to exit their cages quickly when they entered the arena.[112] Jennison does not indicate how he reached this conclusion, although his professional work might have afforded him insights into animal flight responses to fire. Such responses are also recorded in a range of zoological literature on the relationship of wild animals to fire in modern times.[113] The capacity of fire to elicit flight behaviour can therefore explain why this particular stimulus would be effective for controlling animals in the arena.[114] However, we can take this observation a step further by also considering other ways in which the Romans might have gained knowledge about the effect that fire has on animal behaviour. This can be achieved by surveying the ancient sources for evidence of the use of fire in other contexts where human-animal interactions took shape, for instance, in the hunting fields, in agriculture, and in warfare.[115]

Following this procedure allows more room for the dynamic processes of knowledge exchange and decision making in spectacle design, and the possibility that certain aspects of the *venationes* were informed by, and adapted from, interactions with animals in other contexts. It can also help explain the link between the cultural and symbolic roles played by animals in Roman society and the roles they were made to play in the *venationes.* Approaching the *venationes* not as an isolated phenomenon, but rather as a mirror of Roman society can therefore shed light on the nuances of the relationships which existed between the Romans and the animals they exploited for spectacle.

The third research question seeks to uncover the lived experiences of the animal participants with the aim of providing new perspectives and interpretations of the history of *venationes* that is beyond the human and inclusive of the animals. Animals, as with any other participant of the hunting spectacles, deserve to be made visible on their own terms. However, the study of *their* experiences presents a significant challenge for scholars. As Benson (2011) points out, when researching the lives and agency of animals, "one may use

[112] Jennison (1937) 160.
[113] For example, Komarek (1969); Gutierrez and de Miguel (2020); Doherty et al. (2022).
[114] We will return to this example in more detail in chapter 3 section 3.3.1.
[115] The works of Roman agricultural writers such as Cato (*De agri cultura*), Columella (*De re rustica*) and Varro (*De re rustica*), as well as Pseudo-Oppian's treatises on hunting (*Cynegetica*) are most pertinent to this investigation.

techniques to look for the traces of nonhuman animals in human archives that are superficially similar to those one uses to look for the traces of subaltern, poor, or disenfranchised humans in the archives of the powerful, but there seems to be a deeper divide."[116] The divide which Benson alludes to is an ontological one. Unlike their human exploiters, the animals had no dedicated archives and could not write their own biographies or memoirs of the games. Consequently, this requires this study to look for traces of animals (their behaviours, experiences, and impact on spectacle design) in sources that were created for very different purposes.

To a certain degree, empathy can help us generalise and appreciate what it may have been like for animals in the *venationes*. However, Fudge (2013) has argued that this can sometimes lead us down the dangerous route of anthropomorphism.[117] Animals possess sensory capacities and limitations that are far different from our own. Moreover, their perception of the external world varies between and within species according to their biological properties, personal histories, and environmental contexts. Using the bat as an example, philosopher Thomas Nagel (1974) observed that, "…bat sonar, though clearly a form of perception, is not similar in its operation to any sense that we possess, and there is no reason to suppose that it is subjectively like anything we can experience or imagine."[118] In other words, we cannot truly *know* what it is like to be a bat, or any being from other species. This inevitably raises the question of whether it is possible to accurately represent the experiences of animals in the Roman arena.[119]

Despite this, biologist and philosopher Donna Haraway (2008) has insisted that humans should at least strive to understand what animals "might actually be doing, feeling, thinking", however imperfectly, because to do otherwise would be a "denial of mortal entanglements… for which we are responsible and in which we respond."[120] For Haraway, learning about how animals may think and behave is important for understanding how humans respond to animals.[121] Therefore, while any attempt to recreate the experiences of animal participants will inevitably be incomplete, some understanding can be developed of

[116] Benson (2011) 6.
[117] Fudge (2013) 16. See Daston and Mitman (2005) on anthropomorphism as a useful perspective for studying animals.
[118] Nagel (1974) 436.
[119] See also Isaacs and Otruba (2019) on the ethical and technical issues of speaking for other beings in history.
[120] Haraway (2008) 226-7.
[121] Haraway's emphasis on 'responding to' animals is explored in her reflection on agility training with her dogs. The process of training, Haraway argued, requires the partner (i.e., the human agility trainer) to learn about "how animals actually feel and think as well as behave" so that they may respond accordingly (p.225).

how animals in the arena may have thought and behaved by considering their affective encounters.

Finally, an important precondition for grounding this thesis within the wider 'animal-turn' movement is accepting that animals possess *a degree* of agency. Although definitions of animal agency differ across the social sciences, this study uses the term to refer to the ability of animals to actively influence and/or effect change in the *venationes* through their adaptive behaviours that are predicated on their sentience, lived experiences, cognition, individuality, sociality, and culture. Agency presupposes a degree of rationality and intent rather than just instinctive responses. When animals act, they do so with a purpose, but that purpose is not always immediately apparent to the human observer. As Pearson notes, the "conflation of agency with human levels of intentionality and self-consciousness provides a formidable obstacle for the integration of nonhumans into historical narratives in an active, history-shaping way."[122] Recognising that animals possessed a degree of agency in the arena, even if it was not always expressed in the same way as human agency, is an important starting point for writing a more inclusive history of the *venationes.* By adopting this critical stance, this thesis offers a corrective to anthropocentric scholarship of Roman *venationes* that has historically marginalised the animals.

Scope of the Study

This study has a large chronological scope that ranges from the end of the 1st century BCE through to the early 6th century CE. This wide net permits the study to take into consideration how Roman interactions with animals in the arena changed over time in accordance with shifting attitudes towards the animal participants and changes in the social, political, economic, and environmental climate of the Roman Empire. Given the nature of the available evidence, *venationes* that were staged in Italy, particularly in the city of Rome, will be the primary focus of attention. The study also draws upon the wealth of archaeological, iconographic, epigraphic, and cultural material produced in the Roman provinces, which may be used to illuminate the influence of animal behaviour on *venationes* in the wider Roman world.

[122] Pearson (2013) 133. See also Shaw (2013a) and (2013b) on writing about animal agency in human histories.

Chapter Overview

This study consists of four chapters, each dedicated to a facet of spectacle design that was influenced, to some degree, by the biological characteristics and behaviours of the animals.

Chapter 1 examines the design components of Roman entertainment buildings that met the operational needs of the *venationes.* The range of safety barriers and holding facilities used to accommodate and confine particular animals are described, with reference to the locomotor capability of each animal. As a point of comparison, the design of modern zoo exhibits is also considered. It is shown in chapter 1 that the Romans drew from existing methods of hunting and capturing animals in the wild to develop flexible safety provisions that could be adapted for a wide range of species, performances, and venues. It is also observed that the design of these provisions took into consideration the needs of the human performers and spectators, in addition to the animals. An integrated approach to facility design is proposed for future research.

Chapter 2 investigates the casting process where animals were chosen to play particular roles in the arena. The nature of roles such as "quarry", "combatant" and "hunting aid" are explored, along with others such as "curiosity", "executioner" and "trained performer". It is shown in chapter 2 that when animals entered the arena, they did so as *both* cultural *and* biological beings. Further is shown that the animals' characteristic affordances and cultural significance in Roman society created opportunities for *editores* to exploit animals in myriad roles in pursuit of maximum display impact. Overall, this chapter highlights the potential of animal behaviour to influence the choreography of *venationes* and facilitate performances that were of historical and cultural significance to the spectators.

Chapter 3 explores the design and manipulation of stimuli used in human-animal interactions in the *venationes.* The stimuli were associated with the senses of touch, sight, sound, smell, and taste. Using environmental enrichment (EE) as a model for animal stimulation, this chapter discusses the many and varied ways in which animals may have responded to sensory cues. The chapter then examines how human performers benefited from these animal responses, along with the question of how the responses affected the animals' experiences inside the arena. Chapter 3 demonstrates that the Romans were mindful of the different sensory orientations of animal species and used techniques drawn from agriculture and hunting contexts to stimulate the animals in ways that were appropriate to their performing roles.

Chapter 4 focuses on practical considerations governing the *venationes* staged from the late 3rd century CE until their cessation in the early 6th century CE. It begins with an examination of what I term 'games of evasion', where human performers evaded animals

(most commonly bears) using a variety of non-lethal apparatuses that were designed to excite frustration in the animals, rather than maim them. The context in which these displays found popularity is then discussed, followed by an investigation of the bear's popularity in these displays. It is shown that growing disruptions to the wild beast trade, caused by inflation, political unrest, and agricultural intensification, influenced *editores* to reuse animals as a cost-saving measure. Bears emerged as the preferred candidates for these displays on account of the species' widespread availability, comparatively low costs, tractability, and behavioural flexibility. This chapter demonstrates how the bear's affordances enabled the Romans to make adaptations to the design of *venationes* that ensured their continuation as a formal institution.

Author's Reflexive Statement

Jennison opened his study by stating that "the animals of the Ancient World have never been studied by a naturalist"[123]. Since the publication of Jennison's book, the Roman *venationes* have yet to be revisited by a naturalist. Only further limited study has been undertaken in this area. Most notably, scholars of ethnozoology have taken some interest in the games in their work.[124] I identified this gap in the body of research and set about exploring how I could add to the literature. I believe it is important to disclose what piqued my interest in this topic, and how my experiences with wild animals in captivity shaped my approach.

At the outset it needs to be clear that I do not claim to be a naturalist in the sense that Jennison was. Jennison was actively involved in the acquisition, display, and general care of captive animals whereas my involvement in the zoo industry has been more about education. Nevertheless, I have found that my professional work in zoos has significantly informed my engagement with the ancient sources, in a way that relates closely to how Jennison's work at Belle Vue made certain aspects of the games "clear and simple"[125] for him. I worked as both a staff member and volunteer at Auckland Zoo in New Zealand between 2014 and 2018, and more recently as a volunteer at Dublin Zoo in Ireland from 2019 to the summer of 2020. My volunteer role in both zoos included a range of responsibilities, most of which involved educating the public on conservation topics such as climate change, habitat loss, and human-animal conflict. More specifically, when I was posted outside an animal's exhibit I educated visitors about the animal's conservation status, dietary requirements, behavioural repertoires, personal history, and the design of its exhibit. These interactions afforded me the

[123] Jennison (1937) xiii.
[124] For example, see Alves and Barboza (2018).
[125] Jennison (1937) xiii.

unique opportunity not only to observe animal behaviour at close range, but also to observe visitor behaviour.

While our motivations for displaying wild animals in captivity are vastly different today than they were in Roman times, and even in Jennison's own time, we nonetheless share an innate desire to watch animals, whether familiar or exotic, behaving in diverse ways. One way that zoos promote behavioural diversity in captive animals is by implementing a strategy called 'environmental enrichment' (EE). Environmental enrichment refers to the provision of stimuli that act to enhance the social, cognitive, and physical complexity of a captive environment.[126] The goal is to increase behavioural diversity by making the environment more dynamic and by providing opportunities for the animals to control social interactions and make choices. During my time at Auckland Zoo I occasionally had the opportunity to design and construct enrichment for carnivores, primates, and some bird species. Puzzle-feeders, toys, and boomer balls filled with olfactory substances were used to stimulate natural behaviours such as foraging and object manipulation. The sensory orientations and capabilities differ vastly from species to species, so it was important that the design of the enrichment items was appropriate for a particular species. It was during these exercises that I became curious about the types of stimuli (not necessarily 'enrichments') that may have been used in the *venationes* to encourage desired behaviours from the animal participants. To a large extent, this curiosity was the catalyst for chapter 3. Chapter 3 provides evidence that the Romans were conscious of the human desire to watch animals actively engage with their environment and thought of creative ways to promote activity in order to satisfy such desire.

Observation and assessment of the design of zoo animal exhibits during this study gave me a relatively good idea of the challenges of containing wild animals with disparate locomotor capabilities. Certainly, there are limitations to this approach as it is not possible to assume that the safety provisions in modern zoo exhibits resemble those used in Roman entertainment buildings. The safety provisions in Roman times must be interpreted within their specific cultural and historical context. Appendix II, Table 1 in this study provides a list of recommended barriers that are used in zoos across New Zealand. This should provide readers with a useful reference to provisions that have proven effective in containing wildlife in modern times.

Beginning in early 2020, the coronavirus pandemic brought tremendous disruption to zoos, aquariums, and animal sanctuaries all around the world. The lockdowns implemented in response to the spread of the virus forced many zoos to close their doors to

[126] This practice is discussed in greater detail in chapter 3.

the public, thereby ending their primary source of income.[127] The precarity of their financial situation meant that zoos had to carefully manage the high costs of animal care, including food, enrichment, and medical care. Shortages in food supplies led some zoos (for example Bandung Zoo, Indonesia, and Neumünster Zoo, Germany) to consider culling some of their herbivores in order to feed carnivores, especially those regarded as critically endangered.[128] Other species were at a disadvantage because of their highly specialised diet. The Calgary Zoo in Canada, for example, was forced to send its two giant pandas - Da Mao and Er Shun – back to China due to disruptions in the supply of fresh bamboo, which was the pandas' primary source of nutrients.[129]

The contingency plans implemented by zoos during the Covid-19 pandemic were not the first of their kind. During WWII, many zoos in Europe were forced to cull animals that were particularly expensive to feed (e.g., megaherbivores), or were considered a major danger if they escaped during an airstrike (e.g., big carnivores, venomous animals). In 1947, around fifty of the most valuable animals from zoos across Britain were transferred to the London Zoological Society for safekeeping.[130] By this means, valuable species were preserved for future exhibition. Although the contexts are vastly different, there are some similarities in how the Romans dealt with animals during the later Empire, when the wild beast trade was heavily disrupted by inflation, political unrest, and agricultural intensification. Under these conditions, the acquisition costs and depletion of certain animals seem to have been of great concern to Rome's *editores.* Chapter 4 provides evidence that numerous measures were taken to ensure high quality, particularly fierce and expensive specimens, remained available for display. My experience carrying out this study during the coronavirus pandemic, and whilst working in the zoo industry, brought into focus many of these same challenges.

Bridging classical studies with modern practices of captive animal management can enrich our understanding of the practicalities of spectacle design and the influence that animal behaviour had on this process. By incorporating my empirical observations from zoos into this study, I aim to bring to life a new perspective on the history of *venationes* from the vantage point of the animal participants. Given the interdisciplinary approach to this thesis, it is my hope that it will be of interest to the communities of classical scholars and zoologists.

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[127] Even when zoos began to reopen, visitor numbers were greatly reduced by ongoing physical distancing requirements.

[128] On Bandung Zoo, see https://gulfnews.com/world/asia/covid-19-as-big-cats-go-hungry-indonesia-zoo-considers-worst-case-deer-cull-1.1590143462460. On Neumünster Zoo, see Kaur (2020). See also Tormes and Thompson (2020) on some of the creative ways that zoos maintained visitor interests in, and (virtual) interactions with, their animals.

[129] A giant panda needs to eat between 12 and 38 kilograms of fresh bamboo every day to meet their energy needs. See Wright (2020) on the translocation of the Calgary Zoo's giant pandas.

[130] See Kinder (2021) for an excellent overview of the history of the Zoological Society and the fate of its animals during WWII.

CHAPTER 1.

Facility Design: Accommodating Animals and their Locomotor Capabilities

In the year 55 BCE an extraordinary *venatio* took place at the inaugural games of the Theatre of Pompey the Great involving a herd of about twenty African elephants. To conclude the five-day celebrations, Pompey ordered the elephants to be hunted inside the Circus Maximus by a group of Gaetulians armed with javelins.[131] The event was reported by no fewer than five Roman writers – Cicero, Seneca, Pliny the Elder, Plutarch, and Cassius Dio – of whom Cicero provides an eye-witness report.[132] Pliny, though writing a century after the spectacle, gives the most detailed account of the event. According to Pliny, one wounded elephant brought considerable delight to the spectators when, after being disabled by its injuries, it crawled on its knees and threw its opponents' shields into the air as if it were a skilled juggler rather than a wild beast (*velut arte non furore beluae iacerentur*, Plin. *NH* 8.7). Another elephant was killed by a single blow from a javelin just below the eye; this appealed to the audience because of the precision of the attack. However, delight quickly turned to panic when the entire band of elephants attempted to wreak havoc by charging at the iron palisade that separated spectators from the arena. Unable to break free, the elephants tried to gain compassion (*misericordia*) from the crowd and appealed for their release by waving their trunks in the air and bellowing as if they were lamenting their fate. The audience's disposition towards the elephants shifted once more. Moved by the animals' behaviour, the spectators broke into tears and invoked a curse on Pompey.

Pompey's elephant display has received considerable scholarly attention in recent years owing to the spectators' unorthodox reactions to the elephants' performance.[133] Most have treated this episode as a rare example of collective sympathy for animals that were killed

[131] The Gaetulians were a tribe of people from north-western Africa. It is highly possible that these men were brought to Rome along with the elephants. This may suggest that the elephants were the smaller African Forest species. In modern times this species still inhabits the coast of north-western Africa.

[132] Cic. *Fam.* 7.1; Sen. *Brev. Vit.* 13.6-7; Plin. *NH* 8.7; Plut. *Pomp.* 52.4; Cass. Dio 39.38. Seneca is the only source that refers to the men in Pompey's *venatio* as criminals. Criminals condemned *ad bestias* were not typically armed with weapons, so it is unlikely that these men were sentenced to be killed by the elephants.

[133] Cicero mentions that, although the spectacle elicited no pleasure, there was an impulse of compassion (*misericordia*) felt among the crowd and a belief that there was a "community between this beast and the human race" (*illi beluae cum genere humano societatem*) (Cic. *Fam.* 7.1.3). Cassius Dio, on the other hand, writes that the elephants' handlers had pledged an oath that no harm would come to the animals when they arrived in Rome (Cass. Dio 39.38). For Cassius Dio, it was the elephants' woeful protest against their unjust exploitation that may have caused spectators to pity the animals. Seneca conveys no sympathy for the elephants (or the human participants), instead criticising Pompey for believing that he was "beyond the power of Nature" (*Ille se supra rerum naturam esse tunc credidit*) (Sen. *Brev. Vit.* 13.7). Thus, Pompey's failure to respond to the elephants' pleas for *clementia* may partially explain the spectators' outrage.

in the *venationes.*[134] Toynbee, for instance, labelled the incident as the first and last known "public protest"[135] against the hunting of animals for entertainment. Kachuck adopted a post-humanist perspective and proposed that the spectators' sympathy may even reflect a "willingness to lower the barriers separating the human from the animal"[136]. Other scholars, however, have attributed the spectators' emotive response to the more immediate danger of the vandalised barrier that provided security from the elephants' rampage. Shelton argued that the spectators' concerns arose when they found themselves suddenly "drawn into the combat"[137] when the elephants unexpectedly charged at the iron palisade. Similarly, Fagan suggested that the spectators' outcry was more directed towards Pompey for placing them in danger, rather than for the liberation of the elephants.[138] Plutarch remarks that the *venatio* was "a most terrifying spectacle" (ἐκπληκτικώτατον θέαμα) perhaps given the real possibility that the elephants could have trampled those seated in the front rows of the *cavea* (Plut. *Pomp.* 52.4).

The elephants' abortive attempt to break through the arena barrier thus calls attention to the practical challenges of keeping wild animals in captivity. Being the largest and the heaviest of all land animals, the elephant requires robust and resilient safety provisions to accommodate its mammoth size, physical strength, and destructive tendencies.[139] The 2020 *EAZA Elephant Best Practice Guidelines* recommends that elephant containment barriers should be no less than 3 metres in height and made of materials that can withstand the animal's strength, such as solid concrete and rock walls, or dry moats.[140] If the arena of the Circus Maximus was indeed provisioned with an iron palisade, as Pliny the Elder suggests, the barrier presumably stood little chance against a group of fleeing elephants, who may have weighed around 4000 kilograms each.[141] Pompey's failure to recognise the elephants' capabilities and provision the Circus with suitable safety measures could have led to much serious consequences had the animals actually succeeded in reaching the *cavea.* Placing

[134] Toynbee (1973) 23; Coleman (1990) 58; Beagon (1992) 129; Bomgardner (2000) 34, 74; Hart and Sundar (2000) 35; Vismara (2001) 63; Shelton (2004) 374-78; Fitzgerald (2007) 56; Fagan (2011a) 249-52; Kalof (2007) 31 and (2011) 11; Lindstrøm (2010) 319; Harden (2013) 187-89; Epplett (2014) 508; Lewis and Jones (2018) 706; Ferris (2018) 114; Kachuck (2020) 157-66.
[135] Toynbee (1973) 23.
[136] Kachuck (2020) 157-66.
[137] Shelton (2004) 377.
[138] Fagan (2011a) 249-51. It was the *editor*'s responsibility to not only keep the spectators safe, but also affirm the ideological boundary between the civilised crowd above and uncivilised nature in the arena below. See also Plass (1995) 21.
[139] Tusked elephants are especially prone to uprooting barriers in captivity (*pers. obv*).
[140] EAZA (2020) 32-33.
[141] This is the average weight of the African Forest species which probably featured in Pompey's *venatio*. The larger African Bush elephant weighs between 3000 and 6000 kilograms.

animals at the centre of facility design therefore had important implications for the overall success of a *venatio.*

The aim of this chapter is to identify the design components of Roman entertainment buildings that met the operational needs of *venationes.* Specifically, it will investigate how the Romans provisioned the circus, stadium, theatre, and amphitheatre with safety barriers and holding facilities to accommodate the locomotion of different species and their biological impulse escape danger and captivity. This tendency of animals, and its manifestation in species-specific flight responses, remains a key challenge in the design of zoo exhibits in modern times. For this reason, the following discussion will begin by considering how modern-day zoos respond to the locomotor capabilities of different species.

1.1. Principles of Exhibit Design in Modern Captive Animal Management

There are a number of basic principles that govern the design of animal exhibits in modern zoos, aquariums, and animal sanctuaries. In general, the design components must address the needs of what zoologists refer to as the three "clients" – the animals in the exhibit, the staff members, and the visitors. Specifically, an exhibit must take into consideration the physical, behavioural, and social requirements of the animals, provide provisions for staff who have to work in and maintain the exhibit, and afford visitors visibility of, and safety from, the animals.[142] While some of these principles are not pertinent to facility design in Roman times, such as the social needs of the animals, zoo exhibits remain illustrative of the types of safety measures that would have been necessary to contain, manage, and display animals inside the arena.[143]

1.1.1. Designing for Animals

Designing an effective exhibit for animals requires detailed knowledge of the species' biology and behaviour. This is not only necessary for keeping the animals in a healthy condition and encouraging natural behaviours but, importantly, for ensuring that the animals do not escape the exhibit. A primary containment barrier is imperative to keep animals inside their enclosures and people out. The design and dimensions of such barriers should correspond to the physical capabilities of the animals that are on display, in particular the animals' strength and the types of locomotion they are most likely to perform inside the exhibit (i.e., running,

[142] Thomas (2013) 237.
[143] For discussions of the welfare and social needs of animals in exhibit design, see Rees (2011) 102-49 and Thomas (2013) 237-40.

jumping, climbing, swinging, swimming, flying, burrowing, etc.) (see Appendix II, Table 1 for examples). The ecosystems in which the animals naturally inhabit can be a useful point of reference for their characteristic locomotory activities. Understanding these activities can help to ascertain how an animal might then behave in captivity. Specialist knowledge of the individual animal "clients" is also important in the design phase of safety barriers. This is often provided by a variety of zoo staff who work with the species on a regular basis and who have empirical knowledge of what has worked before in similar exhibits.[144]

Attempted escape must always be anticipated when designing exhibits for wild animals, particularly for species with complex cognitive and motor skills, such as primates, elephants, bears, big cats, and some bird species.[145] The method by which an animal might try to escape, or its 'flight response', is also important to consider. Flight response is produced when the presence of a threat enters what is called an animal's 'flight distance'. According to Hediger, every species of animal has its particular flight distance, though as a rule wild animals generally have greater flight distances than tame animals who, as a consequence of being trained, may allow themselves to be approached from a close range and even handled.[146] If a predator or rival animal comes within this distance, an animal will try to increase the distance from the threat by moving away from it. Evasive action will depend on the physiological properties of the animal (e.g., locomotion), the properties of the threat (e.g., predator strategies), and the properties of the environment (e.g., location of refuges and potential hazards).[147] Knowing how an animal moves and its motivation for escape are both essential for determining how high and complex a barrier needs to be.

Most zoos nowadays design exhibits to hold a variety of different species simultaneously. This increases the behavioural repertoire of the animals and provides a more dynamic visitor experience (*pers. obv.*). From a safety perspective, however, there are some risks associated with containing different species together. For one, interspecific aggression can occur as a result of the animals misinterpreting each other's warning or threat displays.[148] The disparate physical capabilities of animals can also present challenges to barrier design. This is relatively easy to accommodate when the animals share similar characteristics. For example, orangutans and siamang gibbons are often displayed together as both demonstrate

[144] Zookeepers are generally assigned responsibilities associated with a certain taxonomic group, for example Carnivores, Primates, Ectotherms, etc. A similar system might have been used for the management of arena animals in Roman times. See chapter 2 section 2.6.1 for examples of specialist animal keepers in Rome.
[145] Structural features such as climbing apparatuses, rocky overhangs, and live vegetation can help enhance the aesthetics of the exhibit, but these must be strategically positioned away from containment barriers to prevent the animals from using them to escape.
[146] Hediger (1950) 19-20, (1968) 40-41.
[147] Evans et al. (2019) 341
[148] Thomas (2013) 239.

a proficiency in brachiation (swinging), which informs the provision of high barriers and structural features. However, if the animals perform different forms of locomotion, a flexible approach to barrier design must be taken. This is important to keep in mind when approaching the ancient evidence, for it was often the case that *venationes* featured different species simultaneously, particularly in the games at Rome.

The choice of barrier may also be influenced by the amount of space available in the exhibit. Large exhibits may afford animals a running start to jump or climb over the primary barrier, while smaller exhibits may reduce the energy that an animal could gather to breach it. Again, the abilities of animals differ depending on the species. Wolves, for instance, have short hind legs which prevent them from achieving great heights without a running start. Antelope, on the other hand, can breach tall barriers with a single leap from a stationary position. This is due to their well-developed hindquarter muscles, long limbs, and flexible spine, which enable them to leap and manoeuvre their bodies accurately when in flight to cover great heights and distances. While antelope do have poor depth perception due to the side placement of their eyes and, like deer, are more likely to go around or underneath an object then over it, tall barriers can still be breached by a determined animal.[149] Experience has shown that the critical locomotor capacity, or 'escape vigour', of an animal is greatly increased when the animal is placed under conditions of extreme excitement or stress (*pers. obv.*). Hediger, for instance, observed that "the effectiveness of a barrier is inversely proportional to the strength of the animal's degree of excitement"[150] (Fig. 7). In other words, the higher the level of adrenaline, the more capable an animal is of clearing a barrier that may not be so easily accomplished under normal conditions.

Off-exhibit holding facilities are another essential component of exhibit design. In addition to providing security for animals while they are not on display, holding bays provide staff with ideal locations in which to tend to the animals' needs (feeding, training, veterinary examinations, etc.) without visitor interference. As these are usually indoor facilities, care is taken to ensure that ventilation, drainage, lighting, and temperature are regulated to minimise odours and the spread of harmful bacteria. These conditions will naturally differ depending on the physiological thermoregulation of the species.

[149] Evidently, this would not have been possible in the Roman arena. On deer vision and its implications for fence management in modern times, see Deer Busters (2020).
[150] Hediger (1950) 53.

1.1.2. Designing for Staff

A well-thought-out exhibit will also take into account the people who use the space to interact with the animals, conduct daily perimeter checks, put out food and enrichment, and clean the exhibit. In modern zoos, these individuals are generally zookeepers, volunteers, horticulturists, and maintenance staff. The provision of entry and exit points, as well as off-exhibit corridors, are important to allow staff members to move around and access the exhibit within a safe distance from the animals. Designated areas for storing capture equipment, machinery, and other tools associated with animal management are also necessary, especially in exhibits that hold dangerous species. These provisions all require a high level of security to prevent them from being breached by the animals. For example, most zoo exhibits implement a double-door system to prevent animals from escaping past a staff member as a gate is opened. Facilitating the ease, safety, and efficiency with which staff can move around an exhibit ensures its overall success and effectiveness.[151]

1.1.3. Designing for Visitors

The viewing experiences of visitors is greatly influenced by the design of an exhibit and its safety provisions. A good exhibit will allow visitors to see animals without too much obstruction.[152] Barriers made of materials that afford good visibility, such as woven mesh and tension wire, are frequently used in modern zoos to provide visitors with intimate views of the animals while also being able to hear and smell them. The cost of building materials also plays a large part in choosing a barrier. For example, transparent barriers like glass, although durable and excellent for visibility, are relatively expensive so cheaper alternatives might be used.

The location of viewing areas also influences the visitors' perception of the animals. Up until the late-20th century many zoo animals, especially dangerous species like bears and big cats, were exhibited in deep pits. High viewpoints meant animals were forced to look up at the visitors and that visitors in turn looked down on the animals, thus subconsciously perceiving them as subordinate beings (Fig. 8).[153] Significantly, the design of Roman entertainment buildings, as will be shown below, offered a similar viewing experience for spectators. This might have facilitated domineering sentiments towards the animals (and

[151] Thomas (2013) 241.
[152] In modern zoo exhibits, hidden areas where animals can escape the visitors' gaze are also important for the animals' wellbeing.
[153] Coe (1985) 202-04; Rees (2011) 113.

other performers) during the games. In recent times, most zoo exhibits provide viewing areas that are situated slightly below the grade of the enclosure so that the animals are at or above the visitor's eye level. This has the effect of making the animals appear more impressive which, according to recent studies, positively shapes the visitors' attitudes and behaviour about wildlife.[154]

1.2. Safety Provisions in Roman Entertainment Buildings

The most common venues used for sport and spectacle in the Roman world were the circus, stadium, theatre, and amphitheatre. Each building type was designed for a primary sport, so their architectural form provides a relatively good sense of what types of performances they each accommodated (Fig. 9). Accordingly, the circus was associated with chariot and horse racing, the stadium was designed for athletics, the theatre staged drama, and the amphitheatre was for gladiatorial combats. Hunting spectacles found their way into each of these four building types, but the manner in which they were accommodated varied from venue to venue depending on a number of cultural, economic, architectural, and zoological factors.

Of all the buildings mentioned above, the amphitheatre was by far the most suitable for displaying animals. As with modern zoo exhibits, the canonical design of the amphitheatre catered to the biological and behavioural needs of the animals, the requirements of those who participated in or assisted with the operation of the *venationes*, and the safety of the spectators. In plan, the amphitheatre was elliptical with an oval arena and a concentric *cavea* that enclosed the entire building. Since it primarily catered to combat sports, an oval arena was most appropriate as it encouraged contesters to spar along the central axis where visibility was optimum from all angles.[155] The lack of corners presumably also made it easier for beast fighters and arena attendants to control the movements of animals, as seen in the modern-day circus ring. The largest, and most influential amphitheatre in the Roman world was the Flavian amphitheatre in Rome, now commonly known as the Colosseum (Fig. 10). Construction of the Colosseum began some time in the early years of Vespasian's reign (69-79 CE) and was completed and dedicated by his son and successor Titus in 80 CE (Suet. *Tit.* 7.3; Cass. Dio 66.25). It comprised four architectural orders made of travertine cut stone that reached a height of about 50 metres, with external dimensions of 188 x 156 metres. The arena,

[154] Thomas (2013) 242.
[155] Welch (2007) 50.

measuring 80 x 54 metres, was built over a two-storey-deep substructure that catered to preparatory activities associated with the staging of spectacles (Fig. 11).[156]

The violent nature of hunting displays and the unpredictability of the animals' behaviours meant it was imperative that spectators were seated far away from the arena. Thus, the *podium* wall in all amphitheatres was exceptionally high, ranging from 1.70 metres to 4 metres tall.[157] Some *podia* were capped with concave mouldings which may have helped to prevent some animals (particularly species with jumping or climbing locomotion) from gaining a grip on the wall. This feature is well-preserved on the 2.18-metre-high *podium* in the amphitheatre at Pompeii (Figs. 12-13). The sheer multitude and diversity of animals that were displayed and hunted inside the Colosseum meant that a particularly tall and robust *podium* was essential. Archaeological evidence indicates that spectators in the lowest band of seats were elevated by a marble *podium* that reached between 3.60 and 4 metres high.[158] A fragment of a marble slab, discovered during excavations at the Colosseum in 1874, depicts a drawing of a large balustrade above the *podium,* which would have provided additional protection from the animals (Fig. 14).[159]

The efficient movement of beast fighters and arena staff was an important requirement of the amphitheatre's functional design. Many amphitheatres in both western and eastern parts of the Roman world contained an annular service corridor that ran behind the *podium* and, in some amphitheatres, opened directly into the arena through a series of rectangular doorways (*portae posticae*) (Fig. 15).[160] The service corridor generally gave no access to the *cavea,* which suggests that it was used exclusively by the performers.[161] Scholars commonly refer to the rectangular doorways as 'refuges' for reason that they could have provided performers with a means to escape from the animals during the *venationes*.[162] Artistic representations of these so-called refuges are clearly seen on the leaf of an early 5th

[156] For studies on the architecture of the Colosseum, see especially Golvin (1988); Bomgardner (2000); Beste (2000); Gabucci (2001); Connolly (2003); Lancaster (2005); Hopkins and Beard (2005); Welch (2007); Dodge (2014a, 2021); Rea (2020).
[157] Golvin (1988) 314-16.
[158] Golvin (1988) 287.
[159] Gabucci (2001) 127. Bomgardner (2000, 21) suggested that the *podium* was also equipped with 'crow nests' containing archers, whose responsibility was to ensure that no animals escaped the arena. However, no archaeological or iconographic evidence of this provision has been found.
[160] This corridor should not be confused with the annular gallery situated beneath the *ima cavea*, which was used for spectator circulation.
[161] This provision is well-preserved in several Republican amphitheatres in Italy, for example, at Nola, Abella, Sutrium, and Paestum, and in the imperial amphitheatres at Capua and Puteoli (Campania), Augusta Treverorum (Trier, Germany), Lepcis Magna (Libya), and Thysdrus (Tunisia).
[162] Epplett (2001a) 202-03; Welch (2007) 189; Dodge (2009) 29-25; Karambanis (2020) 77. Evidence for refuges has also been found in other types of entertainment buildings that were built or later modified for *venationes.* Examples: stadium at Aphrodisias (Welch, 1998b, 558-59); theatres at Corinth (Stillwell, 1929, 1952), Miletos (Golvin, 1988, 319-20), and Magnesia on the Meander in Caria, western Turkey (Sear, 2006, 112)

century CE ivory diptych depicting a *venatio* with stags (Fig. 16). The refuges are sealed from the arena by wooden doors with air vents that would have allowed performers to watch the animals safely with the door closed. This also enabled them to calculate the timing of their entry. Such refuges would have been particularly useful for attendants who were responsible for goading the animals, and by implication wore little protective gear (see chapter 3 for discussion of goading strategies). Within the service corridor of the Colosseum are twenty-four preserved niches that may have also served as a temporary refuge for arena attendants so that they could keep out of the way of other staff as they moved through the corridor (Figs. 17-18). Alternatively, some may have been used for storing equipment for the games or small cages for the animals.[163]

Secure areas were also required for segregating animals from the auditorium. These needs were partially met by a designated space beneath the arena floor called the *hypogeum,* which was comprised of vaulted galleries and chambers for housing performers, animals, and stage equipment. Not all amphitheatres had substructures, and those that do contain this feature vary considerably in design and complexity. Well-preserved examples are found in several amphitheatres built between the late 1st and mid-3rd centuries CE, including the structures at Rome, Capua, Puteoli, Lucera (Italy), Syracuse (Sicily), Itálica (Seville, Spain), Tarragona (Spain), Thysdrus (Tunisia), and Uthina (Oudna, Tunisia). The workings of these subterranean systems and the interplay of their design with animal behaviour will be discussed later in greater detail (below 1.3). Here, it will suffice to say that the *hypogeum* was unique to the amphitheatre and played a critical role in the production of *venationes.*

While amphitheatres were the principal venues used for staging imperial hunting spectacles, especially in the western Empire, they were costly to build and not all cities throughout the Roman world had the finances or resources to construct an entirely new venue. For cities that already contained some sort of auditorium - such as a theatre, stadium, or circus - it was often more cost-effective to modify existing structures with appropriate safety provisions. A salient feature that any building required in order to display animals was some sort of containment barrier. However, while only a short *podium* encircled the arenas of most circuses and *stadia,* the theatre contained no barrier at all, leaving spectators in the *cavea* completely exposed to the performance space.

This began to change, to some degree, around the turn of the 1st century CE as Roman-style spectacles (gladiatorial contests and *venationes*) were staged more frequently throughout the Empire as part of the imperial cult celebrations. Many, though not all, entertainment buildings were modified to accommodate these displays, and some were even

[163] Gabucci (2001) 127. On the function of the recesses as a potential storage space for caged animals, see Jennison (1937) 159, note 2.

constructed as multipurpose facilities from the outset.[164] Containment barriers thus became an imperative, but their design and construction varied considerably from venue to venue depending on the building type and the anticipated species for display.

1.2.1. Provisions for Jumping and Climbing Species

Some of the most challenging animals to contain in captivity are those with proficient jumping abilities. Most mammals can jump to some degree and several groups, including big cats, antelope, deer, kangaroo, and some primate species, specialise in this form of locomotion. The trajectory of a jump has two components – height and distance – and the capacity of both is dependent on the physical structure of the animal, its health, size, and the technique it uses. Mesh or netting fences are generally suitable for containing most jumping species in modern zoos; however, additional safety precautions are necessary for animals that are also proficient climbers, such as big cats. Climbing is the principle means of moving for arboreal and scansorial mammals like primates and requires balance, which is facilitated by adaptations including grasping appendages (claws, hands, feet, hooves, prehensile tail), and short limbs. Barriers made of materials that prevent animals from gaining a foothold, such as vertical concrete or rock walls, glass, and moats, are particularly suitable for species with this skill. Both jumping and climbing locomotion are beneficial survival strategies that enable animals to cope with natural or human-made obstacles in the environment (such as a barrier), acquire food resources, and, importantly, escape from danger.

All kinds of animals, not simply jumping and climbing species, posed considerable challenges in the Roman theatre. With the orchestra merged with the *cavea,* spectators on the lowest seats were exposed to the performance space. From the mid-2nd century CE onwards many theatres, particularly in the East where amphitheatres were less common, were either adapted with a permanent *podium* or were built with this feature. Two variations of this provision have been identified in the archaeological record: the first involved building a *podium* less than 2 metres high around the orchestra with a post-and-net extension; the

[164] The adaptation of entertainment structures for Roman-style spectacles is treated in a wide range of scholarship, generally in the form of case-studies that focus on specific buildings or regions in the Roman Empire. For examples of modified circuses in the Roman East, see Humphrey (1986); Ostrasz (2020); Patrich (2002a, 2009); Porath (1995, 2013); Dodge (2008, 2009); Weiss (1999, 2011); on theatres and *stadia*, see Stillwell (1929, 1952); Gebhard (1975); Mano-Zissi and Wiseman (1975); Golvin (1988); Moretti (1992); Welch (1998a, 1998b, 1999); Sear (2006).

second involved removing the lower rows of seats in the *ima cavea* to create a substantially higher *podium* and a larger performance area.[165]

Physical evidence of the first variation is especially well-preserved at the theatre at Stobi (near Gradsko) in northern Macedonia.[166] The theatre was built in the first half of the 2nd century CE and was designed with both Greek and Roman characteristics. It contained a large circular orchestra and an elaborate *scaenae frons.* However, it lacked a permanent stage, which Gebhard interpreted to suggest that amphitheatrical performances may have been prioritised over drama. This is further suggested by the 1.60-metre-high *podium* that encircled the orchestra and elevated spectators in the lowest tiers (Fig. 19). A small refuge was built into the centre of the *podium,* which gave access to the orchestra from a central corridor beneath the *cavea.* Significantly, the *podium* and refuge were both original features of the theatre. This suggests that the building was intended from the outset to be used in part for staging *venationes*.

The surrounding Macedonian forests offer some idea of the kinds of species that might have been displayed and/or hunted inside the Stobi theatre. In modern times, these mountains are still inhabited by the brown bear, Balkan lynx, European grey wolf, golden jackal, fox, wild boar, chamois, and roe deer, which likely would have been present in Antiquity. With the exception of wild boars (who can breach barriers just over 1 metre high), most of these animals are capable of either climbing or jumping over a 1.60-metre-high barrier, even one without footholds. The lynx, for instance, has been observed jumping vertically up to 2 metres from a standing point, and higher with a running start (*pers. obv.*). If such animals were anticipated to appear in the arena unbound (that is, without being contained in a cage or chains), further safety precautions were almost certainly necessary.

To remedy this problem, a post-and-net barrier was fastened to the top of the *podium.* This type of barrier was temporary in nature and comprised wooden posts and ropes that supported a heavy net, which encircled the performance space. Evidence of a post-and-net system at the Stobi theatre is indicated by three sets of cuttings located on the crown moulding of the *podium,* and on the first tier of seats. Rectangular post holes measuring about 0.115-0.145 metres wide by 0.15-0.24 metres long were found along the moulding of the

[165] Examples of the first provision are found at the theatres in Stobi, Heraclea Lyncestis, and Philippi (Macedonia); Thasos (Greece); Mytilene (Lesbos); and Aphrodisias (Turkey). Examples of the second provision are visible in the theatres in Corinth, Argos, Dodona (Greece); Paphos and Kourion (Cyprus); Tyndaris (Sicily); Ephesus (Turkey); Cyrene (Libya); Iol/Caesarea (Algeria). For discussion of the provisions at the theatres in Macedonia, see Gebhard (1975); for Mytilene, see Karambanis (2020) 77-79; for the remaining examples see Sear (2006) 43-44.

[166] The following measurements are taken from the excavation report by Gebhard (1975). For discussion of the theatre's different building phases, see Gebhard (2011). For preliminary reports see Wiseman and Mano-Zissi (1971).

podium, which overhung slightly towards the orchestra. Because of this angle, the holes are relatively shallow (approx. 0.12 metres deep), which suggests that the wooden posts could not have stood securely without additional support. Gebhard suggested that wedges set at an angle may have partially held the posts in place. Directly behind each post hole are traces of iron rings set in lead that most likely held guy lines for extra support (Fig. 20).[167]

While only hypothetical observations can be made here, it is worth considering what effect the slight angle of the post-and-net barrier may have had on preventing potential escapes. Internal overhangs are common in modern big cat exhibits, often in cases where the barrier itself is made from a climbable material such as a mesh fence (Fig. 21). The overhang will typically extend inwards up to 0.9 metres at a 45-degree angle, just enough to prevent an animal from gaining a foothold on the top of the barrier.[168] This provision can also be effective for deterring jumping species, as it requires them to leap a greater horizontal distance in order to escape the enclosure. Whether the angle of the barrier in the Stobi theatre was purposefully designed with this function in mind or was simply a product of the net's placement on the *podium* is difficult to tell. In any case, its angle, however slight, would have created greater physical challenges for animals attempting to breach the *podium.*

The design of the post-and-net system had several benefits in the Stobi theatre. Firstly, its temporary nature meant the barrier could be erected or taken down depending on the type of display and the types of animals that were anticipated to appear. It may have also been possible to adjust its height by extending the wooden posts. Thus, displays involving wolves, foxes, deer, and antelope species may have only required an extension of 1 metre above the 1.60-metre-high *podium*, whereas bears and lynxes would have probably needed a 2-metre extension. Knowledge of what species were anticipated to appear in the theatre may have been passed down to arena staff prior to a show so they had time to make the appropriate adjustments for each performance. Knowledge of the animals' jumping or climbing abilities would have aided them in making informed decisions about the severity of these adjustments. Although the evidence for this does not exist, it is possible that zoological knowledge was transmitted orally to arena staff by specialist hunters and animal handlers.

In addition to being removable, the post-and-net system also had the advantage of visibility. This aspect of barrier design was important for meeting the needs of the spectators.

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[167] Further support was aided by a second set of guy lines that were fastened to the top of the posts from the first tier of seats. This is indicated by a series of diagonal cuttings located on the edge of the tier, which correspond with the post holes on the moulding. A suggested reconstruction of the post-and-net system appears in a drawing by Hemans from Gebhard's 1975 study on the Stobi theatre. This model has been widely re-used and modified by scholarship to examine the workings of the post-and-net system in other buildings.

[168] In modern zoo exhibits, a climbable mesh fence, measuring 4 metres high with a 0.9 metre internal overhang has proven to be effective for containing most big cat species. See Appendix II, Table 1.

There is strong evidence to suggest that the type of nets used for this provision were the same heavy-duty nets employed by hunters for capturing live animals for the arena games.[169] Claudian reported the use of hunting nets for rounding-up wild beasts for the shows of Stilicho in the 4th century CE (Claud. *Cons. Stil.* 3.272-3) and, according to an epigram in the *Anthologia Graeca* (7.626), a large number of African animals were captured in nets for one of Julius Caesar's shows in Rome.[170] Interestingly, the iconography of hunting nets from mosaics throughout the Roman world closely resemble the design of the post-and-net system. A Roman mosaic from Tunisia, dated to the early 3rd century CE, shows wild boar being driven into a netted barrier by men and dogs (Fig. 22).[171] The nets are supported by wooden posts arranged at regular intervals, just like the cavities found along the *podium* in the Stobi theatre. In other mosaics, such as a 4th century CE Bear Hunt mosaic from Campania, the hunting nets are secured by posts and trees within the landscape (Fig. 23).[172]

For these nets to have been effective in containing wild beasts, both in the hunting fields and in the arena, they needed to be durable enough to withstand repetitive impact from sharp claws, teeth, horns, antlers, and talons. Pseudo-Oppian's vivid account of the capture of live bears in Armenia describes how hunters would pile layers of nets onto a bear to trap its paws so that it could not claw its way free. According to Pseudo-Oppian, this problem was fairly common in trapping bears (Ps.-Opp. *Cyn.* 4.354-424; cf. 3.340-363 on tigers, 4.112-146 on lions). To judge from a scene on the bottom left corner of the 'Little Hunt' mosaic from the Villa Romana del Casale in Piazza Armerina, Sicily, some ungulate species may have used their antlers to break through such hunting nets to escape from their captors (Fig. 24). Given its temporary nature, it is possible that isolated damage to the netted screen used in the arena could be replaced without needing to remove the entire structure.

Eclogues 7, composed by the Roman poet Calpurnius Siculus, mentions an unusual mechanism that may have discouraged some animals from scaling the *podia* of entertainment buildings and damaging the netted barriers. The poem describes rolling cylinders that appear to have rested on top of the *podium* inside an elaborate wooden amphitheatre in Rome, which some scholars associate with Nero's amphitheatre in the Campus Martius (Calp. *Ecl.* 7.48-

[169] On capture methods by means of nets and pits see Jennison (1937) 142-47.
[170] In a letter written to Cornelius Tacitus (1.6), Pliny the Younger claimed to have caught three wild boars by means of hunting nets. Pliny notes that he brought with him writing materials rather than hunting spears, which may suggest (if this account is credible) that the nets were arranged in such a way as to reduce the risk of the boars escaping and consequently harming the unarmed writer.
[171] Dunbabin (1978) 69, pl. 22, fig. 54.
[172] For discussion of the possible origin of these two mosaics see Ball (1984) and Lapatin (2014).

53).[173] There are no visual representations of this provision that we know of, but it may have operated in a similar manner to the anti-climb roller barriers that are used to deter animals (and people) from climbing fences in modern times (Fig. 25). Thus, when a bear or big cat tried to scale the *podium* the cylinders would have rotated abruptly, thereby flinging the animals off their course. Repeated attempts would have only caused increasing frustration for the animals while providing spectators with endless entertainment. Calpurnius Siculus also mentions the provision of nets with gold wire that hung on ivory tusks (Calp. *Ecl.* 7.54).[174] Such nets may have stood above the *podium* in an arrangement similar to the post-and-net barrier.

While the post-and-net system provided an easy and flexible solution for theatres without adequate safety provisions, its assemblage may have been costly and time-consuming and its durability comparatively inferior to a tall stone or marble *podium.* Irrespective of the net's strength, the sheer weight of a 400-kilogram bear or a 250-kilogram lion dangling from the barrier could be enough to dislodge the posts from their foundations. As noted earlier, another way of fortifying the orchestra was by removing the lower rows of seats in the *ima cavea* to create a substantially higher *podium* and a larger performance area.[175] Interestingly, the final phase of the Stobi theatre (late 3rd century CE) saw the post-and-net system replaced by a permanent masonry wall, which increased the height of the *podium* to over 3.60 metres.[176] In addition, both *paradoi* were closed off by heavy gates and a wall was installed along the front of the stage building, thus completely enclosing the orchestra. These alterations strongly suggest that *venationes* featuring jumping and climbing species had become the dominant type of display staged at the Stobi theatre in Late Antiquity.

The theatre at Corinth is another good example of this type of modification.[177] Excavations reveal that some time in the 3rd century CE the lower ten rows of seats were cut back to create a 1.60-metre-high *podium* that was capped with blocks of masonry to form a parapet wall. Together, the *podium* and parapet stood 3.50 metres above the arena floor (Fig. 26).[178] The parapet wall was capped by a cavetto moulding that curved towards the orchestra, similar to the internal overhang at the Pompeii amphitheatre. In addition, three doorways

[173] It is generally argued that Calpurnius Siculus' *Eclogues* are dated to the reign of Nero, though some scholars date their composition to the 3rd century CE for linguistic reasons. For discussion of these debates, see Jennison (1937) 94; Gebhard (1975) 46; Horsfall (1997) Welch (2007) 142; Dodge (2011) 62.
[174] For discussion of the possible placement of these features, see Gebhard (1975) 46, note 16.
[175] For excellent discussions of this type of modification, see Gebhard (1975) 61-63; Sear (2006) 43-44; Dodge (2014b) 572-73.
[176] Gebhard (1975) 61.
[177] The following measurements are taken from the excavation report by Stillwell (1929).
[178] Stillwell (1929, 96) dates these modifications to the reign of Caracalla, who visited Corinth between 214 and 217 CE.

measuring about 3 metres tall and 1 metre wide were cut into the *podium.* The central doorway gave access to the *cavea* through a staircase, while the other two openings could only be accessed from the arena. This may suggest that the doorways were used by performers as refuges to escape from the animals.

Excavations at the Corinth theatre revealed that the new *podium* was stuccoed and decorated with frescoes depicting scenes of *venatores* hunting lions, bulls, and other species. In light of the theatre's safety provisions, it seems plausible that these displays took place inside the later theatre.[179] Among these paintings is an illustration of a large, barred structure that Capps has interpreted as a cage.[180] This may have been used to bring the animals directly into the arena before releasing them. Another scene shows a curious interaction between a leopard and a pole-vaulter who employs a jumping pole (*contus*) to leap over the animal. This activity, known in ancient literature as *contomonobolon*, was one of many types of acrobatic exercises that became popular towards the end of the 3rd century CE (discussed further in chapter 4 section 4.1.1). The presence of big cats in the pictorial decoration helps explain the need for a tall, unclimbable *podium.* Logistically, the permanent nature of this barrier would have removed some of the preliminary work that was required for installing a post-and-net system and its durable material also reduced the potential of wear and tear from the animals.

Some circuses and *stadia* were also built or modified to accommodate *venationes* by having their arenas protected by a high *podium* to prevent escapes from climbing and jumping species. The stadium at Aphrodisias in western Turkey, built sometime in the late 1st century CE, is one of several unique *stadia* with a *cavea* that encloses the entire track, thus giving it an elliptical form (Fig. 27).[181] Spectators were protected from the performance area by a 1.60-metre-high *podium* that contains traces of small cavities spaced at regular intervals (Fig. 28).[182] Such cavities, as seen in the Stobi theatre, are indicative of a post-and-net system. A single square niche, carved into a section of the *podium* on the north side, was also identified during excavations.[183] Since the stadium did not contain a service corridor the niche could only be accessed from the arena, meaning it was probably used as a refuge for the performers and arena staff. The refuge, cavities, and high *podium* are all original features, which suggests

[179] Shear (1926) 451-452, fig 6 (bull).
[180] Capps (1949) 69.
[181] Other examples include the stadium at Laodicea ad Lycum in western Turkey and the stadium at Nikopolis in north-western Greece. Most *stadia* in the Roman world conformed to the traditional U-shape.
[182] See Welch (1998b) for an excavation report of the Aphrodisias stadium.
[183] Welch (1998b) 551: H. 1.60 m x W. 1.0 m x D. 1.20 m.

that the stadium was initially designed for a mixed program of games such as those associated with emperor worship in which animals featured prominently.[184]

In comparison to the Macedonian forests near Stobi, the Babadag mountains that surround the ancient city of Aphrodisias are inhabited by a greater range of predators, especially ones with excellent jumping and climbing abilities. These include the Anatolian leopard, Asiatic lion, Eurasian lynx, caracal, striped hyena, brown bear, wolf, jackal, and fox. Herbivores such as the common fallow deer, mountain gazelle, wild boar, and wild goat are also common throughout this landscape.[185] If such animals inhabited these forests during Roman times, most would have had little difficulty clearing the stadium's *podium* without the installation of a post-and-net barrier. This was especially true in the stadium as the large surface area of the arena enabled the animals a running start, more than what was afforded in the Stobi theatre. It could also accommodate a greater number and variety of species at one given time, thus increasing the risk of an animal's physical needs not being met. For instance, if a leopard (the most proficient jumper native to Turkey) was displayed in the arena alongside other species, ideally the post-and-net extension would have been tailored to *their* locomotion capacities. However, whether this was true in practice can only be speculated.

Animal displays that were staged in Aphrodisias from the 1st century CE are well attested in pictorial graffiti, inscriptions, wall paintings, and relief art, much of which was documented by Robert (1940) and subsequently by Roueché (1993) in her monograph on performers in Aphrodisias.[186] This evidence can offer further insights into the structural demands that animals imposed on the production of *venationes* inside the stadium. An inscription found in the northern end of the city commemorates displays given by the high priest Zeno Hypsicles, including gladiatorial combats, condemned criminals, and bull-catchers.[187] The last of these performers specialised in pursuing bulls, initially on horseback and then mounting the bulls. This difficult manoeuvre was often followed by a sharp twist of the bull's horns, which brought them to the ground (Plin. *NH* 8.70; Suet., *Claud.* 5.3). The length and oblong shape of the stadium was particularly suitable for this type of display, which required a large space for the bull-catchers to chase and subsequently bring down the animals.

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[184] The theatre of Aphrodisias, located in the south-east of the city, was adapted to accommodate Roman-style spectacles in the mid-2nd century CE. The orchestra level was lowered by 1.53 metres and a *podium* with an extended safety barrier was constructed around it. For discussion see Sear (2006) 44. It is likely that the theatre was used in conjunction with the stadium for staging games associated with the imperial cult.

[185] For a recent survey of native fauna in Turkey, see De Marinis and Masseti (2009).

[186] See also Chaniotis and Staebler (2018) for discussion of the graffiti at Aphrodisias relating to *venationes*.

[187] "Of Zeno Hypsicles, son of Hypsicles the natural son of Zeno, high-priest, the *familia* of single combatants, convicts and bull-catchers…" Robert (1940) 170, no. 157; Roueché (1993) 63, no. 14.

However, the size of the stadium's arena also gave the bulls a greater chance at clearing the *podium.* Aggravated bulls have been observed jumping over the 1.5-metre-high wooden barrier that surrounds the modern Spanish bullring. An incident of this sort was reported in 2010 at the plaza de toros in Tafalla, northern Spain, after a bull broke its right horn against the barrier (Fig. 29).[188] As previously noted, the escape vigour of an animal is significantly increased when it experiences stressful stimuli or, in this case, pain. Since the bull's horn is living tissue, the slight break caused the animal to become more dangerous and unpredictable, thus enabling it to clear the high barrier. Incidents of this sort are not reported in the evidence for bull displays in Aphrodisias or in other provincial arenas; however, collisions with the *podium* might have been more common than successful escapes. In this respect, a post-and-net extension was almost certainly needed for bull-catching in the stadium.

The inscription above also mentions the appearance of *katadikoi* (condemned criminals). Roueché interpreted these individuals as convicts who were pitted against dangerous animals in the stadium.[189] An interesting fragment of a relief panel, found near the Hadrianic Baths in the western sector of the city, may suggest that bears were used for *damnatio ad bestias* in Aphrodisias (Fig. 30).[190] The relief depicts a man attempting to dislodge a bear that has mauled his right thigh. The man is unarmed and naked except for a loin-guard, which indicates he was probably a convict, like the *katadikoi* mentioned in the inscription. The bear's appearance is more peculiar; it is shown wearing a harness, which might suggest that it had been trained to maul victims in the arena. In this instance, the harness could be used to facilitate its recapture after the performance. If the harness was attached by a rope to the arena floor, it could also reduce the risk of the bear escaping (for further discussion of the harness, see chapter 3 section 3.2.3).

An alternative method for containing bear executioners in the arena is represented on an early 3rd century CE floor mosaic found in a recently discovered villa at Wadi Lebda, near Lepcis Magna in Libya (Fig. 31).[191] The mosaic comprises five panels, two of which feature scenes of unarmed men fighting bulls, bears, elk, and wild boar, while the outermost

[188] Tremlett (2010). For footage of this incident, see: https://www.youtube.com/watch?v=6y3cjzuCGZo

[189] *Katadikoi* are mentioned in another inscription that commemorates the *familia* of the high priest Tiberius Claudius Pauleinus at Aphrodisias in the 1st century CE. See Roueché (1993) 62, no. 13.

[190] Roueché (1993) 72, pl. 11, fig. 41. Bears also appear in two fragments from a panel that represent *venationes* involving bears, wild boars, oxen, dogs, and *venatores*. On one fragment, a bear and a human figure are joined together by a rope. This is more suggestive of *damnatio ad bestias.* See Roueché (1993) 72, pl. 11, fig. 40.

[191] Details of the Wadi Lebda mosaic and its excavation still await full publication; however, a description of the iconography can be found in Dunbabin (2016) 193-94, fig. 7.17a.

panels depict the outcome of gladiatorial combats.[192] The central panel shows a chariot race and other activities in the circus, including two groups of mimes and three dancing acrobats who perform on top of a netted enclosure that stretches between the *metae* at either end. Inside the enclosure two naked or near-naked men can be seen attacking bears, while a third is being mauled. A netted enclosure such as the one depicted here was presumably a more practical and economic solution for containing animals in displays that did not need the full use of the arena. Moreover, its temporary roof reduced any risk of the bears (or indeed the *damnati*) climbing out. Given the unusual composition of the circus scene, the mosaic was most likely commissioned to commemorate a historical spectacle, or several, in which only the central part of the circus' arena was used for small-scale *venationes*. The amphitheatre at Lepcis Magna, which comprised a tall *podium* with numerous refuges, probably accommodated the more varied animal combats that feature on the mosaic.

Thus far we have discussed a number of hypothetical scenarios where the different jumping and climbing abilities of animals likely informed the design of tall *podia* and flexible post-and-net systems in buildings without adequate containment barriers. Naturally, our investigation is rather limited by the lack of empirical reports of animal escapes and structural responses to those events. However, one unique building offers a more detailed picture of how the behaviours of animals directly impacted facility design. Herod's Circus, located in the ancient port city of Caesarea Maritima in present-day Israel, is one of several multipurpose circuses in the East that was remodelled in the later Empire with a short, amphitheatrical arena that occupied the building's southern end (*sphendone*) (Fig. 32).[193] Extensive excavations conducted in the early 1990s by the Israel Antiquities Authority (IAA) and the University of Haifa identified three major building phases of the shortened arena, including repairs and improvements to the venue's safety provisions that correlate with the production of *venationes*.[194] Not only do these modifications point to growing concerns about spectator safety, they may also indicate that animal escapes, or at least *attempted* escapes, were not that uncommon.[195]

[192] The nature of these human-animal combats is discussed later in chapter 2 section 2.1.1.
[193] This type of modification has also been identified at the circuses in Gerasa in Jordan (Ostrasz 1989, 1991, 1995, 2020); Neapolis (Magen 2005); Scythopolis (Tsafrir and Foerster 1997); the *stadia* in Aphrodisias (Roueché 1993; Welch 1998b); Perge (Abbasoğlu 2001; Grainger 2009); Ephesus (Keil 1955); and the stadium of Herodes Atticus (Welch 1998a).
[194] The IAA expedition, directed by Joseph Porath, uncovered the *cavea* and arena, while the University of Haifa expedition, led by Yosef Patrich, exposed the *carceres* and a strip of ca. 40 metres wide of the adjacent arena. For preliminary reports see Porath (1995). Due to the multipurpose nature of the building, there remains considerable debate and disagreement between the two teams over its identity as a canonical Roman circus. For discussion see Humphrey (1996); Porath (1995, 2003, 2004, 2013); Patrich (2001a, 2001b, 2002a, 2002b, 2003a, 2003b, 2009); Dodge (2008).
[195] The following details are taken from the latest excavation report by the IAA (2013, ch.5), who were chiefly responsible for excavating the shortened arena at Herod's Circus.

According to the excavation reports, during the earliest phase of the remodelled arena the surface of the performance space was drastically lowered by over 2 metres, though in places where it lay on *kurkar* bedrock, only 1.30-1.80 metres could be exposed. This engineering feat would have only been necessary if animals were anticipated to appear somewhat regularly in the Circus, since neither gladiators nor athletes required such a high containment barrier. However, the initiative does not seem to have been successful as the arena was shortly filled to its original height of 1.10-1.20 metres and its *podium* was capped with a post-and-net extension. Interestingly, the archaeology attests two different types of barrier extensions that both correspond to the same building phase (Fig. 33). This is visible through the distribution of cavities of varying sizes along the *podium* and lowest band of seats. The earliest datable holes are dispersed along the top edge of the *podium* at 1.20-1.60 metre intervals. They are relatively small in size and semi-rectangular, measuring approximately 0.04-0.08 x 0.08-0.11 metres and 0.10-0.14 metres deep. A set of slanting holes, slightly smaller than the semi-rectangular cavities, were found nearby along the top of the *podium* at irregular intervals. These slanting holes may have contained guy ropes that supported the wooden posts for the barrier, perhaps similar in design to that seen in the Stobi theatre and Aphrodisias stadium.

The second group of cavities, which date slightly later than those mentioned above, are made up of large, round holes measuring 0.25 metres in diameter and 0.30 metres deep. These much larger and deeper depressions are spaced at 1.30-1.60 metre intervals along the middle of the footrest of the lowest tier. Their size and placement suggest that the first few rows of seats were sacrificed to accommodate a taller, presumably more durable barrier than the former safeguard. The added space between the arena and the audience, however slight, might have been enough to hinder, or at the very least slow down, animals trying to escape. Importantly, being farther away from the edge also lessened the potential for wear and tear and the position of the barrier on the footrest meant that the wooden posts could be supported by deeper holes without the need for guy lines. All this suggests that the later instalment was more accommodating for animals who were especially adept at jumping and climbing.

Editores that staged *venationes* in Herod's Circus would have had access to a diverse range of species that could be procured locally. Just under 300 kilometres south of Caesarea Maritima lies the Negev desert, which is still inhabited by the Arabian leopard, caracal, desert lynx, Arabian wolf, golden jackal, red fox, red-necked ostrich, camel, Nubian ibex, Arabian oryx, Persian fallow deer, Dorcas and Israeli gazelle, and wild boar.[196] Although now extinct,

[196] For a recent survey of carnivores in the Middle East, particularly in Syria, see Masseti (2009).

the Syrian lion and Asiatic cheetah could also be found in the Negev desert in historical times. Populations of Syrian brown bears and striped hyenas lay further north of Caesarea Maritima in Lebanon, while the Carmel Mountain range (which stretches between Hadera and Haifa) provided a closer supply of wild beasts. Some of these animals have been identified from wall paintings on the east façade of the Circus' *podium* in the shortened arena.[197] The paintings depict a range of native and exotic species, including an elephant, some type of bovid (possibly an African buffalo), a lion, leopard, stag, dog, horse, wild boar, fox, and a rabbit.[198] The animals are all represented in motion and occupy the full height of the *podium,* although there does not appear to be any relationship between them. Their composition in a diagonal running position may suggest that the artist(s) were partially working from a pattern book.[199]

Based on these illustrations, some archaeologists have argued that only native species represented on the *podium* would have appeared in Herod's Circus.[200] For reasons unknown, big cats were not classified as being native to the area, despite their historic (and for some continued) presence within the surrounding deserts of Caesarea Maritima. This is further supported by a Jewish law, dated to the 2nd century CE, which forbad the selling of lions, bears, and other harmful carnivora for the arena (*Mishna,* Avodah Zarah, 1.7).[201] Indeed, it is possible that big cats were abundant enough in Roman Judaea to even supply Rome with these animals.[202]

Due to this oversight by archaeologists, the modified barrier extensions have not been interpreted within their ecological context. The desert ecosystem surrounding Herod's Circus indicates that various species of big cats, and not simply those represented on the arena's *podium,* could be obtained locally for hunting spectacles and executions. Big cats were not, however, the only proficient jumpers (and predators) that could be found within the province. While hyenas do not typically perform jumping locomotion, they have been known in modern times to jump up to 1.8 metres to catch prey and thus require containment barriers that stand at least 2.7 metres tall in captivity. Gazelle, oryx, deer, and ibex – all of whom both hyenas and big cats hunt or scavenge in the Negev desert – are also excellent jumpers. Any one of these species could have been responsible for sparking growing concerns over spectator safety at Herod's Circus.

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[197] These date to the same building phase as the lowered arena, slightly earlier than the post-and-net instalments. For discussion see Epstein (ch. 7) and Michaeli (ch. 8) in Porath (2013). See also Linn (2017) on the origin of pigments from the *podium* wall in the shortened arena.
[198] Patrich (2002b, 343) interpreted one of the felines as a tiger and the dark-skinned elephant figure as a wild boar.
[199] On the use of pattern books by mosaic workshops in Roman North Africa, see Dunbabin (1978) 65-87.
[200] Michaeli (2013) 186.
[201] Jennison (1937) 167.
[202] Epplett (2001a) 28.

While it is not known for certain if some animals did succeed in escaping the arena, the gradual extension of the *podium* indicates an increasing awareness of the animals' locomotor capabilities and demands. Significantly, the excavations revealed that the semi-rectangular cavities, which supported the earlier of the two post-and-net systems, were later plastered over while the large holes on the lowest footrest of the *cavea* were left untouched.[203] This strongly suggests that the modified barrier had proven effective in containing animals and that no further amendments were necessary. All of these developments took place over a relatively short period (just over half a century), making the remodelled arena at Herod's Circus an excellent example of the experimental and flexible nature of facility design.

There is one last group of highly adapted climbers that have gone largely unnoticed in studies that deal with arena safety provisions – primates. Unlike big cats, who interlock their claws to perform climbing locomotion, primates use their hands, feet, or tail to grasp onto vertical or steeply inclined surfaces. All species of primates are adapted to an arboreal or scansorial lifestyle, and some engage in another form of locomotion called brachiation, which involves using the forelimbs to swing from branch to branch (Fig. 34). This dynamic movement has often been used by primates to escape their exhibits in modern zoos, as Evelyn's story earlier illustrated. Bipedalism - the ability to stand and walk upright - is another type of locomotion that arises out of anatomic structure and was exploited by Jim the gorilla to assist Evelyn in another escape (see Introduction). Primate locomotion is therefore extremely diverse. Although safety provisions may differ between primate exhibits in accordance with the species' repertoire, a universal requirement is that no climbable vegetation or furnishing should be placed within at least 4 metres of a containment barrier. With this in mind, a post-and-net barrier on its own would have been largely ineffective in preventing this group of animals from climbing or swinging their way out of the arena.[204]

Primates rarely appear in the evidence for *venationes* in Italy and throughout the provinces. Pliny the Elder reported the first known sighting of *cepha* (possibly baboons) in Rome at the games given by Pompey in 55 BCE but added that such animals were never again seen in Rome, at least in the period when he was writing (Plin. *NH* 8.28). Pliny describes these animals as possessing hind feet that resembled human legs and feet, and forefeet like hands. These grasping appendages would have facilitated an easy escape from Pompey's Theatre and even the Circus Maximus, where Pompey staged his elephant *venatio.* Pliny does not mention

[203] Porath (2013) 144.

[204] The tendency of primates to escape is alluded to in Plautus' *Miles Gloriosus* (line 162) where a man, who has been caught on a neighbour's roof, is likened to someone chasing an escaped monkey. This may also suggest that some primates were household pets in Rome by the end of the 3rd century BCE. Considering that Roman houses typically had an opening in the roof through which rainwater could enter, the risk of an untethered monkey escaping was presumably quite high!

if the baboons were killed however, considering this was their first appearance, it is likely that the animals were exhibited as natural curiosities, perhaps tethered to the arena by chains (see chapter 2 section 2.4 on animal curiosities).

Monkeys that performed specialty feats in public are reported by some Roman writers; however, the context in which these displays took place is often ambiguous. Juvenal mentions a small monkey dressed in armour that hurled javelins from the back of a she-goat along the embankment of the Esquiline in Rome (Juv. 5.153-155; see also Mart. *Ep.* 14.202[205]); Mucianus informed Pliny the Elder about a species of tailed monkey that had been taught to play draughts (Plin. *NH* 8.80); and Aelian reportedly observed a Barbary ape performing as a charioteer (Ael. *NA* 5.26).[206] A Roman lamp, dated between 30 CE and 70 CE, bears the image of an entertainer dressed in a loose tunic who sits beside a monkey that is shown grasping his arm (Fig. 35). The entertainer holds an unidentified object in his right hand, a stick in his left, while behind him a cat climbs up a ladder. Two juggling rings are depicted above the ladder, which might allude to one of the entertainer's speciality feats. The two animals may have participated in this or other routines, possibly under the guidance of the stick (see chapter 3 for discussion of tactile cues).

Many of the acts mentioned above, if accurately reported, probably did not require a large performance space. In fact, intricate tricks that were performed by small primates like the barbary ape would have been quite difficult for spectators to see from the *cavea* of most entertainment venues. Such displays could have easily taken place in a small, intimate public setting such as the marketplace, where animal curiosities could sometimes be found (Fig. 36).[207] The entertainer from the Roman lamp might then represent a street artist. If, however, trained primates *were* displayed in the arena, it is possible that part of their training involved conditioning the animals to stay close to their handler. Diodorus Siculus, for instance, observed the baboon's propensity to submit to training and even credited the animal with the faculties of learning and memory (Diod. Sic. 3.35; see also Plin. *NH* 8.80). The tangible contact between the monkey and entertainer on the lamp reflects the kind of intimate relationship

[205] Martial alludes to another performance by a long-tailed monkey who supposedly wore a hooded overcoat (*Ep.* 14.128).

[206] An ape driving a charioteer drawn by two camels appears on a 2nd century CE marble relief, currently held at the Museo Nazionale Romano all terme di Diocleziano in Rome (no. 496). See Junkelmann (2000a) 70, fig. 75. Jennison (1937, 128) argued that trained monkeys and their handlers may have been brought over to Italy from large menageries, such as the one at Alexandria during the late Republic/early Empire. The movement of animal trainers throughout the Mediterranean is discussed further in chapter 2 section 2.6.1.

[207] A late 2nd century BCE marble relief from the Via della Foce at Ostia depicts a vegetable and poultry shop featuring two monkeys perched on a counter next to a basket. Neither of the monkeys are shown in chains, which suggests they were not for sale but may have instead been used to entertain and attract curious customers. For discussion of this relief see Lewis and Jones (2018) 469 and Bubb (2022) 98, fig. 4.1.

that so many primate keepers in modern times have with their animals. If the stressful conditions of the arena became too overwhelming for performing monkeys, as it most likely did, the animals could have been tethered to their handler by a long rope or chain that prevented them from wandering too far. This form of restraint continues to be used on monkeys by some street performers in parts of Asia (Fig. 37).

1.2.2. Provisions for Megaherbivores

Megaherbivores including elephants, rhinoceroses, hippopotami, and giraffes pose very different challenges to exhibit design than jumping and climbing species owing to their immense size and weight. Although these animals appear heavy-footed when walking, they are extraordinarily agile when provoked and can charge or gallop at (or away from) a perceived threat at a rate between 30 and 50 kilometres per hour over a short distance. In modern zoo exhibits, robust materials that can withstand impact from these species such as concrete and rock walls, moats, or heavy-duty wooden posts are generally recommended for safety barriers (Fig. 38).[208]

The ancient literary and visual evidence indicate that *venationes* featuring megaherbivores were predominantly staged inside the Colosseum at Rome during the imperial period. Its substantial *podium,* which rose approximately 3.60-4 metres above the arena floor, was made of travertine stone that would have been durable enough to withstand potential impact from heavy-weight animals. Before the Colosseum was built, however, cumbersome animals like the elephant were generally displayed inside the Circus Maximus.

By the time Pompey staged his near-disastrous elephant *venatio* in the Circus (55 BCE), elephants had already made several appearances in this building, and in fairly large numbers.[209] Unfortunately, due to the lack of remains from the late Republican Circus, it is difficult to know for certain what safeguards were in place to protect spectators from the animals during these shows. A corrupt passage from Livy that deals with structural developments in the Circus Maximus in 174 BCE, suggests the building was equipped with ironbound fences or cages (*caveas ferreas*) that gave wild beasts access to the arena (Livy

[208] For a recent study on the challenges of translocating and containing megafauna, see Lekolool (2012).

[209] Metellus reportedly exhibited over 140 war elephants inside the Circus in 250 BCE after his victory over the Carthaginians in Sicily (Plin. *NH* 8.6); in 169 BCE the curule aediles of Rome organised *venationes* with elephants, as well as 63 *Africanae* and 40 bears (Livy 44.18); elephants fought in the Circus in 99 BCE at the shows of Gaius Claudius Pulcher as aedile; and twenty-one years later, the first combat between elephants and bulls was displayed at the Circus games given by the aediles Lucius and Marcus Lucullus (Plin. *NH* 8.7).

41.27).[210] Whether these provisions were also used to protect spectators from the animals is hard to say. Moreover, there is no evidence that indicates whether the elephants from the Republican games were chained to the arena floor or were allowed to roam freely once released into the arena. According to Seneca, Lucius Sulla was the first person in Rome to exhibit unbound lions (*leones solutos*) inside the Circus in 93 BCE, whereas in previous games they had only been shown in chains (Sen *Brev. Vit.* 13.6; cf. Plin. *NH* 8.20).[211] This suggests that the Circus was equipped with some sort of protective screen (possibly a netted barrier or metal grille) by the time of Sulla's games at least.[212]

Like many Roman officials before him, Pompey likely chose the Circus Maximus as the site for staging his elephant *venatio* because it had a spacious performance area that was ideal for accommodating large-scale hunts. The Circus also had a far greater seating capacity than Pompey's recently inaugurated theatre, which was certainly not secure enough to contain a herd of elephants. However, to judge from Pliny the Elder's description of the vandalised iron palisade, the Circus' safety provisions were not much better either (Plin. *NH* 8.7). While elephants cannot jump due to the muscular arrangements of their limbs, they are highly capable of breaking through light fortifications (Strab. 15.43). Using its powerful legs and trunk, an elephant could quite easily push down an iron palisade or use its tusks to uproot it.[213] According to Diodorus Siculus, these destructive tendencies made the elephant a particularly valuable physical aid in siege warfare during the Hellenistic period. Perdiccas is reported to have used elephants to tear down the palisades and parapet walls that fortified Ptolemy's camp near the city of Tanis in Egypt during the siege of 321 BCE (Diod. Sic. 18.34). In modern times, the elephant's capacity to break through barriers remains a particular challenge in human-animal conflict management. For example, in 2012 a tusker (bull elephant) rampaged through six villages in the Achanakmar Tiger Reserve, located in Chhattisgarh, India, causing destruction to crops and at least twelve houses.[214] A similar incident was recorded in 2015 from Randah Village, India, where a herd of twenty elephants destroyed eight houses and left four of the community's livestock dead.[215]

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[210] For a discussion of this passage see Humphrey (1986) 70-71.
[211] Before Sulla, lions had been displayed alongside leopards in a *venatio* produced by Marcus Fulvius Noblior in 186 BCE, presumably also inside the Circus Maximus (Livy 39.22).
[212] A high (though not necessarily durable) protective barrier must have been in place at the time of Pompey's games in 55 BCE for, in addition to exhibiting elephants, Pompey also sponsored *venationes* involving several hundred lions and leopards and, for the first time in Rome, a baboon, lynx, and rhinoceros (Plin. *NH* 8.20, 24, 28, 29; Plut. *Pomp.* 52.4).
[213] For discussion of the use of the trunk as a tool to tear up trees and push heavy objects in modern times, see Sikes (1971) 39 and Poole (1996) 129.
[214] Bagchi (2012).
[215] Singh (2015).

Thus, there is no reason to doubt that the elephants in Pompey's *venatio* were capable of escaping the Circus' arena, if in fact it was surrounded by an iron palisade as Pliny suggests. It is possible that, up until the end of the Republic, the *editores* in Rome had generally relied on the skill of beast fighters and arena attendants to fend off elephants and other megaherbivores from bursting into the *cavea.* Such a casual approach to safety inside the Circus Maximus makes Pompey's elephant incident seem like an accident waiting to happen. Evidently, something had to be done to ensure that this would never happen again.

As Pompey's greatest rival, Julius Caesar made sure that the same mistakes would not be made when he staged his own elephant *venationes* inside the Circus. According to our literary sources, Caesar took the precaution of digging a water 'moat' inside the Circus some time during his first consulship in 49 BCE (Plin. *NH* 8.6; Suet. *Iul.* 39.2). Dionysius of Halicarnassus, a contemporary of Caesar's games, provides the most detailed account of the Circus' architectural form from his own day (Dion. Hal. *Ant. Rom.* 3.68.1-4). According to Dionysius, the moat was dug around the three sides of the racing track and measured 3 metres wide by 3 metres deep. Porticoes that stood 3 stories high were built behind the moat, of which the lowest story accommodated stone seats, probably for important officials.[216] Some sort of barrier presumably separated the moat from the *cavea* to prevent spectators from falling in.

Several scholars have argued that the moat was introduced by Julius Caesar in response to the elephants' dangerous behaviour towards the palisade at Pompey's show.[217] However, Caesar's motive for choosing a moat over other kinds of barrier for this precaution has not been questioned.[218] According to Pliny the Elder, Caesar surrounded the arena with water channels (*euripi*[219]) on account of his intention to stage a similar show to that which Pompey had produced: *qua de causa Caesar dictator postea simile spectaculum editurus euripis harenam circumdedit*[220] (Plin. *NH* 8.7). This may suggest that Caesar specifically had elephants in mind for a display when he decided on a moat.

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[216] At the time of Caesar's games, most of the seating in the *cavea* was still made of wood, while the front rows (reserved for officials) were stone. The monumentalising of the *cavea* took place under Trajan. For discussion see Humphrey (1986) 73-74.

[217] Jennison (1937) 156; Auguet (1972) 82; Humphrey (1986) 74; Vismara (2001) 63; Holliday (2021) 428.

[218] Humphrey (1986, 74) proposed that, besides safety, the moat may have acted as a drain for carrying excess water from the surrounding valley into the Tiber River. Alternatively, the provision of water could have been used by athletes and other performers to wash themselves down. Humphrey does not, however, make any connection between the functional design of the moat itself and elephant behaviour.

[219] The term *euripus* was sometimes used by Roman writers to refer to both the central barrier of the circus and a water channel such as that which could be found along the track in some *stadia.*

[220] Plin. *NH* 8.7: "Owing to this, when subsequently Caesar in his dictatorship was going to exhibit a similar show, he surrounded the arena with channels of water…" Trans. Rackham (1983) 17.

Curiously, there seems to have been a belief among some ancient writers that elephants were incapable of bending their legs due to the absence of joints (Diod. Sic. 3.27; Strab. 16.10). This might have been influenced by the common method of trapping wild elephants by means of pit-falls. According to Pliny, elephants that were captured for African monarchs were chased by horsemen into pits and subsequently starved into submission (Plin. *NH* 8.8).[221] In parts of India, a different technique was employed, which involved luring elephants into a treeless space that was enclosed by a deep trench and could only be accessed by a narrow bridge. Strabo mentions how a group of tame female elephants would be used to lure wild elephants into the enclosure, whereupon the animals would begin to fight (Strab. 15.42). The narrow bridge was then sealed, and the deep trench prevented the elephants from escaping.[222] Other methods employed by elephant-hunters also took advantage of the animal's supposed physiological limitations. Diodorus Siculus describes a capture technique practiced by elephant-eating tribes in Ethiopia, which involved cutting into the trees that elephants would typically use to lean against when sleeping (Diod. Sic. 3.27). The elephant's bulk weight would cause the damaged tree to break, and the fallen animal would, theoretically, be unable to rise from the ground. This method is also mentioned by Strabo, who contended that the elephant's legs do not have joints, but rather "only a continuous unbending bone" (Strab. 16.10).[223] This idea of the elephant not possessing joints may have developed from the assumption that the animal was too heavy and cumbersome to lift itself on its own.

Interestingly, trenches were also used as an effective deterrent against elephants in siege warfare during the Hellenistic period. An example of this strategy is found in Phylarchus' report of when King Pyrrhus of Epirus attempted to besiege Sparta with an army of twenty-four war elephants (Plut. *Pyrrh.* 27-28). The Lacedaemonians allegedly prevented this attack by digging a long trench measuring just over 1.80 metres deep around the perimeter of the city. This succeeded in preventing the animals from getting close to the city. In modern zoo exhibits, dry moats are sometimes used as a safety measure, in addition to fortified barriers, to contain captive elephants (Fig. 39).

[221] Pliny the Elder also notes that when a stray elephant had fallen into a man-made pit its herd could sometimes be observed constructing ramps made of branches and rocks to help it climb out of the pit (Plin. *NH* 8.8). This is one of many examples that Pliny uses to demonstrate the sense of community among groups of elephants.

[222] Pseudo-Oppian describes in detail the practice of trapping other animals such as lions, jackals, and leopards in Africa by means of deep pitfalls (Ps.-Opp. *Cyn.* 4.77-111, 4.212-220). For this method to have been successful, the depth of the pit needed to exceed the animal's jumping capacity and contain no footholds for it to use as a leverage.

[223] For other methods of trapping elephants in Antiquity, see Jennison (1937) 145.

Elephants are also excellent swimmers, so regardless of how deep Caesar's moat was, some form of barrier, located directly below spectators in the front tiers, would have been needed to prevent the elephants from swimming across the moat and climbing into the *cavea*. If the elephants accidentally fell into the moat, they would have had little difficulty lifting their heavy bodies back into the arena, provided that the water was sufficiently high. In this instance, the spectacle would not be brought to an abrupt end simply from the animals seeking refuge inside the moat. Jennison believed that an inner barrier would have been necessary to stop thirsty animals from entering the water.[224] However, this could easily be resolved by goading the animals back into the arena.

From a safety perspective, the moat was a significant improvement upon the iron palisade that was potentially in place for Pompey's elephant display. Why Julius Caesar specifically chose a moat for this precaution is not known for certain; however, the relatively widespread practice of trapping elephants (among other species) in deep trenches or pitfalls may have had some influence over this decision. Having exploited elephants in his own military excursions, Caesar likely possessed some knowledge of the animal's physiological limitations. As far as circuses are concerned, the construction of a moat as a safety provision is unique to the Circus Maximus.[225] However, the fragmented nature of circus remains across the Roman world means that it is difficult to know for certain if it was adopted elsewhere. Furthermore, excavating a deep land fill around a large arena must have been a costly procedure that required significant labour. In this respect, it may not have been the most feasible containment barrier for the circus, despite its potential effectiveness for containing megaherbivores like the elephant.

1.2.3. Provisions for Semi-Aquatic Species

Water spectacles that featured species such as the crocodile and hippopotamus were comparatively rare events and required special provisions to accommodate the animals' aquatic locomotion. Animals that are semi-aquatic have evolved morphological and behavioural adaptations that allow them to move efficiently and safely on land, while surviving the thermodynamically challenging environment of water. For crocodiles, who are ectothermic, dedicated basking areas are highly important in exhibit design as they allow the animals to absorb heat from external sources and regulate their body temperature. The provision of water basins is equally important to prevent their body from overheating and

[224] Jennison (1937) 156.
[225] During the reign of Nero (54-68 CE) Caesar's moat was replaced with seats for the *equites,* who were probably elevated from the arena by a new *podium* wall (Plin. *NH* 8.7; Tac. *Ann.* 15.32.1).

helps simulate the animal's natural hunting environment. Terrestrial locomotion is typically quite slow (although crocodiles can reach speeds of up to 10 kilometres per hour if threatened), whereas in water their speed and agility is significantly improved. Using their powerful cantilever tail, crocodiles can swim at speeds of up to 35 kilometres per hour in short bursts and lunge themselves out of water to incredible heights (Fig. 40).[226] The provision of pools therefore offers spectators incredible displays of crocodilian agility, speed, and coordination.

These semi-aquatic propensities of the crocodile were exploited by some *editores* in Rome and, potentially, by provincial elites in Roman North Africa, where crocodiles were native. According to the literary sources, the provision of water was achieved in one of two ways: by flooding an existing facility or building a specially designed artificial basin (*naumachia* or *stagnum*). The first crocodiles brought to Rome for spectacle were displayed alongside a hippopotamus inside a temporary basin during the aedileship of Marcus Aemilius Scaurus in 58 BCE (Plin. *NH* 8.40; Amm. Marc. 22.15.24). As with crocodiles, hippopotami live in both terrestrial and aquatic environments but are incapable of swimming due to their heavy body and bone density. Rather, aquatic locomotion consists of walking along the riverbed in a slow-motion gallop. Given the natural co-existence of these two species, it is particularly interesting that the first specimens of their kind seen in Rome were exhibited together and in water.

Unfortunately, Pliny the Elder provides no details of the design of the basin itself. Its temporary nature suggests that it could be assembled and dismantled on occasion, similar to the post-and-net system. If this were the case, it must have been made of a robust wood for it to withstand potential impact from a hippopotamus weighing in excess of 3,000 kilograms.[227] The risk of the basin collapsing from the force of a charging hippopotamus would have increased depending on how spacious it was. It is possible that Scaurus had the basin constructed inside the Circus Maximus, where he staged a procession of 150 leopards (Plin. *NH* 8.24). Alternatively, since there is no mention of location, it is possible that a temporary basin was dug into the ground in a public area. Since crocodiles are capable climbers, the basin would have had to be sufficiently deep in order to prevent the animals from climbing out. Interestingly, there is no mention of the animals being killed. Pliny vaguely notes that the

[226] With enough depth, large crocodiles can jump straight upwards to a height that reaches their hind legs. Smaller crocodiles are capable of getting more of their body out of water, depending on their weight. Private conversation with Zookeeper Lawrence White from Butterfly Creek, New Zealand (July, 2023).

[227] The Global Federation of Animal Sanctuaries (2019) recommends using solid barriers made of concrete block or poured concrete and artificial rock as the sole method of containment for hippopotami. Walls made of vertical posts or steel corral type pipe may also be used for indoor enclosures.

hippopotamus and the five crocodiles were exhibited (*ostendere*), perhaps as natural curiosities. This seems appropriate given that it was their first appearance in Rome.

Despite having never seen these animals before in Rome, some of the spectators at Scaurus' show may have at the very least known about their co-existence from Nilotic scenes in art. Nilotic scenes flourished in Roman villas and religious buildings in Pompeii, Rome, and other parts of Italy from the 2nd century BCE.[228] Representations of the hippopotamus and crocodile often depict the pair as formidable keepers of the Nile.[229] It is also common to find the animals represented in conflict with each other or Pygmy hunters (Fig. 41). A particularly well-preserved example is the famous series of mosaics from the House of the Faun in Pompeii, where an agonistic encounter between a crocodile and hippopotamus features in the centre mosaic (Fig. 42). The two species are depicted with anatomical accuracy, which suggests the artist was relatively familiar with the animals. The hippopotamus is shown partially submerged in water but is visible enough to see its large head and barrel-shaped body. Its small ears, eyes, and large nostrils are accurately portrayed on the top of the animal's skull, enabling the hippopotamus to lie mostly submerged in water. The crocodile approaches its foe from the river bank; it is depicted with a plated back, long tail, short legs, and an elongated mouth with rows of conical teeth. Both animals bare their teeth as they face one another, which signifies the enmity between the species. In modern times, confrontations between hippopotami and crocodiles are fairly common around watering holes in Africa and Egypt. Hippopotami, for instance, have been sighted by zoologists exercising dominance by displacing crocodiles from their basking sites (Fig. 43).[230] With reference to Scaurus' games, part of the attraction of displaying the animals together may have been the prospect of seeing the two species fight each other in conditions that simulated their natural environment.

There are no more reports of the hippopotamus being publicly exhibited in water in Rome after Scaurus' spectacle.[231] Aquatic provisions were arranged for crocodiles on three other occasions according to ancient literature, two of which took place during the reign of Augustus.[232] In 2 BCE, Augustus staged a large-scale *naumachia* (naval combat) inside an

[228] On Nilotic scenes featuring crocodiles and hippopotami see Toynbee (1973) 128-30, 218-20. See also Merrills (2017) esp. ch. 3, which explores the "managerial gaze", or experience of viewing Nilescapes by Roman aristocrats.
[229] Diodorus Siculus (1.35) and Pliny the Elder (*NH* 8.37-40) both treat the crocodile and hippopotamus together in their descriptions of Nilotic creatures.
[230] Kofron (1993) 463-69.
[231] Hippopotami were further displayed and/or hunted (though not in water) at the public games given by Augustus (Cass. Dio 51.22), Nero(?) (Calp. *Ecl.* 7.66-68), Antonius Pius (SHA *Ant. Pius* 10), Commodus (Cass. Dio 73.10.3), Elagabalus (SHA *Elag.* 28.3), Philip I (SHA *Gord. Tres.* 33).
[232] In preparation for his son's praetorian games in 401 CE, Symmachus wrote to Stilicho asking for permission to flood the amphitheatre (possibly the Colosseum) to showcase his crocodiles (Symm. *Ep.* 9.141, 151).

artificial lake (*stagnum*) as part of the celebrations of the opening of the Temple of Mars Ultor (Aug. *RG* 23; Cass. Dio 55.10.7; Ov. *Ars am.* 1.171-172).[233] For the same occasion, he also staged a *venatio* with 36 crocodiles inside the Circus Flaminius, although the exact arrangements of this event are not recorded.[234] Cassius Dio is not clear on why Augustus did not stage the hunt in his newly built *stagnum*. Perhaps the artificial lake was too big to accommodate the *venatio.* A smaller, temporary basin built inside the Circus Flaminius might have provided spectators with a better view of the spectacle.

There is literary evidence to suggest that Augustus may have exhibited the same batch of crocodiles in an earlier spectacle that took place in an artificial basin, perhaps the same facility used for the hunt mentioned above. Strabo, a contemporary of Augustus' games, provides a description of a semi-aquatic structure that was designed with a basin and an elevated stage on one side (Strab. 7.44). The purpose of the stage was so that the crocodiles could be dragged in nets from the water onto a "basking-place", which provided spectators with a better view of the animals. The crocodiles would then be dragged back into the water where they presumably remained mostly submerged.

According to Strabo, the agents handling the animals were a group of specialist crocodile hunters from the city of Tentyra (modern Dendera, Egypt) who had accompanied the crocodiles to Rome (Strab. 7.44). Crocodile hunters from Tentyra are also mentioned by Pliny the Elder in his account of the Nile crocodile (Plin. *NH* 8.38). Pliny describes these people as fierce hunters whose method of capturing crocodiles was to dive into the river and mount the animals' backs. A staff would then be used to pry open the crocodiles' mouths and drag them onto land where they were forced to regurgitate their most recent victims.[235] Strabo also claims that the hunters of Tentyra would dive into the river and drag the crocodiles out without fear. A curious interaction between a crocodile and a boy with African features is represented in a marble statue from Rome, dated sometime between the 1st century BCE and the early Empire (Fig. 44). The boy is depicted balancing on top of the crocodile with his back

[233] Augustus' *stagnum* was subsequently used by Titus for naval combats as part of the games celebrating the Colosseum's inauguration in 80 CE (Suet. *Tit.* 7.3; Cass. Dio 66.25.3, Mart. *Spect.* 34, cf. *Spect.* 27-30). According to Cassius Dio (66.25.1-2), Titus also flooded the Colosseum and released horses, bulls, and other domestic animals that had been taught to perform in water. There remains considerable debate among scholars about whether it was even possible to flood the Colosseum. On these debates, see Coleman (1993) 59-60; Gabucci (2001) 234-40; Connolly (2003) 139-61, 185-206; Dodge (2014b) 571-72; Beste (2019); Taylor (2021) 274.

[234] The location and dimensions of the Circus Flaminius have been subjects of much debate among scholars, though now it is generally argued that its foundations lay at the southern end of the Campus Martius, slightly northwest of the Theatre of Marcellus. This situates the Circus near the Tiber River, which could have supplied Augustus' games with sufficient water for the crocodile hunt if the animals were in fact hunted in aquatic conditions. For discussion see Humphrey (1986) 540-45.

[235] Pliny omits any mention of the crocodile hunters travelling to Rome for Augustus' spectacles, nor does he mention the crocodile hunt in 2 BCE in this passage. As a contemporary of Augustus, we should take Strabo's word that hunters from Tentyra performed alongside the crocodiles in Rome.

and legs angled vertically in line with the crocodile's tail. His arms are bent inwards which gives the impression that he has either just dived onto the crocodile's back or is about to jump off. The animated movement of the boy and crocodile suggests that the sculptor may have intended to represent a daring feat similar to that which was performed inside Augustus' semi-aquatic reservoir.[236]

It is plausible that the design of this reservoir was inspired by the unique hunting technique of the people of Tentyra. Indeed, the hunters themselves might have assisted with its construction when they arrived in Rome.[237] Since their technique involved dragging the animals between water and land, it made sense for the structure to contain a basin as well as a platform. Aside from the attraction of this dangerous exercise, the exhibition of crocodiles in terrestrial *and* aquatic conditions afforded spectators the opportunity to observe a wide range of crocodilian behaviours. For example, in the process of trying to capture the crocodiles inside the basin, the hunters probably elicited rapid and turbulent movements from the animals.[238] One of the greatest dangers of capturing crocodiles in water is the possibility of being seized by their powerful jaw and subsequently thrown into a death roll. Environmental philosopher Val Plumwood, who survived a crocodile attack in 1985 in Kakadu National Park, Australia, described this behaviour as "an intense initial burst of power designed to overcome the surprised victim's resistance quickly"[239]. Since the crocodile's heart metabolism and breathing is not adapted for prolonged struggles, the animal will perform this spinning manoeuvre several times in quick succession, usually until its prey drowns. Miraculously, Plumwood survived three death roll attempts, each one attesting to the crocodile's immense power and perseverance in water.

The risk of being caught in a death roll could have been high for the crocodile hunters if they were completely submerged inside the basin. The platform may have provided a temporary refuge from an attack, although the danger of being mauled was still possible, especially if the animals had been provoked. For the spectators, the platform presumably afforded a clearer view of the animals. Due to the hunters' specialist knowledge of crocodilian behaviour, it seems likely that Augustus used them for his crocodile hunt in 2 BCE as well. In

[236] The British Museum identifies the boy as a member of the *Tentyritae* tribe.
[237] The role of animal handlers in building activities has already been put forth by Roueché in her influential study on performers in Aphrodisias (1993), however, at present we are missing direct evidence for this. Potential evidence comes from the discovery of inscriptions from the amphitheatre at Tebessa in Algeria, which identify four groups of people who appear to have been responsible for the construction of the building. Roueché suggested that these groups may have included members of hunting associations, who were actively involved in producing *venationes* as well as supporting them. See Roueché (1993) 75.
[238] On the difficulties of capturing live crocodiles see Webb and Messel (1977).
[239] Plumwood (1995) 31.

this respect, the display inside the semi-aquatic reservoir might have served as a taster for what was to follow in the *venatio.*

1.3. Designing for Animals in the *Hypogeum* of the Amphitheatre

In the last thirty years, considerable scholarly attention has been given to the operation of the *hypogeum,* which catered to a range of preparatory activities inside the amphitheatre. The Colosseum's two-storey substructure was by far the most complex of all *hypogea* in the Roman world and its archaeological remains attest to the orchestration of stage machinery, animals, and performers on an enormous scale. The facility underwent significant remodelling throughout the imperial period and what is visible today are the remnants of Late Antique modifications (Fig. 45).[240] A *hypogeum* built mostly of wood was in existence at the time of the Colosseum's inauguration in 80 CE and in Domitian's reign the substructure received permanent masonry provisions.[241] Martial alludes to this structure in an epigram about a criminal dressed as Orpheus who was mauled by a bear that emerged from the 'Underworld', presumably referring to the *hypogeum* (*Spect.* 25, see also *Spect.* 24). The bear's sudden entry was achieved by an intricate system of pulleys and shafts that hoisted the bear into the arena via one of many possible trapdoor openings, for which there is substantial archaeological evidence (discussed below) (Fig. 46).[242]

Besides the miraculous feat of making animals appear suddenly from beneath the arena floor, the *hypogeum* was also an important space for housing animals and tending to their needs before a show. Whether the animals were anticipated to remain inside the *hypogeum* for a short period (for instance, immediately before a show) or over multiple days, there were a number of basic requirements that had to be considered in order to keep the animals alive, in reasonable condition, and safely contained from stage machinery, arena staff, and other performers. Provisions for meeting these needs are most clearly seen in the archaeology of two extraordinarily well-preserved *hypogea* in the imperial amphitheatres at Puteoli and Capua in Campania. Due to their remarkable preservation, it is possible to reconstruct the sequence of events that possibly led to the animals' eventual release into the arena. Approaching these events from the perspective of animal behaviour can help illuminate some of the inevitable challenges that animals and those overseeing their care faced inside the *hypogeum,* and their implications for facility design.

[240] Important work on the Colosseum's construction phases, particularly regarding the arena floor, can be found in Beste (2000).
[241] Rea (2020) 75-79.
[242] On the logistics of this spectacle see Coleman (2006) 182-84.

The construction of the Puteoli amphitheatre began in the Flavian dynasty during a period when the city was operating the largest and most important port in the region of Campania.[243] Its strategic location gave the city access to important supply routes that transported wild beasts between the southern and eastern Mediterranean and Rome. For this reason, *venationes* held a particularly important place in the spectacle programs at Puteoli, which is reflected in the sophisticated design of its *hypogeum*. The construction of the Capua amphitheatre dates slightly later to the mid-2nd century CE, between the reigns of Hadrian and Antoninus Pius. However, its design closely emulates the Colosseum (*CIL* 3832 = *ILS* 6309).[244] The location of Capua (about 50 kilometres northeast of Puteoli) meant that it too benefitted from the sea trade of animals travelling from North Africa. This is attested by the amphitheatre's rich decoration of zoomorphic sculptural reliefs, in addition to its complex *hypogeum*.

In plan, the substructures of the amphitheatres at Puteoli (Figs. 47-48) and Capua (Figs. 49-50) were oval shaped with a large, central gallery that ran along the main axis of the buildings. This provided two entry points into the *hypogeum.* The central gallery was covered by wooden beams at the arena level that could be removed to allow animal cages and large stage sets (*pegmata*) to move between the substructure and the arena by means of ramps. The rest of the arena floor was made of concrete (*opus caementicium*), which is still in place today at both amphitheatres. At Puteoli, the central gallery was surrounded by a series of concentric corridors and passageways that facilitated the efficient circulation of arena staff and performers. At Capua, these corridors were linear in plan and arranged symmetrically on either side of the central gallery. An annular gallery wrapped around the periphery of the substructure in both amphitheatres, which led to a series of large, vaulted chambers.

Given the size and location of the chambers, it is highly probable that many would have been used for housing the animals immediately before they were released into the arena.[245] The substructure at Puteoli comprised two levels of chambers (forty on each level), which suggests it could have housed a large number of animals at any given time.[246] Some of the lower chambers may have provided temporary accommodation for the animals leading up to the day of spectacles, though exactly how long is impossible to know. Due to the

[243] On the economic prosperity of Puteoli between the 1st century BCE and 2nd century CE see D'Arms (1974). See also the recent study by Taylor (2021) esp. chapters 5 and 6.
[244] Golvin (1988) 204.
[245] The animals could have reached these chambers through either the main axial entranceways or the central gallery.
[246] The upper-level chambers were slightly smaller than the lower chambers. Dimensions of lower chambers according to Bomgardner (2000) 85: 4 m D x 2.3 m H x 2.15-2.30 m W. Upper level: 2.93 m D x 1.9 m H x 2.1 m W. The substructure at Capua comprised one level of forty chambers, which suggests that it too was capable of accommodating a considerable number of animals at one time.

amphitheatre's close proximity to the port, it is possible that some animals were transported directly to the amphitheatre rather than being moved to a nearby *vivarium* (enclosure) before being taken to the arena. If this were the case, considerable thought and planning must have gone into the physical needs of the animals during their stay underground.

With respect to safety, the paramount concern would have been the matter of how to segregate the animals from the busy operations of the *hypogeum.* Iron-barred cages such as those described by Symmachus (*ferreae caveae, Ep.* 2.77) were probably used for containing animals inside the vaulted chambers. To prevent injuries and fatalities, animals would have been subdivided according to their species-type by necessity, with carnivores limited to only one specimen per cage. There is some visual evidence that suggests similar provisions might have been made for the capture and transportation of animals for the arena games. A section of a sarcophagus relief from the Villa Medici in Rome, dated to 270 CE, shows three individually caged lions being transported on a ship (Fig. 51). It is possible that such cages had room to accommodate more than one animal; however, this arrangement could have resulted in escalating aggression between the animals. In modern animal management, lions are transported in individual cages, regardless of age, owing to their large size and aggressive nature. Even before new individuals are integrated in an exhibit, zookeepers take into account whether the animals are territorial, have a rigid hierarchical structure, or are particularly dangerous.[247] In Roman times, the task of luring an aggravated lion into an already occupied cage would have also been considerably more difficult than if the cage was empty. For these reasons, carnivores were most likely housed in individual cages on their journey to the arena and during their stay inside the *hypogeum.*

Notwithstanding these precautions, there was still *some* risk of the animals causing serious injury to themselves in captivity. The inability to satisfy the overwhelming urge to escape must have kept the animals in a chronic state of excitement, just as they would have been inside the arena. Prey species in particular would have remained on high alert if predators were visible, although even their scent and sound could have caused anxiety. Giraffes, for example, are especially prone to myopathy (capture stress), which is mostly brought on by anaerobic respiration and the build-up of lactic acid.[248] This can result in excessive exhaustion, immune disfunction, chronic stress and, in some cases, hyperthermia (on the difficulties of keeping giraffes in captivity, see chapter 2 section 2.4.1).

[247] Rees (2011) 198. On the transportation of lions specifically, see AZA Lions Species Survival Plan (2012) 31.
[248] Deacon (2022) 2. On capture myopathy see also Paterson (2014) and Marino (2018) 105-07.

Naturally, the less an animal has adapted to its new physical or social surroundings, the greater the chances are of it harming itself through escape attempts.[249] It is often during such attempts that an animal will completely ignore structural features and consequently fracture its skull or break its neck against a cage. This behaviour is especially common among ungulates, who are at risk of getting their horns or antlers stuck between bars (*pers. obv.*). Carnivores, as Lucan points out, were liable to breaking their teeth against the bars of cages (Luc. *Pharsalia* 10.445-446). A practical step to avoid this would be to contain the animals in tightly compact cages to lessen the force of impact should they dash themselves against the bars in a state of panic.[250] Such bars must have been durable enough to withstand potential impact. Animal crates with large crossbars are depicted on a late 3rd/early 4th century CE hunting mosaic from Annaba, Algeria, a design which implies that an incredibly strong animal could be contained inside them (Fig. 6).

Another safety precaution that might have been inspired by ancient transportation procedures was the practice of capping the horns of ungulates with padding. Representations of this provision can be found on the 'Great Hunt' mosaic from the Villa Romana del Casale in Piazza Armerina, Sicily (Fig. 1b). In one section of the mosaic, three handlers wrestle with reins attached to the horns of a wildebeest who charges with its head held low in direct line of the handlers. The animal's horns are capped with a slender red beam, which presumably prevented the handlers from becoming impaled. A similar device is fitted to the horns of a scimitar oryx who is led by two men from a leash that also serves as a muzzle. Whether these beams remained fixed on the animals until their display in the arena or were removed after their initial capture is not recorded in the ancient evidence. Nor is it known how widespread this safety provision was if the beams were used at all on captured animals. Nevertheless, their association with ungulates suggests that the Romans were aware of the dangers these animals posed, especially in close quarters.

Another crucial requirement for housing animals inside the *hypogeum* (whether for temporary or long-term stays) was a water supply for sanitation and consumption. During moments of intense stress, many animals will respond to a perceived threat by urinating and/or defecating.[251] In captivity, this can result in the spread of diseases and lead to death.[252]

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[249] Hediger (1950) 44-45.

[250] For example, the shape and dimensions of crates employed in modern wildlife translocations are carefully designed to anticipate an animal's defensive behaviours (e.g., charging, bunting, digging, etc.) and maximum capacity so that it has little room to turn around.

[251] For discussion of sanitation in modern zoo exhibits see Rees (2011) 137-49.

[252] The malnourished and diseased bear-cubs, which turned up on the eve of Symmachus' son's quaestorian games in 373 CE, may have been subject to unsanitary conditions on their journey to Rome (Symm. *Ep.* 9.117). For discussion of the spread of diseases throughout animal caravans in Antiquity, see MacKinnon (2006). For an archaeological perspective on animal diseases in Antiquity, see Baker and Brothwell (1980).

To prevent this from happening, the animals' living quarters (i.e., their cages and the vaulted chambers) would have needed regular cleaning, possibly by arena attendants or animal handlers. The amphitheatres at Puteoli and Capua were fed water by a nearby aqueduct called the *aqua Campana,* which supplied the requirements of the *hypogea* and the provision of drinking water for spectators.[253] A drainage system was also necessary for the efficient movement of water in the underground passages, which would have been prone to flooding.[254] Many of the chambers in the Capua amphitheatre contain well-preserved radial ducts that carried water and residue from the animals into a narrow water channel that wrapped around the outer annular corridor (Figs. 52-53). Similar provisions are also clearly seen throughout the Colosseum's *hypogeum* (Fig. 54).

While it was not the Romans' intention to create a nourishing environment for animals in the *hypogeum,* it was still important to keep the animals alive and in a reasonable condition before they went on display. Mortality rates probably fluctuated depending on the species of animal, the duration of their captivity, and the atmospheric conditions of the *hypogeum.* The humidity, dampness, and inadequate ventilation of the chambers, together with the smell of smoke from lamps and machinery, undoubtedly had adverse effects on the animals' health and behaviours, however brief their stay was. Warm, humid temperatures in the summer increased the risk of diseases spreading, while damp conditions in the winter may have led to respiratory infections. Increased levels of stress caused by climatic changes in the *hypogeum* would have also reduced the animals' resistance to disease and the ability to heal from existing or new injuries. In modern zoo exhibits, the regulation of temperature is a highly important consideration, especially where the latitude or altitude of a species' natural habitat differs from its new surroundings.[255] Reptiles and amphibians, who rely on external sources to regulate their body temperature, are particularly vulnerable to changes in their environment. As a result of their biology, these groups of animals were unlikely to have survived prolonged captivity inside the *hypogeum.* To judge from ancient literature, even species that tend to do well in captivity, such as bears, were susceptible to physical disease from rising temperatures (Apul. *Met.* 4.13).

The provision of food was also important to consider if the animals were expected to remain inside the *hypogeum* for multiple days. Hay, grasses, and other vegetation would have been relatively easy to obtain for herbivores, but meat had to be preserved and safely stored to prevent diseases from spreading. Some of the chambers unoccupied by the animals may

[253] In the 1950s, Maiuri uncovered a series of fountains and cisterns at the Puteoli amphitheatre, including one monumental fountain (*nymphaeum*) near the entrance of the arena. For discussion see Maiuri (1955).
[254] Bomgardner (2000) 80-81.
[255] Rees (2011) 141.

have accommodated these needs (Fig. 55). To avoid contact with the animals, food was probably dropped into their cages or distributed through small apertures that were built into the chambers. This feature is visible in the upper-level chambers in the Colosseum, though its function it not known for certain (Fig. 56).[256]

However, feeding the animals was not simply a matter of responding to their dietary requirements; there were also psychological factors to consider. In their state of alertness, induced by a constant flight tendency, many animals probably refused to accept food, especially if it was given to them with force. Force-feeding only increases an animal's anxiety, thus making it harder for them to adapt to their new surroundings.[257] Symmachus reportedly found himself in such a predicament when a large group of crocodiles, who were destined to be hunted at his son's praetorian games in 401 CE, refused to eat for many days (Symm. *Ep.* 6.43). Symmachus interpreted the animals' hunger strike to suggest they were sick, and hence he ordered the animals to be killed. Interestingly, Hediger observed that it was characteristic for newly caught reptiles to refuse food in reaction to captivity, which often resulted in the animals being force-fed to avoid starvation.[258] This might partially explain why Symmachus had a difficult time getting his animals to eat. Crocodiles are also subject to seasonal patterns of food intake which increases and decreases throughout the year. In the warmer periods, crocodiles go through a fasting process called aestivation, during which time the consumption of food can rot the animal's stomach and sometimes become fatal.[259] It is possible, therefore, that Symmachus' crocodiles were in fact fasting. Whatever the reasons, refusing food was an act of agency that could have serious economic or political ramifications for an *editor.* Symmachus' letters demonstrate that such ramifications could also result from a lack of knowledge on the part of the animals' keepers in interpreting and understanding crocodilian behaviour. We can assume, at any rate, that the *hypogeum*'s unfavourable conditions made the feeding of animals a challenging task for those responsible for their care.

Not every chamber in the Capua and Puteoli *hypogea* was dedicated to the management of animals. The provision of four staircases, located on either side of the minor axis in the Capua amphitheatre, gave arena staff and performers access from four of the chambers to the service corridor located directly above the *hypogeum* (i.e., behind the *podium*) (Fig. 57). Stairs can also be seen connecting the lower and upper-level chambers with

[256] Middleton (1892, 106-07) believed these smalls openings were primarily used for feeding the animals from a safe distance. Jennison (1937, 160), on the other hand, suggested that burning straw may have been dropped into the animals' cages via these apertures to ensure that they exited their cages promptly when released into the arena. Of course, the apertures could have been used for both purposes at different times of the spectacle.
[257] Hediger (1950) 122.
[258] Hediger (1950) 122.
[259] On aestivation see Kennett and Christian (1993) 315-19; Christian et al. (1996) 1-9.

the service corridor at Puteoli (Fig. 58) and inside the Colosseum (Fig. 59). These access points would have been particularly useful for arena attendants tasked with transporting small stage props or goading devices into the arena via the refuges that were built into the service corridor. If additional assistance was required (for instance, during the recovery of an animal after a show), arena staff could quickly navigate their way up these stairs and into the service corridor without getting in the way of the animals or being seen by the spectators.

When the time came for the animals to be sent into the arena, a complex system of pulleys, winches, and ramps was used to hoist the animals through a series of trapdoors located directly above the substructure's corridors. None of the woodwork for the pulley systems has survived; however, large modillions that supported these mechanisms are mounted along the interior walls of the corridors and chambers at Capua and Puteoli.[260] In recent years, Heinz-Jürgen Beste, along with other archaeologists of the German Archaeological Institute in Rome, has reconstructed a cantilever system within the Colosseum's *hypogeum* based on the substructure's architectural plan during the reign of Domitian (Fig. 60). The design of the model was also informed by the evidence of grooves, found along the corridor walls, that supported the lifts and ramps (Fig. 61). According to modern experiments, the caged animals in the lower-level chambers were elevated onto the upper level by means of the pulley system, which required about eight arena attendants (four on each level) to operate.[261] From here, the animals were then driven up a wooden ramp and through a trapdoor that released them directly into the arena. A similar system may have operated in the two-storey substructure at Puteoli and, on a smaller scale, at Capua. Arena attendants were presumably equipped with goading implements such as whips, prods, or burning straw to ensure that the animals exited their cages and did not attempt to turn around. Similar devices may have been available to those operating the pulleys on the upper level in case the animals tried to re-enter the trapdoor. The unpredictability of the animals' behaviours meant that these procedures needed to be timed carefully and executed with precision.

The trapdoor openings at the Puteoli and Capua amphitheatres are remarkably well-preserved due to the concrete arena floor.[262] A total of forty-six trapdoors of varying dimensions (1 x 1.3 metres and 1.25 x 1.90 metres) were built in a concentric pattern around the perimeter of the arena at Puteoli (Fig. 62). A further eighteen trapdoors were placed on either side of the central gallery, of which two are especially large (2 x 2.7 metres). The linear

[260] Square recesses that housed winches for the hoists are also visible along some of the corridor walls in both amphitheatres.
[261] Rea (2020) 79.
[262] The following dimensions are taken from Bomgardner (2000) p. 85 (Puteoli), p. 93 (Capua).

orientation of the corridors at Capua resulted in the trapdoors being arranged into six rows on either side of the central gallery. There are sixty-two trapdoors in total and of similar size to those in Puteoli, of which six are particularly large (Figs. 63-64).

The dimensions of the trapdoor openings give some indication of the types of animals that may have passed through them. The size of the smaller openings would have been sufficient for releasing small to medium-sized animals, including wild boars, dogs, some antelope and deer species, and leopards. Based on personal observation, I could not see how adult bears, lions, or large ungulates like cattle, who can grow up to 2.5 metres in length, could fit through these smaller openings (Fig. 65). Some of these species have been identified from the sculptured handrails and panels that surrounded the entryways (*vomitoria*) that led into the *cavea* at Capua (Figs. 66-67).[263] Fifty-five handrails survive, with the majority representing species that could be sourced from North Africa.[264] The city's close proximity to the port of Puteoli may account for the high proportion of African animals, though it is also possible that the artist(s) were partially working from pattern books. Just over half of the documented reliefs depict big cats, of which lions are the most commonly identified species (Fig. 66c, d, g). If such animals were displayed in the games at Capua, they would have needed to pass through the larger trap doors to enter the arena. In addition to the animals' size, their cages may have provided a rough guideline for the dimensions of these openings, though direct evidence for this does not exist. For megaherbivores like the elephant, whose trunk, tusks, and ears can be made out from a fragmented handrail (Fig. 66e), an alternative entry route was required. A feasible option would have been to release this animal either through the *vomitoria* or, if penned in the substructures, via the central gallery opening.[265] The gallery could also be used for releasing particularly large stage sets onto the arena floor. While the zoomorphic forms of the handrails cannot be taken as direct evidence of the species that featured in the games at Capua, their prime position certainly made them visible for spectators to see as they accessed their seats. This may have reinforced the spectators' expectations of the variety of animals and performances they hoped to see.

In summary, the complexity of the *hypogea* at Puteoli and Capua clearly indicates that both amphitheatres were designed to accommodate *venationes* on a particularly large scale and with a great variety of animals. The well-ordered arrangement of galleries, corridors, and

[263] Some of the handrails are preserved in the Museo dei Gladiatori, located adjacent to the amphitheatre at Capua. The first detailed study of the Capuan sculptural program was headed by Gennaro Pesce, who published on the reliefs in 1941. Since then, Bomgardner (2000, 95-104) and Tuck (2007) have both provided excellent analyses of the reliefs and their connection with the *venationes* at Capua.
[264] Tuck (2007) 258.
[265] The width of the central gallery at Puteoli is 4.75 metres, certainly large enough to allow an elephant to pass through.

staircases below the arena floor facilitated the safe and efficient movement of arena staff, while large, vaulted chambers ensured that animals were safely contained within designated areas that could be used for short-term or possibly even long-term accommodation. The remains of drainage systems in many of these chambers hint at not only the operations of the *hypogeum* (which was prone to flooding) but also the physical needs of the animals. A constant water supply was imperative to keep the animals alive and hydrated during their stay beneath the arena, however brief, and to mitigate the risk of diseases spreading between the cages. Even with these provisions in place there was still a chance that animals could become weak from overstimulation, malnourishment, attempts at breaking their cages, or from the noxious environment. Exactly how many animals died from these factors is impossible to discern from the lack of zooarchaeological evidence. What is clear is that the conditions of the *hypogeum* probably had adverse effects on the animals before a show, potentially giving rise to more aggressive, unpredictable, or even passive behaviours. Ectothermic animals, who depend on external sources to regulate their body temperature, would have been more susceptible to these conditions than other species. A lack of knowledge on crocodilian thermoregulation might have contributed to untimely animal deaths inside the *hypogeum.* The *hypogeum* also played an integral role in the logistics of the *venationes.* An intricate system of pulleys, ramps, and trapdoors allowed the animals to enter the arena in myriad ways, thus bringing novelty to a performance. The varying dimensions of trapdoor openings at Capua and Puteoli indicate that the architects gave some consideration to the different sizes of animals that were anticipated to appear, possibly looking towards the dimensions of their cages as a point of reference. Armed with goading implements, arena staff stood ready to direct the animals' flight paths as they entered the arena and block anyone who attempted to return to their cage.

1.4. Conclusion: An Integrated Approach to Facility Design

The overall success of a *venatio* was largely determined by the design of the facility in which the spectacle took place. Just as with modern zoo exhibits, certain precautions were necessary to ensure that Roman entertainment venues were fit for purpose. The design of the venue needed to make provision for the biological and behavioural needs of the animals, the operating requirements of those conducting the *venationes,* and the safety of the spectators. Responding to the needs of these three "clients" ensured the smooth running of a show and likely enhanced the quality of the spectators' experience. Facility design was therefore an integrated process, one that took into account the interactions between performers (human and animal), spectators, and the built environment. Animals, with their unpredictable

behaviours, disparate locomotor capabilities, and instinctive drive to escape danger and captivity, posed the greatest challenge to facility design. This chapter has demonstrated that the Romans were mindful of these challenges, and they responded by designing flexible safety provisions that could be adapted for a wide range of species, performances, and venues.

The canonical design of the amphitheatre, in particular its high *podium,* service corridors, and *hypogeum*, catered best to the operational needs of a *venatio.* However, as animal displays found increasing popularity throughout the Empire, the circus, stadium, and theatre were built or modified as multipurpose facilities that could stage *venationes* in addition to their primary sport or spectacle. The extant evidence clearly shows that the provision of a high *podium* and/or post-and-net barrier around the performance space was common in many theatres and in some *stadia* and circuses, particularly in the eastern Empire where amphitheatres were less common. Both types of provisions were suitable for containing animals with jumping and climbing abilities, and the post-and-net barrier could be lowered or raised depending on the type of display and the anticipatory behaviours of the animals. Since locomotion varied considerably between species, containment barriers needed to be adaptable to accommodate the different kinds of animals simultaneously on display.

Knowledge gleaned from hunting and capturing animals in the wild had some influence on the design of the barriers used in an arena. We have seen that the post-and-net barrier probably drew inspiration from the heavy, durable nets that were widely employed in the capture of live animals for the arena games. Based on literary evidence, such nets were generally capable of withstanding impact from claws, antlers, horns, and talons, thus making them suitable containment barriers for the *venationes*. Although an isolated incident, Julius Caesar's decision to dig a moat as a safety precaution for his elephant spectacles might have been informed by existing practices of trapping wild elephants in deep pits. Moreover, the semi-aquatic reservoir commissioned by Augustus for his crocodile display could have borrowed its design from a hunting technique used exclusively by crocodile hunters in Tentyra. While direct evidence for the input of animal specialists on facility design does not exist in the ancient sources, their empirical knowledge of a species' natural history must have been incredibly valuable in the planning stages of a *venatio*. As we have seen, exhibit design in modern zoos draws heavily on the expertise of field biologists and other specialists with detailed knowledge of the behaviours and habitats of the species on display. It is therefore not unreasonable to suppose that experienced animal handlers and hunters played *some* role in the provisioning of *venationes.* The diverse environments that different species inhabited, and the people with whom they shared these environments, afforded *editores* opportunities to display animals in new and creative ways.

Bearing in mind that most animals exploited in provincial arenas were probably local fauna, future scholarship would do well to consider a building's ecological context and its implication for barrier design. The terrain typically evident in an animal's natural habitat could offer vital clues about its locomotion and typical flight responses, which in turn could help determine the required height and complexity of a barrier. Considering a building's ecological surroundings could also provide a more detailed picture of the full range of species that might have been available for *editores* to exploit.

Safety was also a concern when it came to housing animals before a *venatio.* The *hypogeum* of some amphitheatres provided a space in which animals could remain safely hidden from the spectators. It was also a space in which arena staff could tend to the animals' needs before a show. The provision of water and, to a lesser extent, food was important for keeping the animals alive and hydrated, and individual cages were necessary to prevent them from inflicting harm upon themselves, other animals, and their handlers. The well-preserved *hypogea* at Puteoli and Capua paint a relatively bleak picture of the stressful conditions in which the animals were exposed, but they also indicate that careful consideration was given to the animals' profound tendencies to escape. Large, vaulted chambers segregated animals from the busy operations of the show, while a complex system of corridors and staircases ensured the efficient flow of arena staff. Whether the *hypogeum's* unfavourable conditions pacified or further angered the animals, their sudden release into the arena by means of pulleys and trapdoors would have surely made for a spectacular sight.

CHAPTER 2.

Assigning Roles: Casting Animals as Performers

By the end of the Republican period, the program of *venationes* in Rome consisted of a wide variety of animal displays, including exhibitions of exotic curiosities, shows with trained animals performing specialty feats, hunts between wild beasts and professional beast fighters, and combats between animals. While the spectators may not have drawn conscious distinctions between each of these displays, the roles that animals were subjected to or played in them *were* distinct and, to a certain degree, influenced by what the animals were physically and behaviourally capable of doing. At the same time, animal participants also served as representations of the types of creatures the Romans exploited, engaged, or otherwise interacted with in various aspects of ancient life. This chapter investigates the casting process of animal performers and considers how *editores* may have capitalised on the animals' behavioural affordances and cultural significance in Roman society to display animals in myriad roles in pursuit of maximum display impact. In addition, focus will also be given to the ways in which these characteristics were exploited by human performers to heighten the danger and unpredictability of the choreography of *venationes.*

2.1. Animals as Quarry

According to the surviving literary, epigraphic, and artistic evidence for *venationes* in Rome and throughout the provinces, the vast majority of animals were hunted as quarry. Some studies have viewed such hunts as a perverse and wasteful phenomenon, with no relation to the Greek and Roman cultural pursuit of hunting wild animals in the countryside.[266] Kyle argued that this perception stems from different definitions of hunting in Antiquity and modernity. The modern concept of hunting envisions men that are hunting unrestrained wild animals as a form of sport, or for food.[267] At first glance, neither of these activities appear to align with the hunts of the arena. However, the Romans employed the Latin noun *venatio* (hunt) to refer to sport hunting in the wild, as well as the hunting spectacles.[268] Similarly, the noun *venator* (hunter) appears in both contexts. This indicates that the Romans probably regarded spectacular *venationes* as *real* hunts, as they did with subsistence and sport hunting.[269] That animal displays usually occurred in the morning of a spectacle program in

[266] Auguet (1972, 81) argued that the *venationes* "had nothing of the hunt about them save the name".
[267] Cartmill (1993) 30; see Marvin (2006) on modern perceptions of different forms of hunting.
[268] Kyle (1998) 188.
[269] Kyle (1998) 189, (2007) 265-67; Bomgardner (2000) 35; Lindström (2010) 313.

Rome (the traditional time for hunting) may also suggest they intended for the *venationes* to evoke hunts in the countryside. This inference is also supported by the close association of the Roman goddess Diana the Huntress with the *venationes* (Cassiod. *Var.* 5.42.2).[270]

While Roman spectators may have regarded the animals as 'quarry' or 'game', there are important distinctions between the physical pursuit of animals in the wild and those in the arena that should be considered. In the wild, a hunt commences with the act of *tracking* an animal in order to kill it. This may take hours or even days to achieve and the animal generally has a means to escape from the hunter. In this context, the deaths of animals are "wild deaths" that transpire from the hunter "leaving the zone of the human habitation" and moving into the natural space of the animal.[271] In contrast, hunting in the arena involved removing the animal from its natural habitat and bringing it into a cultural, symbolic, and political space that was carefully designed to impose controlled animal deaths. The arena afforded no hardship in tracking or finding the animals for they were already there. Rather, the contest between human and animal was deliberately sought out and *staged* for maximum display. This is an important distinction, as the arena was not a natural environment for the animals (nor for the human participants), meaning we cannot expect them to have behaved, at least initially, in the same way as they would in the wild. Similarly, for the *venatores* the pursuit of animals may have involved quite different challenges (as well as opportunities) from those that were afforded in the hunting fields.

The arena may have been a controlled environment designed to prevent the animals from escaping, but the chase itself was still a struggle of power relations just as it was in the wild. Animals still had the ability to challenge and contend with their adversaries, and the risk of injury or fatality for the *venatores* was very much a possibility. The struggle between man and beast runs through the iconography of *venationes,* but it is not always the *venator* who appears victorious. A number of unfortunate beast fighters who have fallen prey to their feral adversaries can be seen on the wall paintings from the *frigidarium* of the Hunting Baths in Lepcis Magna (Fig. 68).[272] Two individuals appear badly wounded from the assault of leopards while others are shown desperately trying to kill more leopards with the help of their colleagues. One of the animals is depicted sinking its teeth and claws into the back of a *venator,* whose spear is shown lying on the sand behind him. Without the aid of his weapon, or another beast fighter, he probably stood little chance of escaping the leopard's grasp. Contrary to what Plass has argued, these representations do not suggest that *venationes* were

[270] On the association of Diana with *venationes* in Roman art see Brown (1992) 192, 197.
[271] Marvin (2006) 21-22.
[272] For a detailed discussion of the wall paintings of the Hunting Baths see Ward-Perkins and Toynbee (1949).

"unrealistic, and entirely safe hunts"[273]. However artificial the environment of the games may be, the hunts were certainly real and, as we will see below, fraught with physical challenges for both the hunters and the quarry they pursued.

2.1.1. Weapon of Choice: Species-Specific Hunting Strategies

In the ancient world, wild beasts, especially large predators, were valued for the opportunities they afforded hunters for demonstrating their alleged prowess, courage, and skill.[274] The disparate defensive behaviours and physicality of animals, however, meant that these opportunities carried different levels of danger and physical challenges. Successfully dispatching game therefore required *venatores* to know what weapons and hunting techniques were most effective against the type of animal with which they fought.[275] Much of the extant artistic evidence indicates that the standard weapon of choice was a long-edged hunting spear known as a *venabulum.*[276] The spear was designed with a wide iron head, generally in the shape of a diamond, and a perpendicular guard to prevent the tip from penetrating too far forward. Unlike the javelin (*lancea*), which could be thrown, the *venabulum* was held with both hands and primarily used as a thrusting weapon to fight and control wild beasts at close quarters. This fighting style was particularly well suited to the enclosed environment of the arena.

Although the *venabulum* was widely used to kill species of various kinds, it was especially practical in hunts involving big cats owing to the animals' exceptional leaping abilities. Theoretically, the length of the spear enabled the *venator* to keep his adversary at some (though not necessarily a safe) distance as the animal made an attack. Representations of such confrontations often depict the moment when a lion or leopard lunges towards the *venator.* Excellent examples are found on the Magerius mosaic from Smirat (Fig. 5) and in the *venatio* scenes on the Borghese mosaic from Via Casilina, Torrenova in Rome (Fig. 69). The *venatores* in these mosaics are shown driving their spears directly into the neck or chest of leopards, which would have ensured a clean kill.[277] This technique required that the *venator*

[273] Plass (1995) 182. Compare, for example, the modern canned hunt which takes place in a confined area, such as a fenced ranch, to prevent the animals' escape. For recent studies on orchestrated killings of animals in canned hunting, see Brandt and Spierenburg (2014); Goodrich (2015); Schroeder (2018).
[274] For example, Carpophorus, a famous *venator* who performed in Rome during the Flavian era, achieved recognition in several of Martial's epigrams for the versatility of his hunting skills, including his ability to bring down especially dangerous animals of unimaginable size (Mart. *Spect.* 17, 32, 26).
[275] Naturally there must have been regional differences in the equipment employed by *venatores,* as there would have been for the types of animals with which they fought. Non-lethal devices were just as diverse in the hunting spectacles, which will be examined in the following chapter.
[276] Junkelmann (2000b) 70-71.
[277] For a detailed description of this technique see Opp. *Hali.* 2.348.

hold his spear securely and keep it forward in direct line with the animal's path. Only with a firm grip was the *venabulum* effective against a charging beast (Mart. *Ep.* 14.30). This would have been no easy feat given the unpredictability of the animal's behaviour. Failure to strike the leopard in the correct place or with a strong stroke meant that the *venator* had to perform this routine again, but against an even more unpredictable and likely more dangerous animal.[278] As seen on the wall paintings of the Hunting Baths in Lepcis Magna, not all beast fighters were successful in executing this technique.

Iconographic and epigraphic material suggests that the lasso (*laqueus*), although technically not a weapon, was used by some *venatores* to capture and bind bears before they were dispatched with the *venabulum*. Both techniques are clearly represented on two panels of an ivory diptych in the Musée du Louvre, Paris (ca. 400 CE) (Fig. 70). The left panel depicts a *venator* driving a long spear into the bear's chest where blood can be seen gushing out. On the right panel, a *venator* attempts to capture a charging bear in a lasso. This particular technique was especially dangerous given that it required the *venator* to use both hands to fling the lasso over the bear, leaving him with no spear or sword for protection. It also required the *venator* to engage with the bear at a dangerously close range, depending on how far the lasso was thrown. Naturally, the closer the bear the more accurate the *venator*'s aim would be. It is possible that a second *venator* would be standing by to execute the final blow. The representation of both techniques on the diptych seems to support this. The lasso-spear combination is also found on a late 4th/early 5th century CE fragmentary mosaic from Zaghouan in Tunisia, which depicts a *venator* named Lampadius confronting bears with a lasso (Fig. 71).

The use of lassoes to capture bears in the arena is mentioned in several 3rd century CE curse tablets (*defixiones*) from Carthage that target *venatores.*[279] The texts inscribed on these tablets contained spells that were intended to literally bind the target (through the evocation of demons) to prevent him from displaying a good performance. One fragmentary tablet wishes for a *venator* to fail in his attempt to fling his lasso over a bear and bind it (*'…nec laq[ueos] possit super ursum mittere, non alligare…*').[280] Another tablet, aimed specifically at a *venator* named Gallicus, evokes the help of demons to bind the *venator* "so that he cannot bind a bear" (*non liget ursum*).[281]

[278] Sparreboom (2016) 155.
[279] The tablets were uncovered by French archaeologist Alfred Louis Delattre from a subterranean room of the amphitheatre in Carthage during the years 1896-97. For the excavation reports see Delattre (1898). On the dating of these tablets see Jordan (1988) 120.
[280] Aud*DefTab* 250.
[281] Aud*DefTab* 247.

An important detail which both tablets unfortunately omit is what part of the bear's body was bound. In modern times, herders will typically lasso cattle and horses by throwing a rope around the animals' neck, which is relatively long in relation to their body. The animals may buck, toss their head, or bolt in response to the rope's sensation, but they are generally unable to rid themselves of the lasso if it is tightly secured. Bears present far greater challenges. While running, a bear's bobbing head and short neck makes for an extremely difficult target. Moreover, once a lasso is thrown over its neck a bear is capable of coiling the rope with its strong paws and pulling its captors dangerously close. As long as the bear continues to struggle, the lasso will remain tight; however, should the bear pause its assault on the rope (even momentarily) the lasso could become slack, thus enabling the animal to escape.[282] On the other hand, if a bear was lassoed around its limbs it would have a more difficult time gaining a purchase on the ground and tearing at the lasso. Empirical reports on the sport of roping Californian grizzly bears in the mid-19th century indicate that vaqueros (mounted livestock herders) would throw multiple lassoes simultaneously over a bear's neck *and* limbs to safely secure the animal (Fig. 72).[283] This technique seems to have prevented the bear from unbinding itself and subsequently charging its captors. Grizzlies are, however, comparatively larger and much stronger than the European brown bear that commonly appeared in the Roman *venationes*, so perhaps only one *venator* was needed to rope this animal. Nevertheless, the placement of the lasso was still key to successfully capturing and maintaining control over a dangerous and highly unpredictable bear.

Capturing bears in the wild by means of the lasso does not seem to have been very common in the Roman world, but binding them with hunting nets might have been.[284] Pseudo-Oppian provides a detailed account of this method being performed by hunters in Armenia (Ps.-Opp. *Cyn.* 4.354-424). After ambushing a bear into a netted trap:

> ἄλλο δ' ἐπ' ἄλλῳ
> νηήσαντο λίνον· μάλα γὰρ τότε θυμαίνουσιν
> ἄρκτοι καὶ γενύεσσι καὶ ἀργαλέαις παλάμῃσι·
> δηθάκι δ' ἐξαυτῆς φύγον ἀνέρας ἀγρευτῆρας
> δίκτυά τ' ἐξήλυξαν, ἀΐστωσαν δέ τε θήρην.
> ἀλλὰ τότε κρατερός τις ἀνὴρ παλάμην ἐπέδησεν

[282] For excellent footage of a grizzly bear escaping a lasso, see: https://www.youtube.com/watch?v=NzFPy0_FjAk&t=15s
[283] Wright (1911) 14.
[284] An engraved glass dish produced in Cologne (ca. 350-375 CE) depicts a mounted hunter hurling what appears to be a rope or lasso over a bear. This technique of capturing bears might have been more common in regions like the Rhineland, where bear populations were abundant. For further discussion of bears in Germany see chapter 4 section 4.3. On the engraved dish see Epplett (2001a) 178.

ἄρκτου δεξιτερήν, χήρωσέ τε πᾶσαν ἐρωήν,
δῆσέ τ᾽ ἐπισταμένως…

Net on net they pile; for at that moment bears greatly rage with jaws and terrible paws, and many a time they straightaway evade the hunters and escape from the nets and make the hunting vain. But at that same moment some strong man fetters the right paw of the bear and widows her of all her force, and binds her skilfully…[285]

The above description of ursine behaviour is exactly what we might expect from a bear caught in a lasso. Once captured, the animal used whatever energy it had left to claw, chomp, and wriggle its way free through the nets, hence the need to pile "net on net" to contain the animal. It is possible that this technique inspired the use of lassoes on bears in the arena. As noted in the previous chapter, hunting nets were probably durable enough to withstand some blows from the animals. Similarly, lassoes must have been of considerable strength if they were expected to hold down an angry bear. However, just as in the wild, bears in the arena may have occasionally broken free from their bonds, thus forcing the *venator* to repeat his routine. Although dangerous for the *venator,* such unsuccessful confrontations were probably what made the hunts so attractive to the spectators.

The challenges afforded by the bear's physiology may have limited this type of interaction to *venatores* who specialised in fighting bears. Such bear baiters are known from epigraphic evidence as *ursarii,* although the term was loosely used to infer someone who worked closely with this animal, especially in Late Antiquity (see chapter 4 section 4.3 for discussion of specialist bear trappers).[286] Sparreboom suggested that their routine in the arena may have been similar to that of the *retiarius*, a type of gladiator who employed a net and a trident to capture his adversary and subsequently kill him.[287] A similar tactic was adopted by the *laquearius,* who fought with a lasso in one hand and a sword in the other.[288] Perhaps the most peculiar equipment employed by some bear baiters were boxing-straps (*caestus*), similar to those used by *pancratiasts* in Greek athletics. Representations of men boxing bears in the arena are depicted on several reliefs from the eastern provinces (for example, the Sofia relief Fig. 2).[289] Part of the attraction of this routine may be related to the bear's unique plantigrade physiology. When confronted by a threat in the wild, a bear will

[285] Trans. Mair (1928) 195.
[286] Examples: *CIL* XII 533.10; *CIL* XIII 5703; *CIL* XIII 5243; *CIL* XIII 8639.
[287] Sparreboom (2016) 156.
[288] In comparison to most gladiators, beast fighters generally wore very limited protection and instead relied upon their own speed and agility to evade attacks from the animals.
[289] For discussion of *ursarii* boxing and wrestling bears on a relief from Istanbul, see Augenti (2001) 47.

often rise on its hind legs in an act of defence to make itself appear larger (Fig. 73). This gave the bear a rather human appearance and may have afforded *venatores* the opportunity to use tactics that were similar to those used for fighting human adversaries. Pliny the Elder believed that a single punch to the bear's skull, apparently its weakest feature, was all it took to bring down this animal (Plin. *NH* 8.54). While this may have been true for polar bears, who naturally have structurally weak skulls as a result of their arctic diet, a punch to the thick frontal bones of a brown bear would unlikely be fatal.[290] In modern times, even rifle bullets and shotgun slugs have sometimes proven ineffective in penetrating the skull of this species.[291] Pliny's claim about the bear's fragile skull might therefore be a product of poor knowledge of ursine physiology. Nevertheless, such dangerous combats must have been particularly alluring for spectators wishing to see a novel outcome.

The boar was another animal that was occasionally lassoed in the arena. Like bears, boars have a bulky muscular body with heavyset shoulders and a short neck, which makes them incredibly difficult to rope. Both sexes have prominent tusks that point out and upward and it might have been this feature that *venatores* aimed for when they lassoed a boar. Evidence for this technique being used in the arena appears on two 3rd century CE mosaics: one from a Roman villa in Thysdrus, North Africa, which depicts *venatores* wrestling with bulls, wild boars, and a leopard (Fig. 74); the second from a Roman villa in Wadi Lebda, modern Libya (Fig. 31). On the former mosaic, an unarmed *venator* secures a rope around a boar's tusks and snout while a second *venator* holds the animal's tail, presumably to keep it from bolting away. This may have also distracted the boar from the *venator* tasked with the difficult job of binding the animal's sharp tusks. Once the boar was bound, it could have been dispatched with the *venabulum* or tethered to the arena floor where it awaited a different fate.

On the Wadi Lebda mosaic, a tethered boar struggles to break free from a rope that is secured from its tusks to the ground; another panel shows a stag in a similar predicament, though with its antlers bound to a rope. To the left of the stag, a second boar charges towards a man armed only with a basket. This seems a rather odd choice of instrument to use given that boars can measure up to 1.8 metres long and weigh anywhere from 70 to 200 kilograms. This type of basket was more appropriate for rounding up and capturing small game like partridges.[292] In this respect, its function in the arena may have been to distract, frighten, or divert the animal in another direction. The lack of weapons in these scenes is worth noting

[290] On the dietary specialisation of polar bears and the implications for skull strength, see Slater et al. (2010).
[291] Freel (2019).
[292] This activity is illustrated on a 2nd century CE mosaic from the House of the Laberii in Oudhna (south of Tunis) which shows hunting scenes amid various farming activities on a mixed-economy estate. This mosaic will be discussed in greater detail in chapter 4 section 4.2.1. See Appendix III, Fig. 151.

and may suggest that the performances were intended to demonstrate human skill in manipulating animal behaviour using non-lethal instruments.

There is some evidence to suggest that a crescent or sickle-shaped sword was the preferred weapon of choice for hunting and decapitating ostriches. Herodian wrote that Commodus used a crescent-shaped weapon to dispatch Mauretanian ostriches in hunts that he staged and participated in during his reign (Hdn. 1.15.5). For this particular routine, Commodus had reportedly been trained by the "finest Parthian archers and Mauretanian spearmen" (Hdn. 1.15.2). The effect appears to have been similar to that which can be observed in headless chickens; the ostriches continued to run around the arena "as though they had not been touched", according to Herodian.

A mid-3rd century CE mosaic from the 'Maison des Autruches' in Hadrumetum, modern Sousse, depicts a *venator* holding a short, sickle-shaped sword that might have been similar to the weapon employed by Commodus (Fig. 75). The *venator* stands in the upper part of the mosaic with three other hunters, who each wield a mixture of straight swords and javelins. Below them are twenty herbivores depicted in a running motion; four of these are the ostriches that gave this house its name. Dispersed between the animals are representations of the weapons held by the *venatores.* Given the variation of tools, it is plausible that the sickle-shaped sword was used specifically for killing ostriches. This is also suggested by a scene from the east side of the Zliten mosaic, where a *venator* is shown brandishing a weapon with a curved point amidst a group of ostriches (Fig. 3g). The design of the blade strongly suggests that it was intended to be used in close combat. Considering the incredible running speed of the ostrich (70 km/h), a characteristic admired by the Greeks and Romans, decapitating the animal in motion would have required remarkable skill (Plaut. *Persa,* 199; Hdn. 1.15.5).[293] It is possible that some hunters pursued ostriches on horseback, though, according to Pliny the Elder, even a horse could not equal the speed of this species (Plin. *NH* 10.1). While we cannot be certain if the crescent-shaped sword was used exclusively for killing ostriches, the theatrical effect that was achieved from lopping off a bird's head may have been one reason for its use on this animal.

We have seen how casting animals as quarry afforded *venatores* the opportunity to demonstrate skill and knowledge of the animals' specific agonistic behaviours. Hunting spectacles also incited the spectators' enthusiasm for the animals' own athletic prowess, including their ability to evade capture and put up a good fight.[294] Pliny the Elder was

[293] Alternatively, because of its curved shape the sword may have been flung towards the animal during a chase, similar to a boomerang. However, this seems unlikely as the *venator* would then be vulnerable to animal attacks as he went to retrieve his weapon.
[294] Brown (1992) 185; Bomgardner (2000) 74; Fagan (2011a) 127.

particularly fascinated with the skills displayed by animal participants. His account of Pompey's elephant *venatio* in 55 BCE reveals greater interest in the elephants' fighting abilities and endurance than in the danger of their assault on the Circus' barrier or their perceived mistreatment (Plin. *NH* 8.7).[295] One elephant is reported to have put up a "marvellous fight" (*mirabili unius dimicatione*) when it refused to back down after having its legs disabled by a shower of javelins. Although Pliny was not present at the spectacle himself, he was evidently impressed by the idea that an elephant would continue its assault on the *venatores* in spite of its injuries. The prospect of animals overcoming their adversaries, and the methods by which they achieved this, might have been just as exciting for spectators as the *venatores*' own courageous efforts.[296]

Some animals may have been allowed to leave the arena with their lives on grounds of an exceptional performance. The practice of granting *missio* ('reprieve') to performers was borrowed from the gladiatorial combats.[297] It appears to have been far less common in the *venationes,* for we only know of several examples from Rome, all of which are recorded by Martial, who was partial to novel performances. In *Ep.* 13.99 a gazelle is said to have been released from the arena at the signal of the crowd waving their robes. Regrettably, Martial does not explain why the gazelle was granted a reprieve on this occasion. Fagan suggested that the animal's characteristic speed and agility may have impressed the spectators enough to spare it.[298] Even if these skills did win the gazelle a reprieve, it may have appeared again in a later show.

In another epigram, Martial calls upon the emperor to decide whether to grant *missio* to a pair of deer (*dammae*) who fought each other with fiery rage while the *venatores* and their dogs looked on with amazement (*Ep.* 4.74, cf. 4.35). Aggressive doe encounters are not that common in the wild as most conflicts are settled with body language threats. However, if these are not effective, a dominant doe will lunge at her adversary and strike it with one or both of the front feet. This may lead to both does fighting on their hind legs and slashing out at each other with their sharp hooves. Such fights generally arise when a doe finds herself in

[295] Beagon (1992) 149-51.
[296] On this occasion, however, excitement quickly turned to fear when the spectators' safety was jeopardised by the elephants' assault on the arena barrier. See chapter 1 section 1.2.2 for discussion of this episode.
[297] On the practice of granting *missio* in gladiatorial combats, see Junkelmann (2000b); Carter (2006/7); Fagan (2014); Coleman (2000) and (2019). The Zliten mosaic from Libya contains several good representations of gladiators appealing for *missio.* Epitaphs of gladiators sometimes mention if the deceased earned release on appeal, often indicated by the term *missus* (lit. "sent", i.e., "reprieved") (e.g., *CIL* 10.7297 = *ILS* 5113).
[298] Fagan (2011a) 248.

competition for limited food resources, or when she is protecting her young.[299] Thus, the likelihood of this occurring in the arena and in the company of predators seems very remote. If the deer were in fact bucks this behaviour may not have been completely out of character. It is common for bucks to aggressively rush at one another during rutting season, a period when a male deer experiences an increase in testosterone and fights other bucks to establish dominance. Sparring, which involves mostly pushing, shoving, and twisting antlers to test each other's strength, is a typical behaviour performed by bucks during this period.[300] Again, this explanation seems slightly far-fetched in light of the arena's conditions, but considering the profound biological drive of rutting behaviour it is not entirely inconceivable. Whatever Martial may have witnessed in the arena, the granting of *missio* suggests that spectators were encouraged to judge the deer based on their own merits in combat, just as they did with *venatores* and gladiators.

When *editores* cast animals as quarry they essentially provided spectators with displays of human *and* animal athleticism. Like their human adversaries, animals specialised in different fighting styles and engaged with their opponents using their own natural weapons that took skill to wield. This, in turn, created distinct challenges for the *venatores* and afforded variety in the types of strategies with which they fought the animals. A bear, for instance, could be speared using the conventional *venabulum,* but its plantigrade physiology also made it appealing to spar and especially difficult to rope. Therefore, an important prerequisite for hunting animals in the arena was knowledge of their anticipatory behaviours and physicality so that *venatores* could make informed decisions about what weapons to use. While only circumstantial evidence for this exists, some of these weapons may have originally been inspired by equipment used in gladiatorial contests and hunting fields.

2.2. Animals as Hunting Aids

Animals that assisted *venatores* with hunting wild beasts in the arena, such as the dog, receive comparatively less attention in ancient literature than the animals being pursued. One reason for this may be related to the relatively common appearance of dogs in the arena, in addition to the spectators' familiarity with their capacity as hunting aids (*canis venaticus*) beyond the arena context. However, it is precisely this familiarity that can help explain why the dog was especially suited to this role in the *venationes.*

[299] For a discussion of parturition behaviour and aggression in white-tailed deer, see Ozoga et al. (1982).
[300] See Bartos et al. (2007) on fighting tactics and techniques of male fallow deer during rutting season.

Dogs played a variety of roles in the life of the Roman world as house-guards, herders, pets, military aids, and hunting companions.[301] Different breeds of dogs were known to have been used for specific activities; those that assisted in hunting excursions tended to be especially strong and swift to deal with the challenges of capturing wild beasts. Dogs of the greyhound type (*vertragi*[302]), imported into Italy from Gaul, were highly regarded for their speed and used especially for coursing small game like hares (Mart. *Ep.* 14.200; Arr. *Cyn*. 3.6, 5.7-9). The heavily built Molossians, on the other hand, were famed for the courage with which they faced marauding wolves and their strength for tackling particularly fierce quarry (Ps.-Opp. *Cyn.* 1.368-375; Luc. *Phar.* 4.440-444; Hor. *Epod.* 6; Virg. *G.* 3.404; Stat. *Achil.* 1.746-749; Claud. *Cons. Stil.* 293-294).[303] Dogs were also valued for their keen hearing and sense of smell, which enabled them to efficiently track prey over long distances. So exceptional were their olfactory abilities that even elderly dogs, who had become blind and weak from old age, may have been carried by hunters so that they could reveal the hiding spots of their quarry by sniffing the air (Plin. *NH* 8.61).

While tracking was not a key component of the hunting spectacles, *venatores* may have capitalised on the dog's speed and courage to help drive big game such as boars and antelope towards the *venatores*.[304] This put the dogs at risk of being mauled, gored, or thrown by their quarry. A literary epitaph composed by Martial mourns the death of a hunting dog named Lydia, who was slain by a fierce boar inside the arena at Rome (Mart. *Ep.* 11.69).[305] The epitaph is written from the perspective of the dog, who claims to have been reared among the trainers of the amphitheatre and was also a fierce huntress in the forests. Martial includes the name of her master, Dexter, but does not specify whether he was a *venator* himself or if he leased Lydia for the *venationes* on occasion. That Martial was acquainted with the dog's name may suggest that she regularly participated in the hunting spectacles. This might explain his motive for commemorating her death, which Martial considered to be noble.[306] In

[301] The ideal traits and qualities of different types of working dogs are listed in the agricultural works of Virgil, Cato, Varro, Columella, and Pseudo-Oppian to ensure that dog owners employed their animals with maximum efficiency. For specific examples, see Virg. *G* 3.404; Cato, *Agr.* 124; Varro, *Rust.* 1.19-21, 2.9.2; Columella, *Rust.* 7.11.1-2; Ps.-Opp. *Cyn.* 430.

[302] Probably meaning "faster runner".

[303] Contrary to their nature, a group of Molossian dogs reportedly spared a doe when it dropped before the emperor in the arena, as if in supplication (Mart. *Spect.* 33). Though Martial attributes the dogs' merciful behaviour to the emperor's divine powers, the animals were probably instructed by the *venatores* to halt their assault so that they could initiate the final blow (cf. Mart. *Ep.* 4.74, 4.35).

[304] In the hunt of bears in North America, dogs are often employed to goad the bear and encourage it to turn around and fight the hunters.

[305] Cf. Hadrian's favourite steed, named Borysthenes, was used by him for hunting expeditions and was given an inscribed burial tomb when he passed away (Cass. Dio 69.10.2).

[306] On this occasion, Lydia may have demonstrated considerable bravery in her interactions with the wild beasts. Ovid echoes Martial's praise for dogs with bold spirits: "Those dogs merit the highest praise who possess outstanding daring…" (Ovid *Hal.* 75).

another epigram by Martial, a ferocious oryx is said to have caused the death of many dogs during the morning shows on one occasion (Mart. *Ep.* 13.95).

Dog fatalities in the arena may not have come as a surprise for some spectators as similar dangers were found in the hunting fields. Such dangers are frequently alluded to throughout Apuleius' *Metamorphoses.* In Book 8, an incident is described where a pack of dogs were caught off-guard by a wild boar of unprecedented size and ferocity (Apul. *Met.* 8.4.5). The dogs had been trained in a specific technique for hunting goats, which involved blocking all entrances where their prey was assumed to be lurking, encircling them, and barking profusely at a given signal. Unaware that their quarry was in fact a large boar, the dogs charged straight into the animal's lethal tusks. Although it is difficult to reconstruct from the ancient evidence exactly how dogs were employed in the *venationes*, it is possible that some were trained in accordance with the different types of quarry they fought, just like the dogs from Apuleius' novel. Hares, goats, deer, antelopes, foxes, and boar may have been pursued using strategies that were familiar to experienced hunting dogs like Lydia, whereas exotic species provided new and more dangerous challenges for dogs who were perhaps unaccustomed to their behaviours.

A particularly good representation of dogs hunting exotic beasts survives on an early 3rd century CE mosaic from Le Kef in Tunisia (Fig. 76).[307] The scene depicts a large group of ostriches and stags (approximately twenty each in number) tightly gathered within an enclosed netted barrier that contains several openings for dogs and their handlers to enter. The barrier is reminiscent of the equipment used for trapping animals in the wild for the arena games, which might indicate that the scene represents the live capture of wild beasts in North Africa. However, as we saw in the previous chapter, such netted barriers were also used for securing the arena of some entertainment buildings. What is interesting for our purposes is that one of the dogs at the bottom of the mosaic wears a harness, as some hunting dogs did in the wild. If the scene was intended to represent a spectacular *venatio,* it might suggest that dogs were tethered when they first entered the arena while the *venatores* scoped out their quarry. Alternatively, since none of the handlers appear to be carrying weapons, the dogs may have fought the wild beasts on their own.[308] If this were the case, the dogs' anticipated release might have signalled the start of the hunt, followed by cheers and applause from exuberant spectators.

[307] A hunting dog is also seen chasing an antelope on the west side of the Zliten mosaic from Libya. See Appendix III, Fig. 3b.
[308] For more interpretations of this mosaic see Epplett (2001a) 89; Dunbabin (1978) 69, pl. 54; Ball (1984) 130.

In the wild, hunting dogs often worked alongside horses to track down and chase quarry, but no such collaboration seems to have been replicated in the hunting displays.[309] Horses do feature occasionally in the literary and artistic evidence for *venationes,* usually in highly specialised routines like bull-catching. This feat involved horsemen leaping onto bulls and dragging them to the ground by their horns (Plin. *NH* 8.70; Suet. *Claud.* 5.3). It was more common to see horses in the chariot races, which were spectacles of their own.[310] Due to the apparent dangers associated with the *venationes,* some *editores* may not have found it profitable to risk using horses (who were presumably more expensive to hire and train than dogs) in their hunts.

What can be gathered from the extant evidence is that dogs occasionally assisted *venatores* with hunting animals in the arena, just as they did in the wild. In both contexts, dogs were valued for their speed, strength, and courage in facing ferocious species who posed a significant threat to their lives as well as their handlers. It is particularly interesting that very rarely are dogs ever shown fighting large predators inside the arena, such as bears or big cats. This is not to say that dogs were never pitted against these animals, but it may suggest that herbivores (boar, deer, antelope, hare) and small carnivores (foxes) were their typical quarry, as they would have been in the countryside. While the dogs' experiences in the arena undoubtedly differed from those they had in the wild, their training in the hunting fields probably equipped them well for the types of challenges they faced in the arena.

2.3. Animals as Combatants

Single combats between wild beasts, usually of different species, formed part of the extended repertoire of *venationes.* At present, little is known about the staging of these combats and how *editores* decided on what animals to pair together. The nature of the evidence is one factor that makes studying animal pairings a particular challenge. With regard to the artistic material, it is not always clear whether a representation of two animals fighting reflects a historical combat, or if it was conceived by the artist. Moreover, it is entirely possible that the artist had chosen to focus on two specific animals out of a larger hunt. Similar problems arise

[309] See Ael. *NH* 8.14 for an excellent description of dogs and horses working together in a hare hunt. Pseudo-Oppian (*Cyn.* 1.444-450) advised owners of hunting dogs to make them acquainted with the horse from a young age so that they may learn to recognise the horse as a friend and thus distinguish it from wild beasts. See Ps.-Opp. *Cyn.* 1.166-173 for a comprehensive list of desirable horse breeds for hunting.

[310] Humphrey's authoritative study *Roman Circuses* (1986) remains an important text on chariot racing throughout the Roman world. For recent studies on the role of horses in Roman sport and entertainment, see Bell (2014), (2020); Bell and Willekes (2014); the edited volume by Futrell and Scanlon (2021), especially chapters by Hollmann (ch.26) and Holliday (ch.33).

in the literature. Martial, as we will see below, often focuses on individual protagonists and their adversaries without providing details of what was going on beyond that interaction. Indeed, it is entirely possible that multiple combats between animals were staged during a single display. However, given the selective nature of our sources, we may only have the recording of one duel, perhaps only a particularly memorable one at that.

2.3.1. Fighting the 'Equal Opponent'

Bearing in mind the challenges outlined above, as a preliminary it is useful to identify some of the qualities that made up a good fight in Roman thought, and how combatants (both human and animal) were expected to behave during a fight. This, in turn, may shed some light on the reasoning behind an *editor*'s decision to pair certain species of animals together in the arena.

There is an interesting story recorded in Pliny the Elder's *Historia Naturalis* and Plutarch's *Moralia* about an unusually large Indian dog that was gifted to Alexander the Great by the king of Albania (Plin. *NH* 8.61; Plut. *Mor.* 970F). Upon receiving the dog, Alexander arranged for the animal to fight against various wild beasts, including bears, wild boars, and stags. The two authors provide different versions of the outcome of these contests. According to Pliny, the dog was overcome by its adversaries, which resulted in the dog being killed afterwards due to its perceived slackness (*segnitia*). Having heard of this, the Albanian king allegedly sent another dog of the same breed and advised that Alexander test the dog against more formidable opponents, such as the lion and the elephant. Now the dog had found its match and consequently defeated both animals in a single combat. Plutarch's version of the story differs slightly in that he ascribes to the dog the agency of choice.[311] Rather than shying away from the bear, wild boar, and stag, the dog *chose* to disregard these animals and match itself with the lion, for it perceived the lion to be a more worthy contender.

This story may well be fictitious. Nonetheless, the message relayed in both accounts is particularly revealing of Greek and Roman attitudes towards the concept of the 'equal opponent', which was fundamental to the condition of glory. To gain *gloria* and *dignitas* in combat, one was expected to face the *aemulus*: the equal competitor, whose skill rivalled that of his opponent.[312] Victory against a lesser foe was a debased outcome and considered shameful in Greek and Roman thought, for it did not demonstrate honour or valour on part of

[311] This perspective is in keeping with Plutarch's agenda of animal sagacity. See section 2.6 below for more examples of the cleverness of dogs in Plutarch's *Moralia.*
[312] Barton (1993) 28, 182-87.

the victor.[313] During the last three centuries of the Republic, Rome's ultimate *aemuli* were the Carthaginians, who on more than one occasion came close to overcoming the Romans during the Punic Wars (264-146 BCE).[314] Hannibal's surprise entrance into Italy from across the Alps with his army of elephants in 218 BCE left such a daunting impression on Rome that 300 years later the episode was still used as an *exemplum* of the general's greatest achievement (Juv. 102-11).[315] The *aemulus* was therefore an enemy whom one both "admired and scorned"[316]. For Seneca, a well-matched adversary also created opportunities for a fighter to demonstrate his own capabilities and worthiness (Sen. *Prov.* 4.3). Indeed, the desire to face one's adversary head-on in close combat was one of various qualities in addition to declaring war and seldom resorting to ambushes, for which Polybius praised the Romans (Polyb. 13.3.7). Striving for a fair fight, as well as a worthy contender, were both important conditions of the military ethos in Roman culture.[317]

The gravity of being matched against a worthy opponent was especially important in the gladiatorial contests. Seneca argued that "a gladiator reckons it ignominious to be paired with his inferior in skill and considers him to have conquered without glory who had conquered without peril" (Sen. *Prov.* 3.4). Thus, gladiatorial contests were expected to be fierce and laborious struggles.[318] By the end of the 1st century CE, gladiators were ranked according to their level of skill and experience, in part to determine their individual price (*pretium*) but also to facilitate fair pairings.[319] Modern historians refer to this ranking procedure as the '*palus* system', based on a number of gladiatorial epitaphs that include the *palus* to which the deceased belonged (e.g., *CIL* 6.10189: "*T Flavio Incitato, secutori, palo primo"*).[320] An important function of this system was that it enabled gladiators to rise through the ranks and contend (though not always) with opponents of equal standing.

[313] Carter (2003) 95.
[314] On the Carthaginians as the 'equal opponent' see Gell. *NH* 10.27.
[315] In this particular instance, Juvenal uses the image of Hannibal riding an elephant across the Alps to represent the general's greatest achievement, which was juxtaposed with his death in exile.
[316] Barton (1993) 183.
[317] Attitudes towards the *aemulus* extended beyond the context of military combat into the literary sphere. Cicero, for example, held his philosophical rivals (the Stoics) in high esteem, and thus found them worthy of contending with (Cic. *Div.* 2.72.150). According to Suetonius, a grammarian called Marcus Verrius Flaccus was famed for his method of pitting students with the same writing competency against one another. The winner would then carry off a prize as if they were a gladiator (Suet. *Gram. et rhet.* 17). Cf. Arr. *Epict. diss.* 1.29.37 on the philosopher's eagerness to engage with a fierce opponent, just like the brave gladiator.
[318] Gladiatorial epitaphs proclaiming that the deceased "fell and he conquered" clearly reflect these sentiments. For a list of examples see Robert (1940) 254-55.
[319] Carter (2003) 87, 95-98.
[320] Ville (1981) 324. There seems to have existed four main *pali,* though epigraphic evidence from Aphrodisias attests to the possibility that one gladiatorial *familia* included up to eight. For discussion of this evidence see Roueché (1993) 64-67 and Carter (2003) 90.

In addition to being sorted by rank, gladiators were also organised according to their armament type and consequently matched against adversaries who generally fought with opposing advantages and disadvantages.[321] Thus, it was often the case that heavily-armed gladiators were matched with lighter-armed opponents. Whereas the former wore heavy armour and typically carried a long shield for protection, the latter were largely unprotected and wielded lighter weapons that enabled speed and agility. The purpose of these combinations was to increase the unpredictability of the combat and ensure that both contenders were given distinct advantages and disadvantages.

A classic pairing in the imperial period, for which we have a range of material, iconographic, and written evidence, was the *murmillo*[322] and *thraex*[323] (see Zliten mosaic, south side, Fig. 3f). The *murmillo* was a heavily-armed gladiator who fought with a large rectangular shield (*scutum*) and carried the *gladius* sword from which we get the term 'gladiator'. The *thraex,* in contrast, carried a smaller, square shield (*parmula*) and wielded the curved *sica* sword. Although his shield was much smaller than his opponent's, the design of the *sica* gave the *thraex* the advantage of being able to reach around the *murmillo*'s shield and inflict serious injury. Both gladiators were protected with varying degrees of padding and wore visored helmets.[324] Owing to his larger shield, only one leg of the *murmillo* was protected by a short metal greave, whereas the *thraex* wore guards on both legs and scale armour (*lorica squamata*) that covered the top of his greaves up to his loincloth (*subligaculum*). Based on their equipment, we can deduce that when the pair fought together their individual strengths would have been matched against each other's weaknesses.

Such was the popularity of this pair that both *armaturae* had a widespread following of Roman supporters. *Murmillones* had the backing of fans known as the *scutarii* ('large shielders'), while the *thraex* gained support from the *parmularii* ('small shielders') (M. Aur. *Med.* 1.5). Caligula, Nero, Titus, and Domitian are all known to have been involved in debates

[321] At least 24 distinct *armaturae* have been identified from the historical sources. Many gladiators were characterised by the type of armour and weaponry they employed. For example, the *retiarius* ('net-man') employed a large net, just as the *hoplomachus* ('shield-fighter') carried a shield, and the highly specialised *dimachaeri* ('two-swordmen') fought with two swords. Some gladiators bore names that reflected a specialist move. The *secutor,* for instance, 'followed' his opponent, while the *equites* ('cavalrymen') entered the arena on horseback. Other types of gladiators, including the *samnis* ('Samnite'), *thraex* ('Thracian'), and *gallus* ('Gaul'), were associated with national groups, which may have reflected the origin of their weaponry. See Junkelmann (2000a, 2000b, 2000c) for a comprehensive discussion of these *armaturae* and their respective fighting styles.

[322] The *murmillo* derived his name from the marine fish called μύρμη, whose image was imprinted on his helmet.

[323] The *thraex* derived his name from the Thracians (modern-day Bulgaria), with whom the Romans came into contact at the time of the wars against Mithridates. See Jacobelli (2003) 9-15.

[324] A long glove (*manica*), which Junkelmann argues was modelled on the boxing glove, was worn by most gladiators on the right arm. See Junkelmann (2000a) 36.

over the fighting styles of these two types of gladiators.[325] That such rivalry was known amongst even the highest level of Roman society suggests there was a strong collective appreciation for the compatibility of this pair.

2.3.2. Bear and Bulls Fights

While the ancient sources reveal no such fan base for certain species or pairs of animal combatants as there was for some gladiators, there is a surprisingly large visual record of bear and bull fights throughout the Roman world. This could be indicative of the perceived compatibility of these animals. According to Seneca, bear and bull fights were regularly staged at the morning shows in Rome during his own time, often with the animals chained together (Sen. *Ira* 3.43.2). Representations of bears and bulls in bonds were painted along the *podium* of the amphitheatre at Pompeii in the 1st century CE. A 19th century watercolour of the painting, displayed in the Museo Archeologico Nazionale in Naples, depicts the pair tethered together by a rope that wraps around the animals' upper body.[326] A similar representation is found on the Zliten mosaic, where a bear and bull fight under the constraints of a chain (Fig. 3c). One advantage of tying the animals together was that it forced the antagonists to remain close to one another. This may have been necessary if the pair initially showed an unwillingness to fight.[327] Thus, if one of the animals attempted to break away, the pressure from the rope being pulled could have stirred the animal on the other end into a frenzy.

Just as we saw with the *murmillo* and *thraex,* the natural weapons and fighting styles of the bear and bull are markedly different from one another. When pitted together, these differences afforded each animal distinct advantages. The bear is a large, heavy-weight predator equipped with sharp, curved claws and long canines that can crunch through bone. As mentioned earlier, bears will typically confront their rivals by standing on their hind legs, for they are most proficient in close-quarters combat. Pliny the Elder observed that when a bear engages with a bull it will utilise its claws, teeth, and weight to hang from the bull's mouth. By this means, the bear progressively exhausts the bull whilst keeping its horns at a distance from the bear's head (Plin. *NH* 8.54). Representations of the two animals fighting in this manner in the arena are clearly illustrated on the Zliten mosaic (Fig. 3c), the Sofia relief

[325] According to Suetonius, Caligula and Titus expressed their support for the *thraex* (Suet. *Calig.* 54.1, 55.2, *Tit.* 8.2), while Nero and Domitian favoured the *murmillo* (Suet. *Ner*. 30.2, 47.3, *Dom.* 10.1).
[326] See La Regina (2001) 335, p. 26, inv. no. ADS 84.
[327] Junkelmann (2000a) 73.

(Fig. 2), on a marble frieze slab from Sardis, Turkey (Fig. 77), and on a floor mosaic from the House of Dionysus in Thysdrus (Fig. 78).[328]

In contrast, the bull utilises its strength and weight differently from the bear during agonistic encounters. Whereas bears are most suited for close-quarters combat, the bull is at an advantage when it has the room to charge. Thus, it will often begin its assault by rushing headlong towards its adversary, which is then followed by bunting and bucking behaviour. This advantage was evidently lost if the bull and bear were tethered together. In close-quarters combat, however, a bull will try to trample its adversary and gouge them with its sharp horns.[329] Standing on its hind legs, a bear was more at risk of having its fleshy stomach impaled by these tools.[330] Therefore, it would seem that binding the two animals together might have also facilitated a fair combat.

While bear and bull fights are well-represented in the visual material, descriptive accounts of these combats are comparatively sparse. Pliny the Elder offers informative insights into the behavioural repertoires of both animals, but specific references to historical combats in the arena are all but absent (Plin. *NH* 8.54, 8.70). Seneca noted that such contests were a common sight during his own time, so perhaps further commentary was unwarranted. Descriptions of bear and bull fights from the California Gold Rush in the 1840s provide a useful comparable lens through which to understand the visceral attraction of watching these two species fight each other. The animal combats in Spanish California were part of the entertainments offered in settlement towns during fiestas and after mass on Sundays.[331] During these occasions, the Californian grizzly was commonly pitted against the Spanish bull, often bound together by a long rope as was sometimes done in the Roman *venationes* (Fig. 79). A diary entry from J. D. Borthwick, who was a frequent spectator of bear and bull fights in the mining town of Moquelumne Hill in Sierra Nevada, sheds an interesting light on how these two animals fought each other:

> …after looking steadily at the bear for a few minutes as if taking aim at him, [the bull] put down his head and charged furiously at him across the arena. The bear received him crouching down as low as he could, and though one could hear the bump of the bull's head and horns upon his ribs, he was quick enough to seize the bull by the nose before he could retreat. This spirited

[328] An illustration of a bear fighting a tethered bull, who is mounted by a performer, also features on a floor mosaic from the Greek island of Kos, dated to the late 2nd/early 3rd century CE. See chapter 3 section 3.2.3 for a discussion of this scene (Appendix III, Fig. 116).
[329] Pliny the Elder (*NH* 8.70) believed that the bull's chief threat to an animal was its powerful legs.
[330] Cf. Pliny (*NH* 8.29) on the dangers of the rhinoceros' horns to the elephant's stomach when the pair fought.
[331] For excellent studies on the cultural reception, social dynamics, and staging of bear and bull contests during the California Gold Rush, see Storer and Tevis (1996) esp. ch. 6; Johnson (2000) esp. ch. 3; Kurutz (2000).

> commencement of the battle on the part of the bull was hailed with uproarious applause; and having shown such pluck, he had gained more than ever the sympathy of the people. In the meantime, the bear, lying on his back, held the bull's nose firmly between his teeth, and embraced him round the neck with his fore-paws, while the bull made the most of his opportunities in stamping on the bear with his hind-feet. At last the General [the bear] became exasperated at such treatment, and shook the bull savagely by the nose, when a promiscuous scuffle ensued, which resulted in the bear throwing his antagonist to the ground with his fore-paws. For this feat the bear was cheered immensely…[332]

From this passage we can deduce that bear and bull fights were well-balanced contests that afforded both animals similar opportunities to demonstrate their distinct fighting abilities. Although separated by nearly 2000 years, the California bear and bull fights share similarities with the contests from the Roman period. Just as Pliny the Elder had observed, the bear begins its assault by latching onto the bull's sensitive nose using its claws, thereby preventing the bull from retreating. In retaliation, the bull repeatedly kicks its adversary and rams its horns into the bear's ribcage in the hope of freeing itself from the bear's grasp. At various stages of the combat each animal receives cheers from the audience for their courageous efforts, which indicates that spectators judged the animals based on their individual merits just as the Romans did with gladiators and quite possibly the animals too.

Bearing in mind that none of the available evidence from the Roman period mentions a decisive victor in these combats, it would be fair to surmise that bear and bull fights were highly unpredictable contests. According to Seneca, such contests often required an "appointed slayer" to end the fight, presumably when neither animal showed any hint of backing down (Sen. *Ira* 3.43.2). It is not difficult to imagine, then, why some *editores* regarded the bear and bull as desirable opponents: the uncertainty of a victor gave some reassurance that the pair could put on a worthy display. With respect to the artistic material, the implication of an ambiguous victor invited the viewer to consider how one animal might fare against the other, considering their respective strengths and weaknesses. Pollitt suggested that mosaics depicting animal combats in the houses of affluent patrons may have served to open conversation at symposia, for instance 'what would happen if a bear challenged a bull?'.[333] If bear and bull combats were common sightings in the Roman *venationes*, as the evidence seems to suggest, one can envisage this question provoking stimulating debates that were analogous to those concerning gladiator combats.

[332] Borthwick (1857) 294-95. For comparable empirical accounts of bear and bull contests, see the diary entries of Helper (1855) 116-30; Marryat (1855) 131, 251; Perkins (1964) 273-77.
[333] Pollitt (1986) 148.

It is also important not to overlook the practicalities of pairing two species that were relatively easy to procure throughout the Roman world. In Italy, bears and bulls could be sourced locally, while exotic breeds, such as the Scottish bear or the Spanish bull, could be obtained from further abroad as a novel attraction (Mart. *Spect.* 9-10; see chapter 4 on bear populations). Local populations of bears and bulls also existed in the provinces, where such fights have been documented: in Bulgaria (Sofia relief), Libya (Zliten mosaic), Turkey (marble frieze), and Tunisia (Thysdrus mosaic). There is no indication from our sources that the animals were considered natural enemies; however, some populations may have co-existed in regions where bear territories crossed over cattle farms.[334] As opportunistic feeders, bears were likely to prey upon weak or injured cattle. For this reason, bear and bull combats may have struck a particular chord with rural spectators, who could have been victims of bear raids.

2.3.3. Mixing and Matching

Notwithstanding the apparent popularity of bear and bull fights in the Roman arena, they were just one of many possible pairings. There is some evidence to suggest that *editores* also enjoyed creating new combinations of interspecies (and occasionally intraspecies) combats, just as they did in the gladiatorial games. For example, although the common opponent of the *murmillo* was the *thraex,* iconographic and epigraphic evidence indicates that the *murmillo* was sometimes matched against the *hoplomachus*[335], *retiarius*[336], and *provocator*[337]. Similarly, in Rome, the bull is reported to have been pitted against the elephant (Plin. *NH* 8.7; Mart. *Spect.* 20 and 22[338]) and rhinoceros (Mart. *Spect.* 11[339]) on several occasions. Wiedemann argued that the creation of new pairs, especially in the 1st century CE, was probably a strategy pursued by the emperors to compete with their predecessors and give the people novel

[334] Indeed, the very fact that bears and bulls were not natural enemies might have enhanced the attraction of these fights.
[335] A victorious *hoplomachus* stands before a *murmillo,* who raises a finger in surrender on the northern frieze of the Zliten mosaic in Libya.
[336] "Purpurio, a retiarius, died in his 11th fight, killed by the *murmillo,* who was his opponent" (*AE* 1960, 139-40 – *EAOR* III 69).
[337] "Here lies the *murmillo,* glory of Smyrna, passer-by, who died at the hands of the *provocator* Hyakinthos, after eleven fights. Nobody snatched victory from me, but Moira determined that I should die, for so I paid my debt." See Robert (1940) no. 8.
[338] A medallion minted under Gordian III (238-244 CE) depicts a combat between a bull and a mounted elephant taking place inside the Colosseum. A similar representation of a bull fighting a mounted elephant is illustrated on a Roman floor mosaic from the Aventine Hill in Rome (3rd century CE). See Appendix III, Fig. 108 and 109.
[339] On the architrave of the Templum Divi Vespasiani in Rome there is a section of a frieze that shows a rhinoceros confronting a bull in combat. See Coleman (2006) 108, pl. 21.

displays.[340] Indeed, the novelty of watching new combinations may have been just as exciting for the spectators as seeing traditional rivals brought together, if not more.

In addition to keeping displays fresh and spectators engaged, another objective of mixing and matching animal combatants was to see how different species responded to new challenges. Gladiators, for instance, demonstrated their technical expertise in overcoming new opponents by using combat strategies that were specific to their armature type. Similarly, pairing new animals together created opportunities to test how familiar combatants (e.g., bear and bull) might respond to exotic adversaries (e.g., elephant and rhinoceros), and vice versa. This might have been the thinking behind a series of combats celebrated in Martial's *Liber Spectaculorum*, where an African rhinoceros was pitted against wild beasts of various kinds. In *Spect.* 11, the rhinoceros is said to have given a sensational display of strength whereby it tossed a bull into the air as if it were a dummy. According to Martial, the rhinoceros' aggression was quite unexpected, for it did not promise (*non promisit*) a ferocious performance. Coleman suggested that Martial may have been referring to the animal's initial docility.[341] It is also possible that spectators, including Martial himself, were not well-acquainted with the rhinoceros' explosive power and tossing abilities.[342] Rhinoceroses in the wild and in captivity show a variety of anti-predator and defence behaviours in response to the approach of a perceived threat. However, charging is a common response to startling or novel stimuli, especially if they are difficult to identify by sight as the rhinoceros' vision is comparatively poor (*pers. obv.*). Due to their large body weight (≥3 tonnes) and forceful propulsive muscles in the hindlimb (e.g., gluteal muscles), such charges are often executed with incredible force and speed.[343] When contact is made, its heavily muscled neck and shoulders, which support the weight of its head (≥362 kilograms), enable the rhinoceros to then lift the threat into the air using its horns.[344] In the wild, some African rhinoceroses have been observed charging and overturning objects twice their size such as

[340] Wiedemann (1992) 61-62.
[341] Coleman (2006) 107.
[342] If we date the performance to the Colosseum's inauguration (80 CE), it would have been the first time the rhinoceros had appeared in Rome since 8 CE, when it featured in a *venatio* staged by Augustus (Cass. Dio 55.33.4). Thus, most spectators were presumably unaccustomed to the rhinoceroses' behaviour.
[343] For a recent study of the musculature organisation and locomotion of rhinoceroses see Etienne et al. (2021).
[344] This is more typical of African rhinoceroses than the Asian species. African rhinoceroses will typically fight with their horns, using them to toss and gore their adversaries, while Asian rhinoceroses will fight with their bottom teeth (slashing).

safari vehicles.[345] Thus, throwing a bull into the air would have been a spectacular feat well within the capabilities of a rhinoceros.

In another epigram by Martial, the rhinoceros is pitted against a much wider range of adversaries, including a bear, aurochs, bison, lion, and bulls (*Spect.* 26). On this occasion, however, the rhinoceros required goading from its trainers so that it would deliver the fierce combat that spectators had now been promised (*desperabantur promissi proelia Martis*). The repeated use of the verb *promitto* suggests that Martial is describing the same protagonist from *Spect.* 11, though possibly from a later performance. The rarity of the rhinoceros in the Roman games is also reason to believe that the same specimen was used for both displays.[346] After considerable goading, the rhinoceros returned to its former rage and overcame its opponents in a sequence of attacks.[347] Thus on two occasions the rhinoceros gave spectacular displays of strength and tenacity that were nothing short of heroic, and hence deserving of commemoration.[348]

Aside from the exotic provenance of the rhinoceros, its characteristic tossing behaviour seems to have been a key attraction of its performances. Pitting the rhinoceros against a diverse range of species with varying weapons and weight essentially put this skill to the test. To successfully toss a bull or aurochs, for instance, it had to navigate the animals' lethal horns, which were similarly employed for goring and tossing adversaries. As these interactions unfolded, some spectators perhaps made sense of the rhinoceros' behaviour by likening it to the more familiar tossing behaviour performed by bulls. Martial's analogy of the dummy (*pila*) – an object typically thrown by bulls in the arena – strongly suggests that he intended his readers to make this connection (see chapter 3 section 3.3.2 for discussion of the *pila*). What we may learn from Martial's commentary on the rhinoceros is that the attraction of paired animal combats lay not only in the prospect of seeing a victor, but also in the skills with which the animals responded to new challenges, just like gladiators. Exotic species like

[345] Captive rhinoceroses have also been observed attacking and flipping zoo vehicles inside their exhibit. An incident of this sort was reported at a German Safari Park in 2019, where an African bull, named Kusini, repeatedly flipped a 1.5-ton car while a zookeeper was guiding the rhinoceros to its stables. See NBC News: https://www.nbcnews.com/news/world/watch-rhino-attacks-zookeeper-s-car-germany-no-one-was-n1047221.

[346] Moreover, Martial makes no indication that the rhinoceros from *Spect.* 11 was killed by *venatores* after being displayed.

[347] So great was the rhinoceros' performance that Martial closes the epigram by reprimanding the audience for initially doubting the animal's ferocity (*Spect.* 26: *i nunc et lentas corripe, turba, moras!*).

[348] It is generally argued that the rhinoceros commemorated in Martial's epigrams is the same specimen represented on small copper *quadrans* that were widely minted by Domitian sometime between 83 and 85 CE. The connection between Domitian's *quadrans* and Martial's epigrams has been used as a compelling argument for the identity of 'Caesar' as Domitian, at least for these two epigrams in Martial's *Liber Spectaculorum*. This debate is reviewed carefully by Coleman (2006) liv-lvi. Detailed discussions of the identity of the rhinoceros on Domitian's *quadrans* are also found in Toynbee (1973) 126-27; Epplett (2001a) 183-84; Buttrey (2007) 106-12.

the rhinoceros were especially appealing to cast as combatants because their behavioural repertoire was presumably much less known to spectators than that of more familiar species such as the bull or bear.

2.4. Animals as Curiosities

Between the late Republic and 1st century CE, it was common for new or particularly rare species to be displayed inside the arenas at Rome as curiosities. As with paired animal combats, exhibitions of curiosities allowed spectators to appreciate the true nature of the animals without the intervention of hunters. The arrival of a new species must have attracted great scientific interest, especially among artists, poets, and naturalists like Pliny the Elder.[349] Some may have even had the opportunity to view or study such curiosities before they reached the arena. According to Pliny, a sculptor named Pasiteles was carving a relief of a lion at a port near Rome when he was badly mauled by a leopard that had escaped from its cage (Plin. *NH* 36.4), and Martial encouraged his readers to go visit a pen that held the unlikely couple of a lion and a ram (Mart. *Ep.* 9.71). These close encounters may have afforded members of the public a more intimate view of exotic curiosities that were destined for the arena games.

There were many reasons why an *editor* might choose to exhibit an animal, rather than have it hunted or exploited in another capacity. From a political standpoint, being the first to display a new *genus* would have carried incredible political and social prestige*;* parading it around the arena enabled the *editor* to make claim to this achievement without the focus being re-directed onto the *venatores* and their courageous efforts in hunting the animals. Other reasons may have been influenced by the animal's behavioural affordances and demands that rendered it more appropriate to exploit as a curiosity. This is particularly clear to see in the case of the giraffe.

[349] Dissectors of animals, such as the Greek physician and surgeon Galen, were another group that would have taken great interest in the arrival of a new *genus* in Rome. During the 2nd century CE, Galen performed dissections and vivisections on an astonishing number of species, many of which are recorded in his treatises, *De Anatomicis Administrationibus.* The imperial *venationes* in Rome probably supplied Galen with many of the exotic animals for his experiments, including an elephant which Galen is said to have dissected on one occasion after it had been killed in Rome, possibly in the arena or captivity (Gal. *AA* 7.10, cf. lions: *AA* 2.535, 573, hippopotami: *AA* 2.548-9). For a recent discussion of Galen's connection to the *venationes,* see Bubb (2022) esp. pp. 105-10. See also Scarborough (1985) on Galen's elephant dissection. On Galen's dissections as a performance see Gleason (2007).

2.4.1. A Tall Order: The Demands of Displaying Giraffes

The giraffe made its first appearance in Rome at the triumphal games celebrated by Julius Caesar in 46 BCE (Plin. *NH* 8.27; Cass. Dio 43.23). The animal may well have been taken by Caesar as war booty from Alexandria, where there seems to have existed a state-owned *vivarium*.[350] Indeed, this may have been the same specimen described by Varro as having been recently imported from Alexandria (Varro, *Ling.* 5.20.100). On the occasion of Caesar's victory games, the giraffe was likely chosen to advertise his own success in Egypt.[351] Pliny the Elder gives no details about the display itself; however, he does mention that, following Caesar's show, the giraffe was recognised to be "more remarkable for appearance than for ferocity", and hence it also went by the name "wild sheep" (*ovis fera*).[352] Giraffes are not inherently dangerous animals, although they are capable of killing predators by striking them with their front feet or kicking with their hind legs with tremendous force (Fig. 80).[353] Our only record of a giraffe hunt in Rome comes from Cassius Dio (73.10), who claims that Commodus dispatched one giraffe, along with a rhinoceros, five hippopotami, and two elephants.[354] The novelty of this event suggests that giraffes did not afford particularly dramatic hunts.

Lewis and Jones argued that the giraffe's docility might help to explain the Romans' supposed lack of interest in the animal, since they preferred to use more "ferocious" species in their *venationes*.[355] The excerpt from Pliny suggests, rather, that spectators *were* interested in the giraffe but found greater pleasure in its outlandish appearance than its behaviour. The giraffe's unusual colouring and morphology shared similarities with the camel and leopard, which gave it its Greek, and then Latin, name *camelopardalis* (Plin. *NH* 8.27; Cass. Dio 43.23; Strab. 16.16; Hor. *Epist.* 2.1.195-196).[356] Horace wrote of a white elephant and a hybrid creature – half camel, half leopard – as attracting the attention of a crowd in Rome because of the animals' unusual complexion (Hor. *Epist.* 2.1.196-197)[357], and Pausanias was captivated by "Indian camels with leopards' colouring", which he probably saw at the *venationes* in Rome

[350] Epplett (2001a) 12. Giraffes were among the long list of animals that took part in the large procession staged by Ptolemy II in Alexandria in the 3rd century BCE (Ath. 5.201C)
[351] Epplett (2001a, 317) suggested that the giraffe may have been gifted from Cleopatra or another ally of Caesar from his campaign in Egypt.
[352] Strabo (16.4.16) even regarded the giraffe as a domesticated animal.
[353] Fowler (2013) 142.
[354] As a contemporary of Commodus' reign, Cassius Dio may have witnessed these spectacles himself.
[355] Lewis and Jones (2018) 451.
[356] The Greeks and Romans often made sense of new animals by giving them names with familiar associations. For example, when elephants were first sighted in Italy in 280 BCE, the Romans called them snake-handed 'Lucanian cows' (*lucae boves*) owing to the appearance of the animals' trunk and the location of their first encounter with the Romans (Varro, *Rust.* 7.39-40; Lucr. 5.1302-4; Plin. *NH* 8.6). Cassius Dio described the zebra, which made its first appearance in Rome under Septimius Severus, as a horse with tiger-like stripes (Cass. Dio 75.14; cf. 78.6 on Caracalla's games).
[357] Horace specifically refers to the camel-leopard cross as a "hybrid monster" (*Epist.* 2.1.195-196).

or on a private estate (Paus. 9.21.2).[358] Indeed, it may have been for the giraffe's hybrid appearance, in addition to its placid nature, that Roman *editores* preferred to exploit the animal as a curiosity than to have it hunted.

Apart from its captivating complexion, the giraffe's spectacularly tall and distinctive physiology may have had more serious implications for its exploitation in the *venationes*. Before reaching the arena, giraffes had to survive the ordeal of being transported over long and probably arduous journeys to Rome from Alexandria or further afield in the sub-Saharan regions of Africa. Giraffes were not unique in having to travel long distances to reach Rome, but their peculiar anatomy posed significant logistical challenges that made them especially difficult to capture and transport. Contrary to what some scholars have argued, the giraffe's docile nature would not have made them a much easier animal to translocate than other exotic species.[359] Recent studies on giraffe translocations have shown that these animals have a high mortality rate during capture compared to other wild animals.[360] Even in more controlled environments, such as zoos and animal sanctuaries, serious complications can arise.[361] A major challenge is the provision of suitable transport to accommodate their huge bodies. Adult males can stand 4.9-5.2 metres tall and weigh 970-1,500 kilograms, while adult females can measure 4.3-4.6 metres and weigh 700-1,000 kilograms.[362] Because of their extremely elongated neck and tall body, giraffes are at particular risk of subluxation of cervical vertebrae during capture procedures.[363] This can occur if a giraffe becomes startled by unfamiliar or frightening stimuli in its environment, thus causing it to slip or fall (*pers. obv.*). Their long, thin legs also make them prone to stumbling, which can lead to potential injury. The giraffe's unique cardio-vascular system and long neck also means that it requires extremely high blood pressure to supply the brain with oxygen. Complications can thus arise if a giraffe's head drops abruptly. In modern times, many risks associated with giraffe translocations can be circumvented by darting the animals with sedatives or anaesthetics.[364]

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[358] A sarcophagus from Rome depicting Dionysus' Indian triumph (ca. 190 CE), echoes Pausanias' erroneous belief that giraffes came from India. See Toynbee (1973) 142, pl. 65. See also Appendix III, Fig. 88.

[359] For example, Epplett (2001a) 317 and Keller (1913) 284. The giraffe is relatively approachable and tractable; however, its capture is extremely dangerous and should only be attempted with experienced handlers knowledgeable of giraffe behaviour.

[360] Muller et al. (2020) 5. For methods of capturing and translocating other megaherbivores in the wild, see Lekolool (2012). Field studies have also shown that giraffes are especially prone to hypothermia caused by capture-related myopathy ('capture stress') if ambient temperatures are too cold. See Fennessy et al. (2022) 19.

[361] Jolly (2003) 33-34.

[362] Fennessy et al. (2022) 8.

[363] Muller et al. (2020) 6.

[364] For discussion of the safe and effective immobilisation of giraffes using drugs, see Deacon (2022).

In the Roman period, however, tranquilisation drugs had not yet been produced, thus making this activity considerably more dangerous for both the handlers and animals.

Although no descriptions of giraffe translocations were recorded in the ancient sources, it is possible that the giraffe's complicated anatomy and sheer size reduced the success rate of these operations. From a practical perspective, it would make sense, then, for giraffes to feature in the *venationes* as curiosities so that they could be reused for future performances. Unfortunately, the ancient evidence is largely silent on what happened to animals after they were exhibited inside the arena. It is possible that some were subsequently sold to wealthy landowners who kept wildlife in enclosures on the grounds of private estates for pleasure and profit (Columella, *Rust.* 9.1.1-2; Varro, *Rust.* 3.3.1-5, 3.13). Some exotic animals may have remained there until an *editor* expressed interest in using them for his own shows. In 248 CE, some of the animals from Gordian III's menagerie featured as curiosities at the Secular Games staged by Philip the Arab (SHA *Gord.* 33.1.2). Among them were ten giraffes who may have returned to Gordian's menagerie, where they could have been reused in private shows for the Roman elite. A similar fate may have been decided for the giraffes who were part of the large assortment of animals used in Aurelian's triumphal procession in 274 CE celebrating his victory over the Palmyrenes (SHA *Aur.* 33.4). Procopius mentions a large *vivarium* for lions and other exotic animals located beside the Porta Praenestina in Rome, adjacent to Aurelian's city wall (Procop. *Goth.* 1.23.13-18).[365] If such a *vivarium* did exist, it might have played an important role in supplying *editores* in Rome with curiosities that were especially difficult to obtain from abroad, such as the giraffe.

Whatever became of the giraffe after these shows, the fact that it featured in the Roman games at all is nothing short of extraordinary. The many complications associated with its anatomy may have discouraged some *editores* from obtaining giraffes, which might account for the animal's minimal appearance in the *venationes*. When giraffes were exhibited, their unusual complexion and morphology incited more enthusiasm in spectators than its docile behaviour, and this too may partially explain its attraction as a curiosity. These characteristics certainly made the giraffe one of the more complex species that were displayed in the *venationes*; a point that remains true in zoos today.

[365] A wall painting found in the *columbarium* of the Villa Pamphyli near Rome, depicting a giraffe with a bell around its neck being led by a handler, may also allude to exotic specimens that were kept as curiosities in state-owned or privately owned *vivaria*. For discussion of this piece see Toynbee (1973) 142.

2.5. Animals as Executioners

From the mid-2nd century BCE onwards, there is evidence that some animals were cast as agents of executions inside the arena.[366] The public nature of these events was intended to punish the condemned in a humiliating fashion (indicating a loss in status) with the view of deterring potential offenders from threatening the state.[367] The reinforcement of social harmony and order was enacted under the gaze of the whole community, thus setting standards for the moral behaviour of its members.[368]

Other capital penalties in Roman society included crucifixion and being burnt at the stake (*crematio*), but these did not carry the same attraction as watching criminals thrown to wild beasts.[369] Part of the appeal of *damnatio ad bestias* was the unpredictability of the animals' behaviours, since it was never guaranteed that they would attack or fatally wound their victims.[370] Various measures were taken to incite aggression from the animals but even these did not always produce a desired outcome. For example, when the martyr Saturus was sentenced to death in Carthage in the early 3rd century CE an arena attendant allegedly tied him to a wild boar in the hope that the physical sensation might anger the animal (*Passio Perpet. et Felic* 19.5).[371] This strategy was successful; however, rather than goring Saturus, the boar directed its aggression towards the attendant instead. During a second attempt to execute Saturus, a bear was destined to be set upon him but failed to leave its cage (19.6). When Saturus entered the arena for the third time, he was badly (though not fatally) wounded by a leopard (21.3). Survivors of these punishments sometimes met their fate by the sword rather than by the jaws or claws of wild beasts as was intended (21.4-10).[372] Exploiting animals for executions was therefore a risky practice. The displays were costly to produce, they required careful planning, and there was no guarantee that the animals would fulfil their

[366] The earliest record of *damnatio ad bestias* in Rome was staged in 167 BCE at the victory games of Aemilius Paullus, where deserters from the Roman army were condemned to elephants (Val. Max. 2.7.13-14). Just over twenty years later, the younger Scipio Aemilianus followed suit by casting war captives to elephants after he defeated Carthage in the Third Punic War. Condemning criminals to wild beasts may have become a regular feature of a spectacle program from the time of Claudius onwards, at least in Rome (Suet. *Claud.* 34.2).

[367] Seneca lists the aims of punishment as correction, deterrence, and security (Sen. *Clem.* 1.22.1); cf. Sen. *Ira* 1.19.7; Gell. *NA* 7.14.4. For a detailed discussion of the Roman juridical system, particularly in the context of the *ludi,* see Coleman (1990). For recent studies on Roman law and performance, see Aubert and Sirks (2002) and Carucci (2019).

[368] Carucci (2019) 231.

[369] Some *crematione*s involved dramatic choreographies that could add excitement to the execution for the spectators. Plutarch mentions seeing criminals, dressed in gold and purple tunics, perform the Pyrrhic dance before being burnt at the stake (Plut. *Mor.* 554B).

[370] Coleman (1990) 56; Wiedemann (1992) 89; Gilhus (2006) 191; Vismara (2001) 76.

[371] For a detailed commentary on the *Passion of Perpetua and Felicity,* see Heffernan (2012).

[372] Kyle (1988) 184-86; Coleman (1990) 59.

performing role. As Jennison rightly pointed out, "that there were so many successful executions is more remarkable than the number of failures."[373]

Despite these challenges, *editores* went to great pains to obtain animals for public executions and, in exceptional cases, a delay of capital sentence was permitted to accommodate the arrangements of animals. According to Gaius, criminals sentenced *ad bestias* were often kept for long periods before being thrown into the arena so that evidence might be extracted from them during torture (*Digest* 48.19.29). This delay may have enabled *editores* to obtain wild beasts for the execution or replace animals that had unexpectedly died before the display. Democharis in Apuleius' *Metamorphoses* found himself in such a predicament when his bears, who were intended to be used in an execution, died in captivity before the show (Apul. *Met.* 4.13). The bears had been collected from abroad in three different ways: in private hunting expeditions, by purchase, and as gifts from friends. The investments that Democharis poured into acquiring these animals suggest that the executions were also an opportunity for the presiding official to show off his wealthy connections.

2.5.1. Red in Tooth, Claw, and Horn

Teeth, claws, horns, antlers, hooves, tusks, talons are all types of defence mechanisms that animals use to avoid predation, fight, and kill adversaries, generally of the same species. In the Roman arena, animals relied on these defence mechanisms to fend off attacks from *venatores* and battle against other animals. In the context of executions, they were vital for dispatching condemned persons. It is only natural, then, that *editores* should look towards these affordances as indicators for how suitable an animal might be for performing the role of executioner.

Not surprisingly, *editores* in Rome and throughout the provinces often deployed big cats and bears to execute condemned persons. Both groups of animals have evolved sharp claws to catch prey and massive jaws to both kill and drag their prey around. An excellent representation of an execution involving leopards and bears is depicted on the remains of a late 3rd century CE mosaic from the Sollertiana House in Thysdrus (Fig. 81). Two surviving corners of the mosaic show leopards biting and clawing at *noxii,* who have been pushed into the animals' path by arena attendants.[374] The involvement of these attendants is interesting for it suggests that animals were sometimes assisted in the executions, perhaps when they showed a reluctance to engage. The western frieze of the Zliten mosaic from Libya depicts

[373] Jennison (1937) 169.
[374] Bears are depicted throughout the scene, though none are shown attacking the *noxii.* This may be represented in the areas where the mosaic has been damaged.

similar interactions where criminals are delivered up to big cats on carts (see chapter 3 for discussion of these carts) (Fig. 3b).

Big cats and bears also use their powerful claws for climbing trees to obtain food or evade other predators. This particular skill was one that the Romans found especially beneficial in the executions. To judge from the artistic evidence, it was not uncommon for criminals to be hoisted up on a stake so that the animals had to climb or jump up it to reach their quarry. An illustration of this type of staging is depicted on an African flask (*lagynos*) dated to ca. 400 CE (Fig. 82).[375] The scene shows a criminal bound and suspended on a stake; behind him a man (arena attendant?) holding a whip and *mappa* looks on while a large animal climbs up the stake. The animal is mane-less, and has a short, stubby tail, which may indicate it is a bear. If so, once the bear had reached the condemned it probably used its curved claws to excavate and its teeth to tear at the victim's body. Representations of lions attacking *noxii* bound to stakes are found on a 1st/2nd century CE lamp from North Africa (Fig. 83) and a 2nd century CE *terra sigillata* lamp discovered at the La Graufesenque archaeological site near Millau in France (Fig. 84). Rather than climbing the stake like the bear, the lions lunge toward their victims from a double ramp, which probably enabled arena attendants to goad the animals from the other side.[376]

Martial provides a particularly vivid description of a Scottish bear mauling a bound criminal disguised as the legendary Italian bandit Laureolus in a spectacular execution enacted inside the Colosseum (Mart. *Spect.* 9). To enhance the realism of this display, Martial likens the criminal's fate to that of the Greek god Prometheus who, like the criminal, was physically tied down and savaged by a wild animal. What makes 'Laureolus'' execution especially horrific is the possibility that the bear's assault did not immediately kill him. Unless a vital organ was punctured, the bear's characteristic excavation technique may have left the criminal in a mangled state but not necessarily dead. Martial in fact envisages 'Laureolus' still being able to move his limbs, even though his body had been severely mauled to the point of being unrecognisable: *uiuebant laceri membris stillantibus artus / inque omni nusquam corpore corpus erat.*[377] Suspending the criminal also made it more difficult for the bear to

[375] On the iconography of this *lagynos,* see van den Hoek and Herrmann (2001) 232-33, fig. 15; Coleman (2006) 87-89, pl. 18; Cook (2012) 77-78, fig. 3.

[376] Representations of *noxii* suspended on ramps and platforms are also attested in the iconography of Christian martyrdom in Late Antiquity. The Bardo Museum in Tunis holds a well-preserved 5th century CE mosaic, discovered in a Christian mausoleum at Borj el Youdi in Tunisia, showing Daniel standing nude on a raised platform surrounded by four lions that leap towards him from separate ramps. The inclusion of stage props suggests that the public executions were a source of inspiration in Christian art. See Yacoub (1969) cat. no. A 253. For similar illustrations see Gabucci (2001) 88 and Hermann and van den Hoek (2002) 38.

[377] 'His mangled limbs were still alive, though the parts were dripping with blood, and in his whole body there actually was no body.' Trans. Coleman (2006) 82.

reach him, thus increasing the amount of time it spent attacking. An execution that ended relatively quickly presumably lacked in spectator appeal; making the bear 'work' for its quarry, however, created a more dynamic performance.

Suspending food for large mammalian carnivores is a common feeding-enrichment strategy that modern zoos use to engage visitors and elicit natural hunting behaviours from captive animals.[378] Carcasses of prey are hoisted up on a tall 'feeding pole' just out of the animal's reach so that it takes them longer to reach their food, generally by climbing or leaping (Fig. 85). For big cats likes tigers, this method of feeding provides an opportunity for the animals to replicate the sudden burst of energy they require when trying to chase down prey in the wild.[379] While a bear might tear and chomp at the carcass from the post, as in the Roman executions, a big cat will typically use its powerful jaws to drag the food down so that it can consume it on ground level (*pers. obv.*). In effect, these feeding encounters increase the amount of time visitors get to spend watching the animals behaving in lively and natural ways. We might imagine the same being true in spectacular executions where *noxii* were bound to a stake.

We have already seen how the bear's ability to walk upright – a quality that is rare among large mammals but typical of bears - gave the animal a remarkably human appearance whenever it fought against *ursarii* and species like the bull.[380] This characteristic also made the bear particularly appealing to cast in what Kathleen Coleman calls 'fatal charades': a type of capital punishment that took the form of mythological role-play.[381] One of the most spectacular executions recorded by Martial recalled the story of Orpheus (*Spect.* 24 and 25). Beasts of every kind are reported as being present; however, contrary to the myth, they did not appreciate the art of the fraudulent musician, with a bear fatally mauling 'Orpheus' (*ipse sed ingrato iacuit laceratus ab urso*). It is not clear whether the bear was deliberately chosen for this role or was simply the first of all animals to take interest in the condemned. If the bear was chosen, its behaviour may have been intended to resemble that of the Thracian women who, according to Virgil's version of the myth, tore Orpheus to pieces (Virg. *G.* 4.453-527). Significantly, the violent ending that Orpheus endured at the hands of these women evokes the horrors of being ripped apart by a wild animal (Virg. *G.* 4.520-22):

[378] Rees (2011) 209.
[379] Law and Kitchener (2020) 176.
[380] In addition to walking upright (Arist. *Hist. an.* 594b 15-16; Plin. *NH* 8.54), ancient writers were also fascinated by the way bears manipulated their paws like human hands (Ps.-Opp. *Cyn.* 3.144).
[381] Coleman (1990). Mythological executions have also been labelled by scholars as "snuff plays" (Barton, 1993, 61) and "costumed executions" (Goldberg, 2000, 223). Almost all recorded examples drew inspiration from Greek mythology.

…spretae Ciconum quo munere matres
inter sacra deum nocturnique orgia Bacchi
***discerptum** latos iuvenem sparsere per agros.*

…the Ciconian women, spurned by his devotion,
tore the youth apart, in their divine rites and midnight
Bacchic revels, and scattered him over the fields.

Thracian women were historically characterised as barbarians in Greek literature and cultural material, which strengthens the impression that their behaviour resembled that of a wild, uncontrollable animal (Hdt. 5.6.2; Dio Chrys. *Or.* 14.19).[382] The bear also shared a unique connection with women in stories of metamorphosis, where women transformed into bears and, sometimes inversely, bears transfigured into women. The most famous legend of bear metamorphosis is that of Callisto, a hunting companion of Artemis, who was turned into a bear by Hera after conceiving a son with Zeus (Ov. *Met.* 2.401-530; *Fast* 2.153-92). Brauron in Attica was a particularly important cult site for Artemis and the bear in the 4th century BCE.[383] Aristophanes' chorus in *Lysistrata* mention the festival of Artemis, where girls ritually acted as bears (ἄρκτοι) and wore saffron robes that may have been intended to imitate the pale colour of bears from Thrace (Ar. *Lysistrata* 645; cf. Paus. 8.17.3 on "white" Thracian bears).[384] In the scientific realm, nature writers such as Aristotle and Pliny the Elder likened the bear's maternal propensities to those shared by women and identified similarities in their habit of copulating lying down and embracing one another (Arist. *Hist. an.* 539b 33 - 540a 3; Plin. *NH* 6.54). While we cannot be sure that these cultural and zoological characteristics of the bear were deliberately incorporated into the staging of the execution, its association with female metamorphosis made the bear particularly suitable to cast as Orpheus' executioner.

Large predators were not the only group of animals to be exploited for public executions. Bulls, for instance, are notorious for their unpredictable aggression, which made

[382] Mythological scenes on Athenian pottery from the 5th and 4th centuries BCE commonly represented the brutal killing of Orpheus at the hands of the Thracian women. For example, a fragmentary krater, dated to the early 4th century BCE, depicts a group of heavily tattooed women (a characteristic associated with Thracians and barbarian groups in general) attacking Orpheus with rocks and tools. On the iconography of Thracian women, see Sirbu and Magdalena (2010) 237-39. Negative Athenian attitudes towards Thracians have also been explored in detail by Tsiafakis. See especially Tsiafakis (2000) and (2016).
[383] Perlman (1989) provides a detailed study of the rites of the festival of Artemis at Brauron and the religious significance of she-bear cults in Attica in the early Classical Period.
[384] Hughes (2011) 66. Perlman (1989, 122) suggested that the saffron-coloured dress, worn by the girls acting as she-bears, may not reflect their identification as bears as such, but rather their transformation into marriageable adults. Osborne (1985, 165-67), on the other hand, regarded the bear as an appropriate model for girls transitioning from maiden (wild) to mother (tame), because of its anthropomorphic and maternal propensities.

them valuable agents of executions. The bull's high propensity for reactive aggression is partially a result of its natural disposition as a gregarious prey species. Cattle live in large social groups with a strict hierarchy which they rely on for safety. The removal of an individual from familiar surroundings and companions can be a highly traumatic experience for cattle, which can cause physical and psychological problems as well as an increase in aggression.[385] Thereafter, any movement is perceived as predatory. A bull's instinctive response to fear is to buck, kick, and bunt (push or strike with the horns). Bunting is also a common agonistic behaviour that bulls perform either in defence from an alpha animal or as an attack to establish hierarchy in a herd.

These affordances of the bull are widely attested in ancient literature and artistic evidence for *damnatio ad bestias.* During the reign of Marcus Aurelius, the martyr Blandina from Lyon was reportedly cast into a net and thrown towards a bull after being severely burned (Euseb. *Hist. eccl.* 5.1.55-57). If this account is true, we might imagine that Blandina was subsequently thrown around by the bull's horns, as it was often seen doing with *pilae* in the arena (Mart. *Spect.* 11 and 22; discussed further in chapter 3 section 3.3.2). A similar interaction is depicted on a floor mosaic from the Villa du Taureau at Silin, Libya (Fig. 86). At the centre of the mosaic, a large white bull is shown with its head lowered while two small figures, dressed in white tunics and trousers, hover directly above the animal; to the left, a man wearing an animal skin prepares to fling a third figure (also dressed in a white tunic) towards the bull while another man holding a hooked staff stands above the action and gestures towards the two figures in the air. This scene may represent a type of acrobatic trick, similar to that performed by modern-day recortadores, which involves somersaulting over the bull. In this case, the floating figures may in fact be *salitores* (leapers).[386] Alternatively, the scene could represent the moment when the bull tossed these figures in a display of *damnatio ad bestias*.[387] The animal's stance is characteristic of a bull about to charge or bunt, thus in either instance the performance could have resulted in severe injury for the human participants.

Although a bull's horns are not particularly sharp like the claws of a lion or bear, they can cause internal injury if they strike a vital organ or a major artery. Modern studies on

[385] For discussion of the flighty disposition of cattle and modern strategies for dealing with these animals in an agricultural setting, see Grandin (1989) and (1999).
[386] These particular acrobats became increasingly popular in Late Antiquity, especially in *venationes* featuring bears. Discussed further in chapter 4 section 4.1.
[387] Dunbabin (1999, 124) and Carucci (2019, 127-28) both suggested that the costumes may allude to a ritual that was part of the staging of the execution. If the figures were acrobats, the costumes may well have been part of the theatrics of their performance, as it was in spectacular executions. Wilson (2018, 291) on the other hand, argued that the two figures in the air were not being tossed by the bull, but were in fact previous victims of the animal, and thus were already dead. This seems less likely given that both figures have been composed in a rather dynamic stance which suggests movement.

injured bullfighters suggest that fatal penetrating injuries are not very common during bullfighting.[388] However, we should keep in mind that these are professional fighters trained to evade bull attacks and not condemned persons, so the risk of being impaled was probably much higher for the latter. Bulls were also capable of causing extreme trauma by trampling or kicking *noxii* with their powerful legs. A terracotta figurine from Kalaa Srira, Tunisia, represents a bull trampling over a man with a large shield while a naked *noxius,* who is tethered to the bull's back, is attacked by a small animal with feline features (possibly a wildcat or lynx) (Fig. 87).[389] The shield, unless part of a costume, makes it unlikely that the trampled figure is also a *noxius*; however, in this stressful situation the bull would have most likely perceived all performers (including the feline) as threats.

Clearly then, the bull's highly reactive and indiscriminate aggression made it dangerous to anyone, not simply *noxii,* who confronted it in the arena. Just as in Spanish bullfighting, it is possible that special breeds of bulls were set aside for the *venationes* because of their aggressive temperament, strength, and vigour.[390] Epplett suggested that representatives of the *editores* may have inspected local herds before a show to find bulls that were especially large and ferocious.[391] If so, individuals that bore particularly long horns may have also been selected for the executions. Since most provinces throughout the Roman Empire likely raised cattle to some degree, *editores* most probably made use of local bulls for their shows. This also made bulls a cheaper alternative to big cat species.[392]

2.5.2. Wild Justice: Between Beasts and Beastly Acts

When animals performed the role of executioner they were, in a sense, carrying out justice on behalf of the Roman community (and the emperor as the enforcer of justice).[393] It is possible then, that many of the spectators probably viewed the animal executioners with a positive disposition, or at least one that favoured them over the condemned person.[394] Indeed, there may have been something quite appealing about watching wild nature destroy uncivilised humanity. In Roman law, *noxii* condemned *ad bestias* were demoted to the same degenerate

[388] Rudloff et al. (2006) 970.
[389] Gabucci (2001) 78.
[390] Ville (1981) 349.
[391] Epplett (2001a) 224
[392] Spectacle organisers in Italy may have also made use of locally-obtained bears for executions. A number of inscriptions from southern Italy that advertise spectacles produced by local magistrates mention bears as executioners in their programs. For example, *AE* (1975) 255: *nobilium gladi/atorum conductionem / adiectis etiam ursis mi/rae magnitudinis set et / noxeo omni quoque / cultu atparatuque aucto / diem sublimiter exornavit.*
[393] On justice as a public performance in the high empire see Potter (1996).
[394] Gilhus (2006) 184.

category as animals by choosing to perform bestial crimes and endangering the community.[395] For the Stoic Seneca, humans were transformed into wild beasts if they committed capital offenses and behaved in an uncivilised, non-human manner (Sen. *Clem.* 25.1; cf. Cic. *Off.* 3.20.82).[396] As a consequence of their actions, *noxii* were no longer accepted as members of the community and lost their status as moral, rational agents.

The participation of animals in public executions was an important element in the process of dehumanising condemned persons. Shelton, for instance, argued that the mutilation of human bodies by means of claws, teeth, or horns made *noxii* unrecognisable to spectators and demonstrated the brutality of the lawless world in which they had chosen to live.[397] The Scottish bear in *Spect.* 9 is described by Martial as having mangled its victim so badly that the criminal's body was completely unidentifiable. The process of 'becoming' beast was therefore visually enacted by the tearing of flesh and the sound of "inarticulate, animal-like shrieks"[398] coming from both the executioner and condemned. One of the most disturbing executions recorded by Martial (*Spect.* 6) enacted the coupling of a live bull and a criminal disguised as Pasiphae. If such a punishment was played out, it forced the woman to submit to bestial passions. Similarly, when Nero ordered a group of Christians to wear animal skins at the public games, the condemned took on the appearance of wild beasts (Tac. *Ann.* 15.44.4). Not only were these punishments humiliating, but they also signified the criminals' displacement from humanity.

Christian receptions of *damnatio ad bestias* offer a different view on the role of animals as agents of justice. Since the behaviours of animals were unpredictable, writers such as Eusebius and Tertullian interpreted the motives of animals in ways that suited their religious agenda. Thus, it is particularly intriguing, though perhaps unsurprising, that almost all examples of animals who withheld from attacking human suppliants are found in Christian works on martyrdoms. Though the historicity of these works is highly unreliable, they reveal

[395] Shelton (2000) 90-91, (2014) 474; Fagan (2011a) 18-19.

[396] Sen. *Clem.* 25.1: *Crudelitas minime humanum malum est indignumque tam miti animo; ferina ista rabies est sanguine gaudere ac vulneribus et abiecto homine in silvestre animal transire.* "Cruelty is an evil thing befitting least of all a man, and is unworthy of his spirit that is so kindly; for one to take delight in blood and wounds and, throwing off the man, to change into a creature of the woods, is the madness of a wild beast." Trans. Basore (1928) 423. Elsewhere, Seneca argues that, in watching public executions, spectators also became wild beasts since the spectacles encouraged them to act like animals (Sen. *Clem.* 7.4). This reasoning - that cruelty transforms man into a wild beast - had a major influence on Renaissance conceptions of human versus non-human nature. For discussion see Fudge (2006) 101.

[397] Shelton (2014) 474.

[398] Shelton (2014) 474. Cf. Lucretius' vivid description of the shrieks of primitive humans being torn by wild boars and lions in the forests (5.991-993).

that animal behaviour was used as a vehicle to explore justice in Christian discourse even when the animals themselves were metaphorical entities.[399]

Eusebius, for example, frequently justified acts of animal resistance as testimony of God's triumph in the Roman arena. In his account of an execution involving five martyrs from Tyre, Eusebius describes how leopards, bears, bulls, and boars all behaved as if their mouths were muzzled (Euseb. *Hist. eccl.* 8.7.5-7). After considerable goading from a hot iron, the animals reportedly assaulted the arena attendants instead of the martyrs (cf. the boar in *Passio Perpet. et Felic* 19.5). The animals' responses, if such an execution did happen, seem hardly surprising given the fact that the attendants were the ones causing harm to the animals. Eusebius, however, had a different message for his readers: rather than complying with the orders of their exploiters, the animals behaved as if moved by divine providence.

Lions that were reluctant to engage with *damnati* were also romanticised by Greek and Roman writers as beasts who spared their victims out of gratitude and loyalty.[400] The tale of Androcles and the lion, reported first by Apion (relayed by Aulus Gellius in *NA* 5.14) and later Aelian (*NA* 7.48), is perhaps the best-known account of the merciful lion in ancient literature. According to the story, a slave condemned *ad bestias* named Androcles was saved in the arena at Rome when a Libyan lion, who Androcles had formerly nurtured in the wild, protected the slave from being mauled by a leopard. Having recognised Androcles as its former healer, the lion unexpectedly attacked the leopard. Seneca recalled a similar incident where a lion protected a beast fighter from a leopard when the lion recognised the man as his former keeper (Sen. *Ben.* 2.19.1). Variations of the 'grateful lion' were later adopted into the Christian literary tradition, where uncooperative lions spared their victims out of piety. In the *Acts of Paul and Thecla* (7.2-9.10), a lioness is said to have fought off a bear and a man-eating lion to protect Thecla from execution. The story of the baptised lion in the *Acts of Paul* follows a different variant of the tradition, where a lion refuses to harm St. Paul in the arena after it had been baptised by the Apostle.[401] Although these particular episodes are probably fictional, they likely reflect contemporary events in which the sight of dangerous animals refusing to attack criminals condemned *ad bestias* was not at all uncommon.

Representations of *damnatio ad bestias* from floor mosaics that decorated the private villas of wealthy patrons were also open to judicial interpretation. Illustrations that commemorated games sponsored by the villa-owner demonstrated his power and political authority to exploit wild beasts as executioners, but they may have also served as a warning

[399] Gilhus (2006, ch.9) provides a particularly detailed discussion of the role of both real and imagined wild beasts in the genre of *Acta Martyrum.* On the spectacle of Christian martyrdom see Potter (1993).
[400] Pliny the Elder argued that lions were the only wild animal to show mercy towards its victims in the arena (*NH* 8.19) and to travellers in the wild (*NH* 8.21).
[401] On the popularity of the 'baptised lion' in the Christian literary tradition, see Adamik (1996).

to members of the household that crime would not be tolerated. In this context, the wild and violent propensities of animals were a visual reminder of the consequences of defying the laws and social order of Roman society.

As we have seen, the animals' agency to resist engagement, turn against their exploiters, and behave in unpredictable ways was readily appropriated in Greek and Roman receptions of *damnatio ad bestias.* Using animals for executions, then, might not have been as risky for the *editores* as initially thought, since the outcome could evidently be interpreted in various ways by the spectators. If an animal fatally mauled a person condemned *ad bestias,* some may have viewed this as justice being served because the condemned was deserving of the punishment and it removed them from society. However, if the animal refused to attack, its actions could also be interpreted by others as merciful or even pious. As might be expected, animals with lethal weapons and a high propensity for reactive aggression, such as the big cats, heightened the spectators' (and presumably the *editores*) expectations of a bloody outcome. However, as the widely adapted tale of Androcles and the lion may suggest, the prospect of predators behaving in ways that ran contrary to their nature could also excite curiosity in spectators. This was particularly the case in displays where dangerous animals performed tricks, as we shall now see.

2.6. Animals as Trained Performers

At the beginning of the 1st century CE, some species of animals, particularly elephants, lions, and bears, increasingly appeared in the *venationes* in more diverse roles as trained performers. It is difficult to attribute this development to one factor alone. Rather, it seems that the growing pressure for the emperor and provincial elites to produce novel spectacles, coupled with a natural curiosity to see animals behaving in new ways, influenced the expansion of *venatio* repertoires. In addition to this, a number of scholars have argued that the movement of animals and specialist handlers between the Greek East and the Roman world, particularly during the late Republic, exposed the Romans to new practices of training wild beasts.[402] The large menagerie at Alexandria, founded by Ptolemy II and subsequently obtained by Augustus in 30 BCE, may have provided Rome with an invaluable source of animal trainers (as well as exotic species) for the early imperial games.[403]

Unfortunately, the journeys and lives of these trainers are nearly impossible to trace through the historical sources. Seneca's anecdote of a beast fighter who was protected by a

[402] Loisel (1912) 90-91; Jennison (1937) 10-11, 25; Epplett (2014) 506.
[403] Jennison (1937) 28-41, 168.

lion after the animal recognised him as its former *magister* may suggest that some *venatores* also functioned as trainers for the animals (Sen. *Ben.* 2.19). If this were the case, the *venatores* may have gained useful combat experience during the days away from the arena when they were training the animals.[404] Individuals that were responsible for the maintenance of wild beasts in *vivaria* may have also functioned as trainers for certain animals. Epigraphic evidence from Rome attests to a freedman called Speclator who held the position of *procurator Laurento ad elephantos* ('manager of the elephants at Laurentum') during the reign of Claudius and/or Nero (*ILS*: 1578).[405] Apart from their titles, however, animal keepers such as Tiberius have left no written or material records of their responsibilities or care of the animals. Specialist knowledge of the animals' behaviours and training routines was probably transmitted orally between other keepers, trainers, and possibly even *venatores.*

Most of our written evidence for tame animal displays comes from a small group of elites in Rome who had no involvement in the actual training of wild beasts. Unfortunately, this gap in our knowledge has left us largely reliant on these writers, who were naturally partial towards novel performances produced in Rome and often showed more interest in the qualities that made animals comparable to humans, rather than the historical veracity of the performances themselves (discussed below). There is also the fact that the surviving written evidence from certain periods (especially in the three centuries from Hadrian to Honorius) is very scanty, making it difficult to make generalisations about tame animal displays. For these reasons, it is often only possible to make limited observations about a specific species of animal that may have received training for the *venationes.*

Another point worth noting is that rarely do we see specialty animal feats represented in the visual evidence, as we do with the hunts and executions. Professional bear troupes, as will be seen below, have been associated with several floor mosaics from North Africa, and depictions of lions wearing harnesses on Roman sarcophagi may allude to the animals' trained status (discussed further in chapter 3). However, none of the particularly complex routines recorded in the literature are visually attested. One reason for this may be related to the artistic challenge of depicting animals performing unnatural, perhaps even awkward, movements. Literature, although written by and circulated among a small group of elites (including the emperor), enabled the Romans to articulate the intricacy of the animals' routines far better than in a visual medium. In literary form, writers such as Martial could also

[404] Epplett (2001a) 110. By the end of the 1st century CE, beast fighters in Rome were likely training with animals at the imperial beast-fighting school (*Ludus Matutinus*) that Domitian established during his reign.
[405] For more examples of animal keepers who may have overseen various animals at the *vivarium* in Laurentum see Epplett (2016) 142-3.

directly attribute the animals' remarkable feats to the emperor's divine power and authority over the natural world.[406]

2.6.1. Inversions of Reality

While the ancient evidence for animals performing tricks in the arena is not abundant, enough does exist to give some sense of the different ways the Romans were experimenting with animal behaviour, and what species they considered most appealing for these types of performances. According to our literary sources, one feat that gained some popularity in the early Empire involved harnessing (often exotic) animals to chariots or carts. An epigram by Martial suggests that not only were wild herbivores, such as stags, bison, and boar, subjected to this treatment, but, remarkably, large predators such as leopards and bears (Mart. *Ep.* 1.104). Big cats, especially lions, leopards, and tigers, held a firm place in mythological iconography as draught-animals. Thus, it is possible that displays featuring harnessed leopards were designed to imitate the animal's role in pulling the chariot of Dionysus in his Indian triumph (Fig. 88).[407] Similarly, when Mark Antony reportedly had himself and the actress Cytheris pulled by a lion-drawn chariot in public, his intentions may have been to emulate the goddess Cybele and her entourage of draught-lions (Plin. *NH* 8.21).[408] A pair of leopards drawing a chariot are depicted on three Late Antique mosaics from Andania in the Peloponnese, which might allude to a routine performed in the arena.[409] The inclusion of the charioteers' names strengthens the possibility that the mosaic represents an actual event rather than artistic license. Although camel racing remains a popular sport in North Africa and parts of the Middle East in modern times, only two reports are known where camels were yoked to chariots inside the Circus Maximus in Antiquity (Suet. *Ner.* 11.1; SHA *Elag.* 23.1). The rarity of these displays might suggest that *editores* were reluctant to exploit such potentially useful draught-animals for purely entertainment purposes.[410] Similarly, the employment of dogs for pulling chariots is only recorded twice in the ancient sources (Philostratus the Elder, *Imag.* 2.17.10; Cass. Dio. 61.6).

Interestingly, the practice of harnessing wild beasts as a spectacle continued into the 20th century, where it was not uncommon to find exotic animals such as zebras, ostriches, bison, hippopotami, elephants, lions, and even alligators displayed as draught-animals in zoos

[406] See especially Martial's commentary on the lion-and-hare trick, discussed below (*Ep.* 1.6, 1.14, 1.22, 1.48, 1.51, 1.60, 1.104).
[407] Epplett (2001a) 269.
[408] Toynbee (1973, 64), argued that the public's disproval of this feat, reported by Pliny the Elder, was "largely because it hinted at a claim to divinity".
[409] Toynbee (1973) 86.
[410] Epplett (2001a) 338.

across Europe and North America (Figs. 89-90). Part of its attraction, both in ancient and modern times, may have been the pretence that wild animals could be domesticated and not merely trained. From a technical standpoint, in comparison to the more complex routines performed by contemporary circus animals, this particular feat did not demand much from the animals besides compliance, which could be reinforced through the use of physical aids (e.g., a whip or prod). This might explain why such a broad range of species have historically been used for this activity.

On a symbolic level, yoking wild beasts in the arena demonstrated human or, more precisely, Roman control over the unpredictable and dangerous forces of nature. Psychologically, however, spectators likely felt excitement at the unexpected ways in which the animals were behaving. Fagan described such surprising sights as examples of 'cognitive synergy', "whereby expectations are not met, or opposites are set in close proximity, and are thus enthralling and fascinating".[411] Martial devoted no fewer than seven epigrams to a particularly surprising act where lions allowed hares to jump in and out of their mouths unscathed, contrary to their nature (Mart. *Ep.* 1.6, 1.14, 1.22, 1.48, 1.51, 1.60, 1.104). Seneca was equally impressed by a trainer who thrust his hand into the mouth of a lion, which may have been an earlier variation of the lion-and-hare trick (Sen. *Ep.* 85.41).[412] Yet the risk of trained lions reverting to their wildness and turning against their keepers was still very much a possibility, as one epigram by Martial attests (*Spect.* 12).[413] In fact, some lions may have participated in hunting spectacles despite having been trained to suppress their savagery. Statius composed a poem commemorating the death of a performing lion, who unexpectedly lost its life to a fleeing beast under the mournful gaze of Domitian (Stat. *Silv.* 2.5). Although the lion had reportedly been taught to perform tricks in the arena, it courageously fought its adversary in a manner that was expected of a wild lion: just as a dying soldier strikes a final blow to his opponent, so too the lion's valour returned when it tried to raise itself at the very end.[414] Such inversions of reality no doubt left spectators intrigued by the reversal of the animals' instinctive behaviours.

[411] Fagan (2011a) 247.
[412] Cf. Mart. *Spect.* 21 on a tiger who was trained to lick the hand of its *magister.*
[413] As Swiss Zoologist Heini Hediger famously argued (1954, 76), 'tameness', i.e., the loss of the tendency to flee from humans, does not change the character of a wild animal fundamentally.
[414] Augoustakis (2007, 210-11) argued that Statius was using the lion's unexpected death to question the profitability of training wild beasts in human skills, since the lion reverts to its wildness only to be defeated by its prey. For similar discussions of the taming of nature in *Silvae* 2.5, see van Dam (1984) and Newmyer (1979). The consequences of imposing human culture on nature are also discussed in Sen. *Epist.* 85.8-9.

Given their capacity to captivate spectators with their human-like stance, it should come as no surprise that bears were another favourite candidate for tame *venationes*.[415] As we have seen already, bears, just like the lion, were widely exploited as agents of executions and held a firm place in the Roman imaginary as dangerous predators. Displays where bears performed in a dance (SHA *Car.* 12.20) or allowed themselves to be dressed in human attire (Apul. *Met.* 11.8)[416] were designed to be maximally stimulating and confound widespread beliefs about the animal's threatening nature. Evidence for what appears to be professional bears troupes has been identified on several mosaics from North Africa, including the Radès mosaic in Tunisia, dated to the late 3rd century CE (Fig. 91) and a fragmentary mosaic from Korba (ancient Curubis) in Tunisia, dated to ca. 350 CE (Fig. 92). The bears have all been ascribed names, many of which are reminiscent of the kind of stage names adopted by gladiators.[417] On the Radès mosaic, some names denote physical characteristics such as BRACIATVS ('Strong-armed'), while others signify an innate quality of the bear, for example GLORIOSVS ('Full of Glory'). Naturally, one can see the practical value of naming an animal that would be subjected to long hours of training.[418] For the *editor,* however, the convention of naming animals may have also had currency: it allowed for individual animals to gain a reputation for themselves (presumably helping with advertising) which in turn enabled *editores* to attain a piece of that reputation when they hired them.[419]

The individualistic representation of each bear on the Radès mosaic is further reason to believe that the animals belonged to a professional troupe. BRACIATVS lunges towards the viewer's left, SIMPLICIVS stands on its hind legs with its body twisted in movement, and FEDRA climbs a post, possibly in pursuit of a tree climber (*toichoabates*; cf. SHA *Car.* 19). The bears on the Korba mosaic are just as animated: one bear on the top register mirrors the human-like stance of SIMPLICIVS, while a bear on the bottom register walks towards the

[415] Writing in the context of 20th century zoos, Hediger (1970, 121-22) argued that the bear's "exhibition value" is greatly influenced by the so-called "law of angles". According to Hediger, "the degree of attraction decreases in proportion with the deviation from the vertical posture towards the horizontal". With this thinking, the bear naturally generates arousal because of its bipedalism.

[416] For other examples of trained animals adorned in clothes and decorative ornaments, see: Sen *Epist.* 41.6 lion embellished with a golden headdress; Apul. *Met.* 11.8 tame monkey wearing a Phrygian cap and saffron dress; Juv. 5.153-155 monkey dressed in armour; Ael. *NA* 2.11 elephants clothed in flower garments. These props and costumes likely enhanced the tame façade of performing animals.

[417] Interestingly, while the Radès mosaic includes other species, such as an ostrich, deer, bull, and wild boars, only the bears have been given names. Dunbabin (1978, 72-74) interpreted this to suggest that the bears belonged to a professional troupe. See also Ball (1984) 131-32.

[418] Interestingly, Pliny the Elder (*NH* 9.15) observed that seals could be taught to interact (verbally and physically) with the public and respond to their name by answering with a hoarse roar.

[419] Another way of identifying performing animals was to brand them with the emblems of professional hunting associations. This is clearly seen on the hindquarters of the sleeping bulls from the Banquet mosaic from Thysdrus in Tunisia. Discussed further in chapter 3 section 3.2.1. See Appendix III, Fig. 111.

viewer's right with one of its front legs raised. The owners of the commissioned mosaics may have wanted to capture not only the individual bears from the troupes, but their specialty routines as well. These may have involved simple feats such as staged fights, to more sophisticated acts that included props, such as the post used by FEDRA.[420] It is possible that such specialty acts helped the bears achieve a luminary status in the Roman games.[421]

Some of the clearest examples of cognitive synergy are found in displays that featured trained elephants. Beginning in the early Principate, we have reports from Pliny the Elder, Seneca, and Suetonius, among many other writers, of elephants performing technical routines that only humans had traditionally been seen doing. These included walking on tightropes, writing, and dancing.[422] Plutarch, who may have been an eyewitness to several elephant displays in the early Empire, observed that the routines performed by elephants were "so varied and so complicated to memorise and retain that they are not at all easy even for human artists" (Plut. *Mor.* 968C). Pliny the Elder maintained that the elephant's astonishing memory and learning abilities was due to the fact elephants, like humans, possess the faculty of reason, which enables them to be obedient and quick to learn (Plin. *NH* 8.1, cf. Strab. 15.42). With reference to his contemporary Gaius Lucinius Mucianus, Pliny reports the case of an elephant that learnt to write Greek letters (Plin. *NH* 8.3).[423] Aelian claims to have witnessed with his own eyes a similar feat, where an elephant wrote in Latin on a tablet using its trunk, however with the assistance of a trainer (Ael. *NH* 2.11).[424]

Neither Pliny nor Aelian explain the dexterity of the elephant's trunk which made these feats anatomically possible. However, understanding the trunk's musculature can provide some insight into how elephants may have achieved such kinaesthetic feats. Both Asian and African elephants use their trunks (which can weigh as much as 150 kilograms) to communicate and manipulate objects that can be as heavy as a log or as light as a tortilla chip. This is aided by a complicated set of muscles in the trunk that are made up of sheathed collections of fibres called fascicles. Recent studies that dissected trunks have estimated the entire appendage contains about 90,000 fascicles, significantly more than the primate hand, which is one of the most dexterous appendages in nature.[425] Twisting movements are also aided by a series of transverse muscles that spiral around and outside the trunk. These

[420] Dunbabin (1978) 72.
[421] On animals as 'stars' in the arena see Coleman (2012).
[422] Elephants walking on tightropes: Sen. *Epist.* 85.41; Plin. *NH* 8.2; Suet. *Galb.* 6.1, *Ner.* 11.2.12.1; Cass. Dio 62.17. Elephants writing: Plin. *NH* 8.3; Ael. *NA* 2.11. Elephants dancing: Plin. *NH* 8.2; Mart. *Ep.*1.104; Ael. *NA* 2.11; Plut. *Mor.* 968C-E.
[423] This follows from an earlier comment that elephants can understand the language that is spoken in their country (Plin. *NH* 8.1).
[424] These displays might have taken place in a private or more intimate setting than the arena, where the elephants' intricate movements could be better appreciated.
[425] Longren et al. (2023) 5. See also, Dagenais et al. (2021) and Schulz et al. (2023).

muscles enable the elephant to curl its trunk around objects to scoop them up, like the shields that were hurled into the air by the elephants at Pompey's spectacle in 55 BCE (Plin. *NH* 8.2). The tip of the trunk also contains a prehensile "finger", which allows the elephant to grasp onto particularly small or fragile items, such as a brush that could be used for writing.[426]

The most complex use of the elephant's trunk in a *venatio* is illustrated in Aelian's account of a performance that was staged in 12 CE by Germanicus, the nephew and adopted son of Tiberius (Ael. *NA* 2.11, cf. Plin. *NH* 8.2). Under the instruction of a dance-master, a group of twelve elephants dressed in flowered garments executed a sequence of turns, all the while sprinkling flowers onto the arena floor with their trunks and keeping time in a rhythmical dance. Following the dance, the elephants shared a banquet that was elaborately staged with couches, embroidered coverlets, citrus wood tables, and food in abundance. Using their trunks like hands, the animals then proceeded to eat and drink in an orderly manner.[427] While younger elephants generally take longer to learn how to flex and elongate their trunk in complex ways, these behaviours can be taught and refined through rigorous training. Indeed, Aelian remarks that these particular elephants had been trained as calves by an experienced elephant-handler in captivity near the Ager Laurens, some 24 kilometres south of Rome (Ael. *NH* 2.11). This could have been the same large facility where Tiberius Claudius Speclator held the position of *procurator ad elephantos.* Juvenal also knew of an imperial herd of elephants that were kept in a large enclosure in Laurentum in the early 2nd century CE (Juv. 12.102-107).

In addition to their proficiency at object manipulation, elephants are also astonishingly agile and possess remarkable cognitive abilities, which would have aided them in performances that relied on balance, memory, and teamwork. In the wild, elephants live in complex fission-fusion social environments where they must negotiate and keep track of social relationships with many individuals.[428] Long-term memory is important for forging strong bonds with herd members, and captive elephants have demonstrated this capacity in operant conditioning and problem-solving tasks.[429] These affordances of the elephant greatly influenced the choreographies of Euro-American circus acts in the 19th and 20th century, such as those which featured elephants performing dance routines and collaborating with trainers and other animals.[430] Some degree of collaboration was presumably also required for the

[426] The Asian elephant has one finger at the top of the trunk's tip, while the African species has two fingers that can more firmly grasp objects.
[427] Ancient Greek and Roman writers often commented on the practicalities of the elephant's trunk and were particularly impressed by its multisensory function as a hand, mouth, and nose. For examples see: Arist. *Part. an.* 659a, *Hist. an.* 429b 13-21; Ael. *NA* 1.38, 9.56, 13.8; Plin. *NH* 8.9, 8.29; Gal. *UP* 17.1
[428] Plotnik and Jacobson (2022) 3.
[429] Arvidsson et al. (2012) 809.
[430] For excellent studies on circus elephant acts from this period, see Cowie (2013); Nance (2013) esp. ch. 1 and 2; Tait (2016) and (2012) esp. pp. 74-107 on dancing elephants.

routine choreographed for Germanicus' show. The elephant's excellent balancing skills, which it uses to feed on high branches or walk along narrow pathways, makes it possible to train the animal to balance on particularly small or slender objects like stools, balls, and even tightropes (Figs. 93-94).[431] These skills probably afforded the Romans opportunities to exploit elephants as tightrope artists, as attested to by the spectacles staged by Galba during the reign of Tiberius (14-37 CE) and subsequently by Nero in 59 CE (Suet. *Galb.* 6.1, *Ner.* 11.2; Sen. *Epist.* 85.41; Plin. *NH* 8.3; Cass. Dio 62.17).

Part of what made the elephant so appealing to cast in acrobatic routines rested on the fact that its enormous size and weight contrasted starkly with its agile movements. As Toynbee pointed out, the elephant's theatrical appearance in these routines probably provided light relief for the spectators in contrast to the hunting spectacles.[432] It is not surprising, then, that stories of dancing and dining elephants appealed to the likes of Aelian, who was inclined to integrate paradoxical elements into his accounts of animal behaviour.

However, not all modern scholars believe that performances from trained elephants incited curiosity in the animal's behavioural repertoire. Jo-Ann Shelton, who has published widely on Roman-elephant relations in Antiquity, argued that the Romans appropriated the elephant's affordances as a means to "humiliate"[433] the animals. For Shelton, the Romans' hostility towards elephants, informed by their encounters with Pyrrhus and subsequently the Carthaginians, sparked a desire to see the elephant reduced to an "absurdly inferior"[434] object. Wiedemann similarly argued that these less dangerous performances reassured Roman spectators that "even the greatest of beasts"[435] could be subdued and stripped of their threatening properties.[436] However, despite the elephant's historically hostile relations with the Roman army there is very little evidence to suggest that tame elephant displays were designed to invoke vindictive sentiments towards the animal. Such sentiments are found at a much earlier date in the mid-Republic, when elephants were weaponised against Rome by the armies of Pyrrhus and Carthage. Commenting on the parade of Pyrrhus' captured elephants

[431] In more recent times, performing elephants have been observed walking across metal tightropes as a public spectacle in parts of Southeast Asia. See Mills (2018).
[432] Toynbee (1973) 48.
[433] Shelton (2004) 380-82, (2006) 6, 10, (2014) 473-74. It is worth bearing in mind that, as a human concept, the word 'humiliate' is problematic to use in reference to the elephants' experiences at the games.
[434] Shelton (2004) 370.
[435] Wiedemann (1992) 63.
[436] Arguing from a different angle, Epplett (2001a, 238) suggested that the use of elephants in non-violent displays may be related to the practice of associating these animals with the emperor's divinity. His suggestion that the public killing of elephants "would reflect poorly upon the emperors of whom they were symbolic" does not seem overly convincing since elephants continued to be hunted in the Roman arena well into the 3rd century CE: under Claudius and Nero (Plin. *NH* 8.7); Titus (Cass. Dio 66.25); Antoninus Pius (SHA *Ant. Pius* 10.9); Commodus (Cass. Dio 73.10.3); Septimius Severus (Cass. Dio 76.1); Caracalla (Cass. Dio 78.6); Elagabalus (Cass. Dio 80.9).

at M. Curius Dentatus' triumph in 275 BCE, Florus wrote that "nothing that the Roman people saw pleased them more than those beasts whom they had feared, carrying their towers and following the victorious horses with heads bowed low not wholly unconscious that they were prisoners" (Flor. *Epit.* 1.13.26-28). The pleasure felt by Roman spectators in this instance seems justified, given that the elephant at this time represented a genuine threat to the people of Rome. Spectators in the early Empire, on the other hand, were far removed from this context and may not have felt such a strong aversion towards the animal.

That is not to say that the threat of war elephants was all but forgotten by the people of Rome. As Shelton rightly notes, centuries after the Pyrrhic and Punic Wars Greek and Roman writers continued to reflect on the elephant's destructive tendencies in battle.[437] Aelian even alludes to the elephant's perilous nature in his description of the animals' strenuous training regime for Germanicus' spectacle (Ael. *NA* 2.11):

> καὶ ἦν γε τὰ μαθήματα αὐλῶν ἀκούοντας μὴ ἐκμαίνεσθαι, καὶ τυμπάνων ἁράβου κροτοῦντος μὴ ταράττεσθαι, καὶ κηλεῖσθαι σύριγγι, φέρειν δὲ καὶ ἤχους ἐκμελεῖς καὶ ποδῶν ἐμβαινόντων ψόφον καὶ ᾠδὴν συμμιγῆ· ἐξεπονήθησαν δὲ καὶ ἀνθρώπων πλῆθος μὴ δεδιέναι. ἦν δὲ καὶ ἐκεῖνα διδάγματα ἀνδρικά, πρὸς τὴν τῆς πληγῆς καταφορὰν μὴ θυμοῦσθαι, μηδὲ μὴν ἀναγκαζομένους λυγίζειν τι τῶν μελῶν καὶ κάμπτειν ὀρχηστικῶς τε καὶ χορικῶς εἶτα ἐς θυμὸν ἐξάπτεσθαι, καὶ ταῦτα ῥώμης τε καὶ ἀλκῆς εὖ ἥκοντας.
>
> So what they learnt was not to go wild at the sound of flutes, not to be alarmed at the beating of drums, to be charmed by the pipe and to endure discordant notes, the beat of marching feet, and the singing of crowds. Moreover they were thoroughly trained not to be afraid of men in masses. And further their disciplining was mainly in the following respects: they were not to get angry at the infliction of a blow, nor, when obliged to move some limb and to sway in time to dance or song, to burst into a rage, even though they had attained to such strength and courage.[438]

In the passage above, Aelian marvels at the elephant's ability to control its aggression in the arena when confronted by threatening stimuli, such as those that could be found in battle (i.e., loud noises, large groups of people, painful blows). This allusion to the battlefield suggests that Aelian's readers were familiar with the elephant's military history and its

[437] Shelton (2006) 7-8. For examples, see Lucr. 5.1302-07; Livy 27.14; Plin. *NH* 8.6-9; Juv. 102-11; Plut. *Pyrrh.* 21.7; Ambrose, *Hex.* 6.5.33; Amm. Marc. 19.2.3.
[438] Trans. Scholfield (1958) 105.

liability to turn against its allies (or trainer in the arena).[439] Moreover, it indicates an awareness that the elephant could never become truly tame, and there was always a possibility of it reverting to its natural ferocity, just like the lion from Statius' poem.

Aelian's description of Germanicus' spectacle, even if fictional, nonetheless illustrates that animals never entered the arena as purely biological beings. Their cultural associations and symbolism in the Roman imaginary gave meaning to their performances that was of historical significance, both for the *editor* and the spectators. Thus, when elephants were employed to perform tricks, *editores* capitalised on not only the contrast of the elephant's cumbersome size and agility, but also its history as a military aid; arguably not to humiliate the animals, but to demonstrate a new level of Roman mastery over what was, and what remained, a highly dangerous animal.

2.6.2. Canine Credentials

Not all animals who appeared in the arena as trained performers were exotic or wild beasts. Plutarch reportedly witnessed a pantomime inside the Theatre of Marcellus that featured an anonymous performing dog, whose consummate acting received praise from the emperor Vespasian (Plut. *Mor.* 973E-974A). At one point in the pantomime, the dog was given food on which was poured a soporific drug that was believed by the audience to be poison. The dog ate it, and appeared to shiver, stagger, and nod, until it finally dropped down, seemingly like a corpse. The actors in the mime proceeded to drag and haul the animal around the theatre, as the plot of the show prescribed, though the dog showed no signs of life. Suddenly, at a given cue the dog began to recover as if from a profound sleep and ran straight to the right person (perhaps its owner in the plot) and fawned on him with great joy.

The dog's intelligence, seen through its ability to learn the choreography of the pantomime and perform it on cue, is celebrated by Plutarch as a characteristic of the species. The dog conforms to the script with strict obedience and, through its movements, elicits a visceral response from the audience: it shivers and staggers when 'poisoned', stirring sympathy and grief among the crowd, while its recovery (signalled by its gradual awakening) evokes joy and relief. The dog's capacity to hold the audiences' attention may partially be attributed to the dynamic relationship which it shared with the Romans. As we have seen already, dogs were an important part of daily life in Roman society and assisted in many activities, including herding, hunting, and household security. Some breeds of dogs were also

[439] For a modern comparison, see Tait (2016, ch. 10) on 19th century war re-enactments in London featuring elephants from British colonies in Africa and Asia. See also Ray (2006) on circus elephants as representations of British imperialism and military might.

kept as lapdogs and trained to perform tricks, perhaps not so different from those which we teach our pets today. Martial, for example, composed an epigram about a small Gallic lapdog, who had learnt so many tricks that a whole page was apparently not sufficient for noting them all down (Mart. *Ep.* 14.198).

Funerary epitaphs naming pet dogs and statues of deceased canines dedicated by bereaved owners occur in sufficiently large numbers from the Roman period to suggest dogs were popular pets at this time and often played a dual role in their owner's life.[440] A Gallic dog named Margarita ('Pearl') is commemorated on a marble epitaph plaque, dated to the 1st/2nd century CE, with a lengthy inscription describing her place in the household as a beloved lapdog and trained hunting aid (Fig. 95).[441] So disciplined was Margarita that she never endured beatings from her owner, nor was she accustomed to being tethered; she also understood the appropriate time of when to bark and retire to bed. From her epitaph we can deduce that Margarita was clearly a valued member of her owner's household, enough for them to spend lavishly on her commemoration and display their grief over her untimely death.

While it is difficult to know exactly how many spectators at the pantomime were dog owners themselves, it is reasonable to assume that most were familiar with the animal's unique partnership with humans. Thus, as the dog reacted to the poison, its performance may have stirred emotional memories of separation or the loss of a pet. In the same vein, the dog's revival could invoke memories of reunification. The pantomime concludes with the dog finding its way back to its owner, an act of devotion that was probably familiar to anyone who worked with dogs in a close capacity. Unlike the dancing elephants from Germanicus' spectacle, or the docile lions who 'played' with hares, the dog does not diverge from its natural character. Rather, its performance reaffirms what the audience already knows and admires about the animal, namely its discipline and loyalty.

When Toynbee wrote her important study *Animals in Roman Life and Art* (1973), like many scholars she found it difficult to reconcile the paradox of Roman sentimentality towards pets and the exploitation of animals inside the arena. What Plutarch's anecdote of the performing dog shows us is that not all animal displays projected ideas about hostile nature and Roman control over the animal kingdom. The arena was also a place where domestic life could be performed and the animals who shared this space celebrated. Not every spectator

[440] For general studies on the emotional attachment to pets in ancient Rome and Greece, see Bodson (2000) and MacKinnon (2014). On dogs specifically, see Brewer et al. (2001) and Trantalidou (2006). On the archaeozoological evidence for pet dogs in Antiquity, see especially MacKinnon (2010).
[441] The verse is written from the perspective of the deceased dog, similar to Martial's epigram about the hunting dog Lydia (Mart. *Ep.* 11.69). For discussion of Margarita's epigraph see Ferris (2018) 47-48.

may have found these types of displays as captivating as the dramatic hunting spectacles that featured exotic species, but that is not to say they were any less important as a vehicle for exploring Roman-animal relationships. Just as they did in their role as hunting aids, performing dogs reminded spectators of certain pleasures of Roman daily life and of the intimate relationship they shared with this species.

2.7. Conclusion: The Omnivorous Spectator

In considering the roles that animals were made to play in the arena, this chapter has shown that the behavioural affordances of animals, together with their cultural significance in Roman society, influenced the nature of their exploitation. By the end of the Republican period, animals appeared in the ancient sources as quarry, hunting aids, combatants, curiosities, executioners, and trained performers. Distinct though these roles were, many species could perform more than one role on account of their behavioural diversity. Thus, while most animals were hunted as quarry, a great many also featured as executioners because of their high propensity for reactive aggression, or as trained performers due to their cognition and motor skills. The impetus to compete with members of the Roman elite, for prestige or political success, drove *editores* to produce increasingly diverse *venationes.* Part of this diversity was achieved by casting animals in new and creative ways, thus adding variety to a performance.

The arena also afforded the Romans opportunities to test the physical capacities and limitations of animals by pairing different species together in combat. Such pairs might have been informed, to some degree, by the animals' disparate fighting styles. Spectators might have judged the animals based on their own individual merits just as they did in the gladiatorial contests, which suggests they also expected the combats to be fierce and balanced. Based on the frequency with which the bear and bull are referenced in the ancient evidence, these species were considered to be especially compatible due to the uncertainty of a victor when they fought each other. Some species might have also been paired on an ad hoc basis, depending on the availability of animals and novelty of the pair.

While the diversity in animal behaviour afforded considerable scope in what an *editor* could do with animals intended for display, some species were restricted in their use as a result of their biological demands. The giraffe was one such animal whose unique physiology, specifically its elongated neck, thin limbs, and tall body, presented enormous logistical challenges with regard to its capture and transportation. Its rare appearance in the arenas at Rome, and near-exclusive role as a natural curiosity, attests to the giraffe's limitations as a performer. However, that the giraffe appeared in the arena at all in spite of these challenges

is nonetheless remarkable and demonstrates the high risks (and investments) an *editor* was willing to make for the sake of an animal's exotic nature and potential political value.

Far from simply being political currency, the animals were also representations of the kinds of creatures the Romans encountered, exploited, and otherwise engaged with in the hunting fields, on the farm, in battle, through mythology, in art and literature, and in some cases domestic life. Dogs, for instance, served as intermediaries of sorts by playing the role of a hunting aid inside the arena and beyond. Among the qualities most admired by the Romans were the dog's keen senses, tractability, and loyalty, which enabled it to help *venatores* in capturing and dispatching wild beasts. Such transferable skills presumably enhanced the dog's exhibition value, not only in the hunting spectacles but also in other types of displays which made similar demands on the dog.

The multifarious relationships which existed between the Romans and animals, both within and outside the arena, made it therefore possible for *editores* to cast animals in varied roles. Animal behaviour served as a general guideline for informing *editores* what an animal was or was not capable of physically doing. Nevertheless, it was the performances themselves that captured the nuances of the animals' relationship with the Romans. As omnivorous spectators, the people of Rome consumed different repertoires of *venationes* avidly, with the anticipation of seeing animals perform in roles that reflected their myriad contributions to Roman society.

CHAPTER 3.

The Art of Manipulation: A Sensory Approach to Human-Animal Interactions

The Roman arena afforded a kaleidoscope of sensations that were integrated into the design of the hunting spectacles. The sound of musicians playing and crowds cheering created an electrifying soundscape, over and above the distressing cries from the performers.[442] Awnings might have provided spectators an escape from the unforgiving heat[443], and saffron mist was sometimes sprayed over the *cavea* to mitigate the pungent smell of sweat, blood, and other bodily fluids.[444] Depending on where they sat, a spectator might have endured the close proximity of their neighbour's body; a shove from an elbow or a brush from a tunic.[445] Generous *editores* occasionally had bread and other sustenance thrown into the crowds to satisfy their appetites during the intervals[446], while some spectators might have consumed the carcasses of animals which died during the show.[447] Perhaps most evocative were the sights of wild and exotic animals, coupled with technological novelties that blurred the boundary between reality and fantasy.[448]

Sensory studies of the ancient world are rapidly becoming an area of intense scholarly interest in classical studies. The past couple of years have witnessed important publications such as the *Senses in Antiquity* series[449], Toner's edited volume *Cultural History of the Senses in Antiquity* (2014), and most recently *Senses of the Empire* (2017), edited by Betts, with articles that investigate the ways in which people of the past experienced the world through

[442] Juv. 3.34; Petron. *Sat.* 36.6; Ov. *Fast.* 6.657-60; Apul. *Met.* 10.31; Mart. *Ep.* 14.166.
[443] Val. Max. 2.4.7; Vitr. *De arch.* 10.3; Suetonius claims that the emperor Caligula would sometimes draw back the awnings during the gladiatorial contests when the sun was at its warmest and demand that no one leave the arena (Suet. *Calig.* 26.5).
[444] Calp. *Ecl.* 7.71-2; Lucr. 2.416-17; Mart. *Spect.* 3, *Ep.* 3.8; Apul. *Met.* 10.34; Ov. *Ars am.* 1.104; Plin. *NH* 21.33.
[445] Besides the reserved seats for important officials, most spectators would have sat in tightly packed rows with their knees pressed up against the backs of those below them. Holliday (2021, 435) suggested that such closeness "engendered the sense of solidarity and collective energy found in any mass audience".
[446] Titus reportedly had wooden balls handed out to spectators with inscriptions indicating food, clothing, precious stones, pack-animals, and even slaves (Cass. Dio 66.25.4). Elagabalus was also known to distribute prizes during the games including food, animals, and valuable minerals (SHA *Elag.* 22). Nero and Hadrian also gave away prizes at the games by throwing inscribed balls into the stands (Cass. Dio 62.18.2, 69.8.2).
[447] Tertullian criticised the cannibalistic behaviour of spectators, who consumed wild beasts that had eaten condemned persons (Tert. *De spect.* 2.13.85). The fictitious character Lucius, from Apuleius' *Metamorphoses,* observed spectators feasting off the carcasses of performing bears who had been struck down with disease (Apul. *Met.* 4.14). On the consumption of arena meat at the *venationes*, see Kyle (1995) and (1998) 184-94.
[448] Seneca praised the mechanics responsible for constructing stage machinery that pleased the eyes and ears at the public spectacles (Sen. *Ep.* 88.22)
[449] Synaesthesia: Butler and Purves (2014); Smell: Bradley (2015); Sight: Squire (2016); Taste: Rudolph (2017); Sound: Butler and Nooter (2018); Touch: Purves (2018).

their senses. Given the rich sensorium of the arena, a sensory approach can be constructive for exploring the spectators' experiences at the games and the methods by which *editores* manipulated them. This approach can also be used to illuminate some of the animals' experiences. Just like the spectators, animals encountered a medley of sensory information that deeply affected their behaviours and their interactions on the arena floor. Until now, the manipulation of this information has not been considered from an animal behavioural perspective. This chapter explores the range of ways in which the Romans exploited, and benefited from, the animals' sensory capacities by stimulating them using strategies associated with touch, sight, sound, smell, and taste. It also considers how the Romans adapted some of these strategies from their engagements with animals beyond the arena. While any reconstruction of the animals' experiences will be speculative to a certain degree, by piecing together the ancient sources with ethological observations of animal sentience this chapter attempts to draft a more detailed, interdisciplinary interpretation of the human-animal interactions that played out inside the arena.

3.1. Sentience and Stimulation: Illuminating the Sensory Experiences of Animals

Sentiens, from which we get the English term 'sentient', is the present participle of the Latin verb *sentire,* which means simply "to feel". In animal studies, sentience is standardly defined in terms of "the capacity for conscious suffering and/or enjoyment"[450], which applies to humans and, according to recent scientific studies, a wide range of non-human vertebrate species as well.[451] Animals "feel" in substantially different ways, however. Many possess forms of perception that are subjectively different from anything that humans can experience. Their perception of the world also varies considerably between and within species according to their biology, environment, and personal history. As noted in the Introduction, this ontological divide creates significant challenges for understanding the past through the experiences of animals.

Since the 1950s, the sensory perceptions of animals have been greatly illuminated by a strategy widely implemented in accredited zoos known as 'environmental enrichment' (EE).[452] Although there is no universal definition for this practice, EE refers to the provision

[450] Varner (2018) 358.
[451] With the exception of cephalopods, invertebrates are generally not believed to be able to consciously feel pain, though debates in this field are constantly shifting. Fish species have been a particular focus of recent studies on sentient vertebrates. See Rose (2002); Braithwaite (2010); Gruen (2017).
[452] Environmental enrichment has had a long and complicated history under different names and conceptions. For excellent discussions of its evolution and significance today in zoos and aquariums, see Newberry (1995); Shepherdson (1998); Mellen and MacPhee (2001).

of stimuli that act to enhance the social, cognitive, and physical complexity of a captive environment.[453] The goal is to increase behavioural diversity by making the environment more dynamic and providing opportunities for the animals to control social interactions and make choices.

In general, there are five main categories in which enrichment can be provided: cognitive (e.g., problem-solving tasks, training), social (e.g., interactions between companions or individuals of different species, including humans), 'furniture' (e.g., climbing structures, hiding places, living vegetation), feeding (e.g., manipulation of food), and sensory. The last of these can encompass any of the five senses: **touch** (e.g., foraging tools, physical obstacles), **sight** (e.g., coloured objects, capture-eliciting devices), **sound** (e.g., generated vocalisations of conspecifics, music), **smell** (e.g., odour from conspecifics or non-conspecifics, perfume), **taste** (e.g., novel foods). All of these enrichments are carefully designed to induce species-appropriate behaviours, which means the animals' natural history and sensory capacities are taken into account. For example, among tactile stimuli, objects that can be physically manipulated are effective for stimulating exploratory behaviour in species that typically forage, such as bears (*pers obv.*).

At its core, EE aims to enhance animal welfare in captivity, but there are other valid reasons for it. Animals that interact with their environment in dynamic ways tend to be more engaging and interesting to zoo visitors and thus more likely to facilitate meaningful connections between humans and wildlife.[454] A lion that is subjected to a barren exhibit, for instance, will not have the same opportunities to perform locomotory activities such as climbing, stalking, or chasing (all of which are immensely exciting for zoo visitors) as a lion whose exhibit is provisioned with furniture and capture-eliciting devices. Recreating natural stimuli in captivity is therefore beneficial from both a welfare and entertainment perspective. By observing how animals respond to enrichment, keepers also gain a more detailed picture of how animals use their senses to engage with, and extract information from, their immediate surroundings.

Environmental enrichment was evidently not a concept the Romans were familiar with, nor was it ever their intention to enrich the lives of the animals they exhibited or hunted

[453] The AZA Behaviour Scientific Advisory Group defines EE as follows: "a process for improving or enhancing zoo animal environments and care within the context of their inhabitant's behavioural biology and natural history. It is a dynamic process in which changes to structures and husbandry practices are made with the goal of increasing behavioural choices to animals and drawing out their species appropriate behaviours and abilities, thus enhancing animal welfare". https://www.aza.org/behavior-scientific-advisory-group?locale=en. See Young (2008) for more definitions of EE.

[454] Shepherdson (2013) 396. Animals living in enriched environments are also more likely to breed successfully, which is integral to species recovery programs and the zoo's conservation efforts.

in the arena. Moreover, as we saw in the previous chapter, not all the behaviours performed by animals, specifically trained specimens, were considered natural, even if their movements were based on natural abilities (e.g., an elephant balancing on a tightrope). Nonetheless, EE provides a useful model for thinking about the various ways in which animals *could* be stimulated by the sensory properties of the arena and the equipment employed therein.[455] While these stimuli can be extrapolated from the ancient visual and literary evidence, deciphering how the animals might have responded to them presents a challenge. This is where modern ethological material can be particularly useful. Many of the stimuli represented in the ancient sources, as will be shown below, are analogous to those which some captive or wild animals experience in modern zoos, circuses, rodeos, agriculture and hunting activities. Fire, for instance, is an excellent example of a visual stimulus that has been used in both ancient and modern contexts as a driving aid to manipulate the flight paths of wild animals, often in human-animal conflicts (discussed below 3.3.1). By studying how animals respond to different stimuli in these contexts, we can gain some idea of how animals in the arena might have behaved when confronted with similar stimuli. In turn, this can help illuminate some of the visual and literary evidence from the Roman period.

3.2. Tactile: The Importance of Physical Cues

Tactile stimulation refers to the subjective sensation of touch. Behavioural responses to this type of stimulation are influenced by a range of factors such as the intensity of the stimulus, the location of contact, and the personal history of the recipient. Almost all animals have nociceptive systems that allow them to detect noxious stimuli and respond appropriately to potential dangers.[456] As such, adaptive responses such as fight-or-flight are especially common if the stimulus induces pain. The question of how (and whether) animals experience pain remains a major point of contention within the fields of ethology and the social sciences, as it once did in Antiquity between philosophical schools.[457] It is beyond the scope of this chapter to enter this debate; however, that pain was considered an important component in

[455] The Latin verb *stimulāre* ("to urge on") was commonly used to refer to goading animals, often by means of physical force (e.g., Liv. 42.66.7: *iumentis, cum stimularentur, in turba saevientibus*; Cat. 63.77: *ibi iuncta iuga resolvens Cybele leonibus / laevumque pecoris hostem stimulans*). However, as the following discussion will demonstrate, tactile stimulation was by no means the only way the Romans roused animals into action.

[456] Braithwaite (2018) 252.

[457] For recent discussions of the animal pain debate, see Allen (2004); Nuffield Council on Bioethics (2005, esp. ch.4); National Research Council (2009); Guichet and Latouche (2014). See also, Newmyer (2006; 2011a; 2011b), who has written widely on philosophical debates in Greek and Roman thought concerning animal pain. Aristotle believed that animals with sensation (i.e., human and non-human animals) also experienced pain and pleasure (Arist. *Parv. nat.* 25-30).

managing animals and establishing power relations is clear from various genres of Greek and Roman literature.

Pliny the Elder, and later Apuleius, noted that the best way to teach a parrot human speech was to knock its head with an iron rod to make it recognise its master's command, just as a teacher might use a stick to discipline his pupil (Plin. *NH* 10.58; Apul. *Flor.* 12.3). Seneca argued that the appropriate way of dealing with a disobedient animal was to apply physical force using a whip, so that it might correct defiant behaviour (Sen. *Constant.* 12.3). In contrast, Columella advised against using harmful goads to control livestock, and endorsed the whip only as a driving aid (Columella, *Rust.* 2.2.26-7, 6.2.11-12).[458] Taking a philosophical viewpoint, Plutarch argued that dogs and horses were punished for perceived misbehaviour by having pain inflicted upon them, so that they might repent their actions (Plut. *Mor.* 961D). The administering of violence upon animals is also a theme that permeates Apuleius' *Metamorphoses.*[459] Throughout Lucius' journey as an ass, he endures countless beatings from diverse representatives of Roman society, including criminals and bandits (3.28-29, 6.25, 6.26), slaves (3.27), priests (8.30), youths, (4.3, 7.17-19), travellers (7.25), farmers (8.17-18, 8.21), and even other animals (3.26, 7.16). The striking regularity of these beatings throughout the novel suggests that Apuleius' readers were familiar with the use of physical force in managing livestock.

In the *venationes,* arena attendants and animal handlers rarely entered the arena without some sort of physical aid that could be administered directly on the animals, either in defence from potential attacks or as a means to elicit desirable behaviours.[460] In the visual evidence, they are often depicted holding a whip and/or goad, but the methods by which they employed these tools varied greatly depending on the species of animal, the type of performance, the design of the stimulus, and what behaviours they anticipated from the animals.

3.2.1. Whips

Some of the most iconic images of animal circuses from modern times depict large fauna, usually elephants, horses, big cats, and bears performing complex feats under the instruction of a whip (Fig. 96). Circus trainers typically use a lunge whip to control their animals, often by cracking the whip nearby or directly on the animals or waving it in certain directions. What

[458] Columella argued that persuasion (through speech), and the withholding of food, were both preferable methods for dealing with uncooperative animals (Columella, *Rust.* 6.2.11-12). Cf. Varro's argument that slaves were best managed with words rather than whips (Varro, *Rust.* 1.17.5).
[459] Fagan (2011b) 472-74, table 22.1.
[460] See chapter 2 section 2.1.1 for discussion of the equipment employed by *venatores.*

makes this tool such a valuable accessory in this environment is its versatility. As a visual stimulus, the whip signifies the extremities of the trainer; every instruction is communicated through the whip's movements, thus indicating the animals what to do and where to move. For instance, raising the whip could prompt a tiger to stand up from a crouching position, or sit down when lowered. As an auditory stimulus, the lunge whip is cracked in close proximity to the animals to induce them to follow a certain direction or make them move faster (also seen in horse racing). Wielding a whip also requires a certain level of skill, thus trainers often exploit its startling sound as part of their showmanship.

Ultimately, however, the whip's value as a visual and auditory aid is a result of how it has been physically and psychologically used on the animals. During training, circus animals are taught to associate perceived misbehaviours such as aggression and disobedience with the painful or uncomfortable pressure of the whip hitting their body (positive punishment).[461] From learning this association, the mere sight or sound of the whip in the circus ring should theoretically ensure the animals' cooperation and elicit performance.[462] However, despite their training, circus animals are still liable to revert to aggression. As Hediger observed, under appropriate circumstances the core wildness of a circus animal can be reactivated by exciting them.[463]

The versatility of the whip as a visual, auditory, and tactile stimulus was readily exploited by human performers in the Roman arena. In the circus, charioteers employed the whip to spur horses on in a race and control their behaviours (Mart. *Ep.* 14.55). In Silius' *Punica,* a certain Darius resorted to lashing his horses vigorously with their reins after accidently dropping his whip (Sil. *Pun.* 16.456). That Darius continued to strike the horses after the incident suggests that tactile stimulation had been the objective of the whip. Directly whipping the horses may have also reinforced directional cues provided by the horses' reins. It is possible that charioteers used this strategy for navigating around the *metae*, as seen on a terracotta Campana relief depicting a *quadriga* race (Fig. 97).[464] Another tactic was to strike an opponent's horse around the eyes to drive them off course.[465] Cases of lacerations and

[461] Positive punishment (P+) involves adding a stimulus (e.g., whip) to make a behaviour less likely to happen again (e.g., aggression).
[462] This association is particularly clear in the animals' body language: circus animals can be observed flinching or shying away from the sound or touch of a whip due to its association with uncomfortable or painful experiences. For empirical observations of these behaviours see Pratte (2018) 22.
[463] Hediger (1954) 76-78.
[464] Ovid describes a rider who directly struck his horses' backs before navigating the turning-post (Ov. *Am.* 3.2.11-12).
[465] Hyland (1990) 224.

injuries to the eyes of racehorses were widely documented by the 4th century CE veterinary author Pelagonius (Pel. *Hipp.* 30.410-13).[466]

In the *venationes,* animal trainers benefited from the whip's tactile properties and used it as a punitive instrument for training wild beasts. Since elephants and lions were both popular candidates for tame displays, they often appear in the literary evidence as victims of repeated whipping.[467] Pliny the Elder may have witnessed an elephant being flogged as a punishment for being slow to learn its trainer's instructions (Plin. *NH* 8.3), and Plutarch recalls a story of an elephant that was caught rehearsing its performance at night after being whipped (Plut. *Mor.* 968D). Martial reported a number of episodes where lions were whipped for perceived misbehaviour in the shows he witnessed inside the Colosseum. *Epigram* 2.75 describes an incident where a lion, who was accustomed to receiving blows from its keeper, suddenly killed two arena attendants. As punishment for this behaviour, the lion might have been whipped again or even killed. By order of the emperor, death was the punishment for another lion that mauled its trainer's hand during a performance (*Spect.* 12). According to Martial, this resulted from its refusal to submit after it sustained multiple whiplashes, as has so often been observed in the modern circus.[468] The ancient sources do not indicate if whips were also used by trainers as pointers, although their startling sound could certainly prompt an animal (even an untrained specimen) to move in a specific direction.

Some *venatores* may have fought off particularly dangerous animals using the whip as opposed to more lethal weapons like the *venabulum*. A 3rd century CE medallion mosaic from a Roman villa in Nennig, Germany, provides an interesting example. In one of the medallions, two *venatores* wearing leg wrappings and thick arm padding are shown whipping a bear that has fallen upon a third man (Fig. 98). The bear claws at the injured man, who shields his face with his arm. Since he is dressed in similar attire to the two *venatores,* we can infer that the injured man is also a beast fighter.[469] In this instance, the physical sensation and frightening sound of the whip may have been intended to deter the bear from fatally wounding the fallen *venator.*

With the exception of trained animals and curiosities, most animals were expected to behave aggressively towards the human participants and other animals in the arena. For

[466] Pelagonius dedicates an entire chapter to discussing treatments for injured eyes caused by incidents in the circus (Pel. *Hipp.* 30.415, 418, 422, 433, 439, 441).
[467] Although the tiger featured rarely in the *venationes*, an epigram by Martial may suggest that some tigers (perhaps trained specimens) were also subjected to the whip (*Ep.* 1.104).
[468] A circus lioness named Vega, who recently attacked trainer Maxim Orlov at a live performance in Moshkovo in Russia in 2021 was removed from the circus industry after the incident and was left injured from multiple whiplashes. For a report of the story see Drake (2021).
[469] Note also the whip lying beside the injured *venator* that presumably belonged to him. Other medallions from the Nennig mosaic depict beast fighters wearing similar gear.

some species like bulls, the stressful conditions of this environment likely exacerbated their aggression, while for others, such as the big cats, this might have had the opposite effect. It is often the case that when a big cat escapes from captivity its first response is to find a dark, covered area to shelter in rather than use its energy to attack bystanders.[470] This is because felids are instinctually driven to hide and conceal themselves when they are stalking prey and avoiding other predators in the wild. When a group of lions and tigers escaped from Alfred Court's circus in Saint-Amand, Flanders in the early 20th century, it was observed that the animals "… were so confused and frightened, so they just stayed there sizing up the situation."[471] One of the tigers took shelter under a wagon in the middle of the street, while a lion named Caesar sought cover in a nearby café.[472] Taking the animals' perspective, circus trainer Charly Baumann explained, "while the thought of a lion or tiger on the loose at the circus or in any populated area stirs up a fearful image in the minds of most laymen, they don't realise that the experience is equally traumatic for the animal."[473]

Thus, when big cats were released into the Roman arena, many would have probably been reluctant to fight (at least initially) and instead became disorientated by the fear and novelty of the arena.[474] An incident of this sort is reported in the SHA with reference to the shows given by Probus in 281 CE (SHA *Prob.* 19). To the disappointment of the spectators, 100 lions were immediately dispatched by archers for their failure to exit their cages quickly. The severity of this action, if indeed taken, suggests that spectators expected animals to be engaging and responsive when they first entered the arena.

Directly whipping big cats or striking the whip within their 'critical distance' was probably one way to induce unwilling animals to actively engage or display aggression. The critical distance is the distance at which an animal will typically change from defence to attack. Whereas flight responses may occur in any direction, critical responses (i.e., attacks) are almost always aimed at a specific target (see chapter 1 on flight responses). Modern circus trainers have been known to exploit this behaviour to draw big cats towards them from different points of the ring. To block the attack, the trainer will skilfully step out of the critical distance of the approaching animal or place an obstacle in its path, such as a pedestal, which

[470] Kawata (2016) 264-65. The same is also true when releasing captive lions into a new environment. Despite being confined in a crate for a lengthy period, a lion may still be reluctant to leave the crate. See AZA Lions Species Survival Plan (2012) 32.
[471] Gebel-Williams and Reinhold (1991) 316. For similar incidents involving escaped circus lions and tigers see Beatty and Anthony (1933) 245.
[472] Court (1955) 74-75.
[473] Baumann (1975) 167.
[474] Corippus Africanus describes how wild beasts would become frozen by the fear of thousands of spectators in the *cavea: ferae populorum milia circum / suspiciunt magnoque metu mitescere discunt* (*In laud. Just.* 3.249-50). "The wild beasts, looking up mistrustfully at the thousands of spectators, become tame under stress of fear." Trans. Jennison (1937) 160.

it is forced to mount.[475] This strategy is not entirely fool proof even if the animals are highly trained. It has been observed many times in the circus industry, where persistent pain-induced stimulation from aversive tools such as whips, goads, or prods results in an animal acting aggressively towards a target other than the one administering the stimulus (e.g., a circus assistant or spectator).[476] In ethology, this response is understood as a redirected behaviour called 'displaced aggression'.[477] If an animal is unable to rid itself of the perceived threat, the likelihood of displaced aggression increases.

Theoretically, then, a *venator,* attendant, or animal handler could provoke attacks or re-direct them towards other participants like *noxii* by whipping an animal or striking the whip within critical distance of the animal. This is one way of interpreting the execution scenes on the west side of the frieze of the Zliten mosaic (Fig 3b). Two dark-skinned *noxii* wearing loincloths are shown tied to poles that are mounted onto small carts. Behind one *noxius* stands two arena attendants: one controls the cart, while the second wields a whip and *mappa* beside the criminal, who is about to be attacked by a leopard (on the *mappae* see below, 3.3.3). Further along the frieze, a third attendant holds another *noxius* while also brandishing a whip above his head in anticipation of a charging lion. Neither of the figures holding whips wear protective gear, nor are they equipped with a *venabalum*. This suggests that their task was likely to provoke the animals and lure them towards the condemned (i.e., incite displaced aggression). Just like in the modern circus, the whip was probably the preferred goading implement used to interact with big cats, since its length afforded some distance from the highly skilled jumpers.

3.2.2. Goads, Prods, and Bullhooks

Goads and prods are another group of physical stimuli used by modern circus trainers to coerce animals to move in a specific direction, elicit performance, or punish animals for perceived misbehaviour. Like the whip, these instruments operate on an association with uncomfortable or painful experiences. For example, a circus trainer might coerce a bear to stand on its front paws by applying a prod as a guide to its feet, thus prompting the animal to lift them to avoid being struck (Fig. 99).[478] The zoo is another context where prods have been

[475] Hediger (1968) 123-24.
[476] The 2018 Shrine Circus Animal Welfare Report identified this behaviour in several of the big cats and bears owned by the James Cristy Cole Circus in the United States of America. The staff from the circus were observed whipping and jabbing their animals with prods to compel submission when the animals came too close to another staff member. See Pratte (2018) 10-11.
[477] McFarland (2006) 53-54. For discussions of displaced aggression in wild and captive animals, see Azrin et al. (1965) and Archer (1976; 1989-90).
[478] Pratte (2018) 26.

used to elicit desired behaviours from animals; however, in contrast to the circus, these instruments are not applied with force, nor do they exploit the animals' fear responses. Prods are most commonly used for target training, which involves the animal touching a specific body part, often their nose, to a 'target pole', which consists of a long or short prod with a ball at the end (Fig. 100). To reinforce this behaviour and its association with the target stimulus (i.e., the prod), the animal is usually given a reward, typically in the form of food (positive reinforcement).[479] This type of training can lead to the animal performing more complex tasks, such as presenting a paw or opening its mouth, which are geared towards voluntary medical participation, among other activities.[480]

Representations of prods are fairly common in the iconography of *venationes.* Although there is no direct evidence for how these instruments were used, their design can give some idea of how animal handlers might have employed them in their interactions with animals inside the arena or during training. A 3rd century CE sarcophagus from the Torlonia Collection in Rome depicts a lion standing adjacent to an elderly man who wears a long cloak and holds a short prod that closely resembles the modern-day target pole; a prey species, perhaps the lion's kill or its reward for executing a trick, lies beneath the lion (Fig. 101).[481] The shortness of the prod is particularly interesting as it suggests that, for it to have been applied directly on the lion, the animal and man had to be standing closely together. This would have only been possible if the lion had received training, possibly from the elderly man (i.e., its *magister*). A fitted harness is shown tethered around the lion's shoulders and torso which strongly suggests the animal was associated with the *venationes* (on harnesses see below, 3.2.3). To judge from the target pole, the circular end of the prod was probably not intended to severely harm the lion but rather guide or encourage a desired behaviour. A short prod such as this might have been used to pry open the lion's mouth for a trick similar to that described by Seneca (*Ep.* 88.44) and Martial (*Spect.* 12). Alternatively, the prod might have been used as a visual aid to instruct the lion to move in a specific direction.

Similar representations of lions standing next to (what could be) their trainers are found on a number of imperial Roman sarcophagi, though the instruments held by the trainers vary in design. Two 3rd century CE sarcophagi, one held in the Metropolitan Museum of Art in New York (Fig. 102), the other in the Vatican Museum in Rome (Fig. 103), show animal handlers carrying a long staff with a single or double-pointed hook. Since trained lions were presumably expensive to maintain and hire for the *venationes,* the sharp ends of this

[479] Positive reinforcement (R+) involves adding a stimulus (e.g., food) to make a behaviour more likely to happen again.
[480] For an overview of conditioning techniques implemented in modern zoos, see Crowell-Davis (2008).
[481] Coleman (2006) 116-17.

particular tool were probably used only to thwart potential attacks from the lion if it turned against its trainer, rather than to seriously maim it. As for the hooked end, one theory is that the staff may have connected through a loop that was located at the top of the lion's harness. With the staff firmly secure, the trainer could then lead the animal between the holding bay and the arena as if it were on a leash.[482] A section of a marble frieze located in the Library Hall of the Castel Sant'Angelo in Rome depicts Cybele leading a harnessed lion in exactly this manner (Fig. 104).

Interestingly, the hooked staff from the Roman sarcophagi shares similarities with the ancient *aṅkuśa,* or iron hook, that mahouts from the Mauryan army in India used to control war elephants (Fig. 105).[483] This tool, now commonly known as a 'bullhook', is still used today by mahouts and many elephant handlers in circuses, zoos, and temples in the disciplining and management of captive elephants.[484] The pointed end of the bullhook is traditionally used to jab sensitive areas of the elephant's body where the skin is particularly thin, such as around the eyes, while the hook is designed to grip behind the elephant's ears and act as a directional cue (*pers. obs.*). The forehead, trunk, stomach, and feet of an elephant are also extremely sensitive to the touch of the sharp end of the bullhook. A mahout will often apply the instrument from the elephant's back, where it is difficult for the animal to rid itself of the stimulus (Fig. 106). By learning to fear the pain inflicted by the bullhook, the elephant is more likely to obey commands, which are communicated through the pressure of the instrument.

During the Hellenistic period, a goad that was similar in design to the *aṅkuśa* and bullhook was employed widely by elephant handlers in eastern armies.[485] A ceramic plate from Capena, Italy, now located in the Museo Nazionale Etrusco in Rome, depicts a turreted war elephant carrying a rider who is armed with a hooked staff (Fig. 107). The plate has roughly been dated to ca. 275-270 BCE, and some scholars have speculated that it commemorates the Romans' victory over Pyrrhus' elephants at Beneventum in 274 BCE.[486] If

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[482] Alternatively, trainers may have led their animals by holding directly onto the top of the harness. This method is represented on a 4th/5th century CE plate of African stamped ceramic, currently held in the Römisch-Germanisches Zentralmuseum in Mainz, Germany. See Gabucci (2000) 80.

[483] Trautmann (2015) 65-68, fig 2.1, 2.2.

[484] For an excellent overview of the bullhook's function in these industries, see the *Elephant Voices* database: https://www.elephantvoices.org/elephants-in-captivity-7/about-the-bull-hook.html. On the defence of using bullhooks on circus elephants in North America, see: https://www.cbsnews.com/news/circus-defends-use-of-hooks-on-elephants/.

[485] A pair of silver military disks (*phalerae*) from modern-day eastern Iran, roughly dated to the 3rd/2nd centuries BCE, show a turreted elephant (possibly belonging to the Seleucids) being directed by a rider who holds a double-pointed hook. See Scullard (1974) 120-45, pl. XII. This instrument is also identified on the reverse side of a double shekel of New Carthage depicting a mounted African elephant. Scullard (1974) pl. XXIb. See also the hooked staff held by an elephant rider on the sarcophagus showing the Triumph of Dionysus (Appendix III, Fig. 88)

[486] Bar-Kochva (1989) 584, pl. 12; Ambrosini (2005); Picón and Hemingway (2016) 118-19, no. 21; van Oppen de Ruiter (2019) fig. 8.

the dating of the ceramic plate is correct, it indicates that the Romans were aware of the instrument, and its use in managing elephants, as early as the mid-3rd century BCE. Empirical knowledge of the goad might have been transmitted by experienced elephant handlers (and Greek mercenaries) when they were brought back to Rome as war captives along with the elephants.[487] The movement of these specialists would have created opportunities for the Romans to learn about the elephant's behavioural affordances and how it responds to different types of stimuli.

It is possible that the hooked staff was used for managing elephants in the *venationes* at Rome, although direct evidence for this is sparse. Due to the fragmentary nature of some of the visual material, it is difficult to accurately identify the instrument or distinguish it from other types of goads. A mosaic from the Aventine in Rome, roughly dated to the 3rd century CE, depicts a combat between a mounted elephant and bull that has been tethered to the arena floor (Fig. 108).[488] The rider of the elephant is shown prodding the elephant's forehead with a short instrument, which could be the hooked staff. Considering the restrictions imposed on both animals, one might imagine the rider as a kind of referee with the ability to control the power dynamics and development of the combat. Theoretically, through targeted stimulation, the rider could guide, control, and manipulate the elephant's behaviour towards the bull. A similar interaction between a bull and an elephant is illustrated on a medallion of Gordian III that commemorates the restoration of the Colosseum (Fig. 109).[489] The elephant carries a rider who appears to be holding a goad – whether or not this is the hooked staff can only be speculated. An elephant rider depicted on a Roman lamp discovered in Puteoli, dated to the late 1st century CE, is clearly shown holding a staff with a hooked end (Fig. 110).[490] Since Puteoli was operating the largest and most important port in Campania at this time, it might not have been unusual to see elephants and their handlers arriving from North African to participate in *venationes* held at the local amphitheatre (see chapter 1 section 1.3 for discussion of the Puteoli amphitheatre).

A more peculiar goad that appears to have had some association with bulls specifically was a long staff with a crescent-shaped prong. Representations of this tool have been identified alongside bulls on several provincial mosaics, including a 2nd century CE mosaic from the Large South Baths at Timgad, a 3rd century CE Banquet mosaic from Thysdrus, and a 4th century CE mosaic from Rudston in Yorkshire, Britain.[491] The goad's function remains a

[487] Elephant riders may have been included in the spoils that were brought back to Rome after L. Caecilius Metellus defeated the Carthaginian's elephant army in Sicily in 250 BCE (Plin. *NH* 8.6).
[488] Scullard (1974) 250, pl. XVIIb.
[489] Scullard (1974) pl. XXIVe.
[490] Bailey (1980) 74, fig. 78, cat. Q1206.
[491] See Manas (2017) for a discussion of these mosaics and the bull's association with the instrument.

mystery since it is never shown being used on the bulls by *venatores,* attendants or handlers, nor is it described in ancient literature.

Most scholars argue that the crescent-shaped staff was a symbolic emblem of the *Telegenii* association.[492] The tool has also been interpretated as a weapon or goading instrument specifically used by *venatores* of the *Telegenii* to prod, prick, and push the animals around the arena.[493] As with the *venabulum* and whip, the long length of the instrument made it convenient for handling dangerous animals at a distance, though whether it was used to fatally wound the animals or to physically stimulate them is not known. Looking closely at the tool represented on the Banquet mosaic, one can see that the colour of the staff is a light brown while the prong is considerably darker (Fig. 111). This may indicate that it was made from a different material, possibly metal, which could have caused the animals serious discomfort from the pressure of contact.[494] Gilbert suggested that the design of the crescent-shaped prong may have allowed *venatores* to grab the animals by their neck.[495] If this were the case, however, we would expect the prong to be considerably wider than it appears in the iconography. Certainly, the prong depicted on the Banquet mosaic seems too narrow to fit around a bull's neck, if in fact it was used on these animals. Since the other individuals seated at the banquet table are each accompanied by an emblem representing their *sodalitas,* it seems more likely that the crescent-shaped instrument, held by the figure on the far right, was also symbolic in nature.

A more recent theory, put forth by Manas, proposes that the staff may have been designed for hamstringing bulls.[496] Manas' interpretation was informed by a similar crescent-shaped goad that was used in Spanish bullfighting from the 16th century, called a *dejarretadera*.[497] The earliest written source on this tool describes it as having a long pole with an iron tip, shaped like a half-moon (Fig. 112).[498] The curved blade was designed to fit behind the bull's knee so that it would cut the animal's hamstring tendon.[499] Importantly, this did not kill the bull but rather crippled it enough to allow the matador to dispatch it at a closer

[492] Picard (1954) 419; Salomonson, (1960) 37; Blanchard-Lemée (1996) 214; Wilmott (2008) 164; Vismara (2001) 66, 70.
[493] Neal (1981) 93; Blázquez (1990) 199; Dunbabin (1978) 71; Vismara (2001) 70; Witts (2005) 149-50; Nossov (2009) 136; Gilbert (2013) 100.
[494] Manas (2017) 4.
[495] Gilbert (2013) 100.
[496] Manas (2017) 6-13.
[497] From the verb *desjarretar* = "to cut the legs at the height of the *jarrete"* (hamstring tendon).
[498] See Argote de Molina (1582) esp. ch. 37.
[499] Manas (2017) 6.

range.[500] Its function in this context was to enable bull-fighters to swiftly immobilise dangerous animals from a safe distance.

While the design of the crescent-shaped prong from Antiquity seems to match the shape of a bull's hamstring tendon, one would expect this kind of interaction to be documented in the ancient sources. Clearly it required an impressive level of skill to administer the stimulus on a moving bull. Interestingly, the staff also appears in the leopard hunt from the Magerius mosaic, though it is not represented as a weapon or a goading instrument (Fig. 5). A partially-naked figure, identified as Bacchus (the patron deity of the *Telegenii*), is depicted holding the staff. Since the *venatores* are shown fighting the leopards with the *venabulum*, the staff in this context may have simply been emblematic. Manas rejected the possibility that this was the same instrument on the grounds that the prong was too narrow and blunt to be a hamstringing tool.[501] However, bearing in mind that many of the goading tools discussed above were multifarious by nature, it is entirely possible that the crescent-shaped staff was used in various ways as well, targeting different points of an animal's body for certain effects.

3.2.3. Tethering Implements

It was noted in chapter 2 that cattle have a high propensity for reactive aggression due to their natural disposition as a herd species. Once separated from the herd, any novel or surprising stimulus is perceived as predatory, especially if it comes into contact with the animal. Columella, for instance, advised his readers that cattle should be tethered from the front, where the animal could see the farmer approaching them. Administering a rope or strap from behind, or from the side, risked startling the animal, which could put the farmer in danger (Columella, *Rust.* 6.2.5).

Modern bovine rodeos have been known to exploit the bull's sensitivity to physical stimuli by tethering the animals with a fleece-lined strip of leather known as a 'flank strap'. As its name suggests, the strap is tied around the bull's flank (the lower torso, near its hind legs), and its function is to encourage bucking, rearing, and kicking behaviour (Fig. 113).[502] In an effort to remove the pressure from the strap, a bull will instinctively buck by elongating its torso repeatedly until the sensation has gone (i.e., until it has removed the bull rider and/or strap). Part of the bull rider's score is determined by how many times the bull bucks with the

[500] The need for this weapon in 'corrida de toros' (bullfights) was due to the value of the bull's hide, which was diminished if it had significant wounds from failed attempts to kill the animal. Manas (2017) 6.
[501] Manas (2017) 5.
[502] Kubke (2006) 21-22.

rider on the bull, while other points are given for how well the rider controls the bull, which can include their ability to incite bucking behaviour.[503] Naturally, failure of the bull to remove the stimulus increases the incentive and intensity of this behaviour. Since cattle are not built to be ridden, this method of stimulation is particularly effective for inciting aggression in these animals.

There is some visual evidence to suggest that the Romans also exploited this tendency of cattle by tethering them with harnesses in the arena. A 2nd/3rd century CE marble slab with bas-reliefs from ancient Thracia (modern Tekirdag, Turkey), shows a zebu wearing a harness (Fig. 114). The zebu is mounted by a man in a short tunic who clings onto the top of the harness where the three straps meet. A second figure, protected by thick padding, seems to have been thrown into the air by the zebu. This scene may represent a type of exercise that involved the second figure provoking the animal and evading capture (in this case unsuccessfully). A mounted zebu with a fitted harness also features on a fragment of a relief from the ancient city of Kibyra (late 2nd/early 3rd century CE) (Fig. 115).[504] On a floor mosaic from the Greek island of Kos, a man named Roupheinos is depicted riding on the back of a bull while the animal gores first a boar and then a bear (Fig. 116).[505] The bull is clearly strapped in a harness, which would have given the rider something to grip onto. Part of the attraction of these acts might have been the challenge of staying on the bull while it fought against other animals in the arena.

Not all harnesses that were worn by animals in the arena were intended to incite aggression. Many were, in fact, worn by specially trained animals such as the lions on the sarcophagi discussed above. To judge from the visual evidence, these particular harnesses wrapped around the animal's torso and shoulders much like the fitted harness worn by some hunting dogs (Fig. 117).[506] Importantly, its design meant that it could be modified according to the animal's size. This made it more secure than a basic collar, which was liable to slip off. A fitted harness could also be re-adjusted for another animal if the original wearer died in the arena.

Fitted harnesses likely served a number of different functions in the *venationes*; one of these might have been to facilitate the easy capture of wild beasts after a performance. A 1st century CE marble relief, held at the Museo Torlonia, offers some insight into how this could be achieved. The scene depicts five *venatores* fighting two lions and a bear, who each

[503] See Furman (2001) for an overview of the regulations and rules of bovine rodeos.
[504] Berns and Ekinci (2015) 173-74, fig. 42, block C8.
[505] For a detailed discussion of this mosaic see Dunbabin (2016) 197-98, fig. 7.21.
[506] Gorzalczany and Rosen (2018) 80-82, fig. 4. The 'Little Hunt' mosaic from the Villa del Casale in Piazza Armerina, Sicily, provides a good illustration of a tethered dog who has returned from a hunting expedition. See Toynbee (1976) 272, fig. 6.

wear a decorated harness (Fig. 118).[507] Each harness comprises a loop at the top, which enabled a rope (or staff, as mentioned earlier) to pass through. A thick rope is shown dragging behind the bear's harness, where it may have been attached to the arena floor or held by an attendant. If the animals survived the hunt, the rope could be pulled (physical stimulus) towards the animals' holding bay. Alternatively, tethering such dangerous animals as lions and bears might have been a practical solution to a venue's inadequate safety barrier. However, fastening the harness would have been no easy task, unless the animals were accustomed to wearing one. The existence of late imperial vessels (*ampullae*) in the shape of tethered bears may allude to trained specimens that became popular features of the Late Antique *venationes* (Figs. 119-120).[508]

The iconography attests that some harnesses might have also been embedded with exquisite jewels. Excellent examples include the harnesses worn by a lion on an *opus sectile* panel from the Porta Marina in Ostia (Fig. 121) and a lion on a fragment of Proconnesian marble relief from a sarcophagus (Fig. 122). While these details could be attributed to the artists' imagination, the practice of adorning exotic animals with exquisite embellishments may have been another way for an *editor* to show off his wealth and prestige. The harnesses in these instances were perhaps more symbolic than practical in nature.[509]

3.2.4. Structural Features

As mentioned earlier, tactile stimulation can also be provided by modifying an animal's environment with 'furniture' such as climbing structures, perches, and living vegetation. In modern zoos, this form of enrichment is designed to enhance the physical complexity of the environment and encourage animals to behave in dynamic ways that are engaging and interesting to zoo visitors. Types of furniture that are common in big cat exhibits, for example, include large boulders, bridges, branches, and tree logs, all of which encourages climbing locomotion (Fig. 123). In addition to providing animals with more control in their exhibit, these structures aim to simulate the animals' natural environment, thus facilitating species-appropriate behaviours.[510]

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[507] Vismara (2001, 70) comments on the decorative nature of these "belts" but does not discuss their practical value.
[508] Toynbee (1973) 96, figs. 38-9.
[509] It was common practice throughout the Roman world to adorn performing (and sacrificial) bulls with garlands, wreaths, and other types of embellishments, though the effect of these stimuli on bull behaviour is not known. A good example is a Roman mosaic from the House of Bacchus in Thysdrus, Tunisia, which shows Bacchus surrounded by animal combats involving bulls, who wear loose ribbons over their torso (Appendix III, Fig. 78). For discussion of the decorative and symbolic function of garlands on performing animals, see Turcan (1971) and Toynbee (1976).
[510] Coe and Dykstra (2010) 207.

In the last twenty years there has been an increase of scholarly interest in the provision of live vegetation, springs, and artificial scenery in the Roman games and their role in manipulating the spectators' responses in the stands.[511] Many scholars have argued that structural modifications of this kind served to enhance the authenticity of the hunts, violence, and wild landscapes which the *venationes* aimed to evoke.[512] The creation of such naturalistic settings was achieved by the emperor Probus on a massive scale inside the Circus Maximus, where he reportedly planted an entire forest of live trees (SHA *Prob.* 19.3). According to the SHA, the trees had been torn up with their roots by soldiers, who then planted them on a wide platform of wooden beams that was topped with soil.[513] Subsequently, a large number of wild herbivores, including ostriches, stags, wild boars, deer, ibexes, and wild sheep, were let loose into the arena and members of the audience were invited to seize the animals.[514] If such provisions were made for Probus' forest hunt, it is possible that many of the animals (except for the ostriches) had been obtained from his recent campaign along the Rhine in western Europe. Indeed, some of the trees that were uprooted by soldiers could have been gathered from this region and displayed in the Circus as spoils from his conquests.[515] For the lucky participants, some may have felt as though they were hunting on the banks of the Rhine.

As realistic as this might have been for the spectators and those who participated in the hunt, it is worth considering how the animals might have engaged with the live vegetation. Studies on zoo exhibit design have shown that animals in structurally-enriched exhibits tend to demonstrate higher levels of activity than animals housed in barren enclosures.[516] This, of course, is almost impossible to prove in the Roman games without empirical observation, but

[511] Coleman (1990, 1993); Auguet (1994); Beacham (1999); Hammer (2010); Carter (2015); Fagan (2016). Sophisticated stage machinery was also used in some of the public executions in Rome. For examples, see: Strab. 6.273; Mart. *Spect.* 24-25; Apul. *Met.* 4.13. On the use of stage machinery in other types of spectacles involving animals, see: Mart. *Spect.* 18 on a 'flying' bull; Apul. *Met.* 10.34 on an artificial Mt Ida complete with live flora and domestic animals.

[512] Coleman (1990) 52, 68 (1993) 73; Auguet (1972) 71; Beacham (1999) 240; Hammer (2010) 67; Carter (2015) 117-120; Fagan (2016) 376-77.

[513] This may have covered the entire performance space of the Circus, with the exception of the *euripus* that ran down the centre.

[514] From a logistical perspective, this scramble was probably only reserved for a select few, perhaps important officials, rather than every spectator in the *cavea.* Alternatively, there may have been a lottery system in place, whereby participants were chosen at random from the audience to hunt the animals.

[515] In the Roman triumph, live flora (along with exotic animals and human captives) was occasionally paraded as spoils of war from captured territories. The balsam tree, according to Pliny the Elder, was among the 'captives' paraded in the city of Rome at the triumph of Vespasian and Titus in 71 CE (Plin. *NH* 12.54). Thus, Pliny remarks, the balsam tree is "a subject of Rome and pays tax together with the race to which it belongs." Carter (2015, 121) argued that the phenomenon of landscaping the arena with exotic flora was an expression of Roman control over the natural world, just as it was in the context of the Roman triumph. If Probus did acquire his spectacular forest from his campaigns overseas, the staging of his *venatio* allowed the people of Rome to actively participate and have a share in the emperor's conquests.

[516] Mallapur et al. (2002) 111; Smith et al. (2022) 380.

there may have been a chance that the animals utilised stage scenery in the arena to climb, hide, and evade the *venatores.* None of the species exploited in Probus' games were proficient climbers, though some may have used the trees to conceal themselves and avoid capture, as they would have done in the wild. From their vantage point in the *cavea,* spectators presumably had a better view of where the animals were hiding in comparison to some of the participants on the arena floor. This would have added considerable suspense to the hunt, and some spectators may have even shouted out the areas where the animals were lurking.[517] As the animals dodged and dashed around the forest in a disorderly manner, the trees could have heightened the risk of collision between animals and the human participants.

Calpurnius Siculus described a particularly sophisticated amphitheatre, possibly that which Nero built in the Campus Martius, in which golden arbutus trees, fountains of saffron spray, and wild animals suddenly sprang forth (*creverunt*) from the *hypogeum* (Calp. Sic. *Ecl.* 7.69-72).[518] Carter proposed that the trees may have been actual living vegetation, as opposed to an artificial set, due to the use of the verb *creverunt* which he translated as 'grew'.[519] The springs that appeared with the trees may have created the impression of rain as they sprinkled the 'forest' and possibly even the audience in the *cavea.*[520] Wild beasts of every kind are described as being present, including hares, wild boar, elk, bulls, buffalo, *urus* (aurochs), seals, hippopotami, bears, and other clawed creatures (probably big cats). However, there is no mention of *venatores.* Were the animals released into the arena to be left to their own devices? Or has Calpurnius Siculus deliberately excluded the *venatores* from his description to give more focus to the wonders of the arena (i.e., the animals and stage machinery)?

Whether the animals were hunted or merely exhibited, the presence of stage scenery would have afforded the animals at least *some* degree of control over what happened to them in the arena, even if this was only for a fleeting moment. For instance, the bears and "other clawed creatures" that Calpurnius Siculus alludes to might have climbed the arbutus trees to escape the chaos of fleeing animals, the hares possibly made attempts to burrow under the trees (as is natural to them when evading a predator), while other herbivores may have used them for concealment. Although this is only speculation, provisioning the arena with scenery,

[517] We have no evidence of this in the *venationes*. However, evidence of spectator acclamations is attested in the literature on gladiatorial contests. For example, see *Spect.* 23, where Martial praises 'Caesar' for responding to the crowd's request to display the gladiators Myrinus and Triumphus, who were clearly crowd favourites. See below section 3.4.1 on the possible effects of noisy spectators on animal behaviour.

[518] For a discussion of the pastoral setting of *Eclogues* 7, see Newlands (1987).

[519] Carter (2015) 117; cf. Coleman (1990) 52, note 70.

[520] The use of saffron mist to cool down spectators and cover pungent smells of the arena may have been a common component of the spectacles, at least in the arenas at Rome. For examples, see: Lucr. 2.416-17; Mart. *Spect.* 3, *Ep.* 3.8; Apul. *Met.* 10.34; Ov. *Ars am.* 1.104; Plin. *NH* 21.33. On the manipulation of the animals' olfactory experiences in the arena, see below section 3.5.

and thus increasing the physical complexity of the environment, may have afforded the animals opportunities to perform a wider range of behaviours that were not possible in a barren arena. Just as the living forest in the Circus Maximus helped to bring Probus' campaigns along the Rhine to life, so the arbutus trees and springs here simulated some of the animals' natural habitats, thus providing spectators a glimpse into the zoological world.

3.3. Visual: The Power of Movement

Movement is a powerful visual property that affects how animals engage with their environment. For stalking predators such as big cats, movement helps to discriminate prey (e.g., antelope) from non-prey (e.g., inanimate objects) whereas for prey-species, sudden or unexpected movements are inherently recognised as predatory threats.[521] The ability to perceive and respond to sudden motion is therefore an important survival mechanism that all species possess. Approaching an animal too quickly or waving an object erratically are both effective strategies for stimulating fight-or-flight responses.

3.3.1. Fire

For many animals, fire is a natural part of the environment they live in. This has resulted in certain biological and physiological adaptations such as infra-red detection, olfactory detection, or other sensing organs that allow them to detect the direction of fire and smoke and change their behaviour accordingly.[522] In modern times, this tendency to avoid fire has been exploited to drive 'nuisance animals' away from human habitations where human-animal conflicts occur. In large parts of India soaring deforestation has displaced many tigers and Asian elephants, causing them to traverse through human settlements, kill livestock, and destroy crops. In response, farmers have used firebombs, burning straw, and flaming torches as deterrents to frighten the animals and reroute their flight paths, however not always successfully (Fig. 124).[523] While fire is a strong visual stimulus for avoidance behaviour, it can also incite aggression, resulting in the animals turning on the offenders if an opportunity arises. This heavily depends on the animals' past encounters with humans, their current motivation, and the characteristics of the fire.

Although the reactions and relationships of wild animals to fire have only recently been studied as a field animal behaviour, the controlled use of fire to manipulate the fight-or-

[521] Curio (1976) 85.
[522] Komarek (1969) 197.
[523] Cockburn (2019).

flight responses of animals has a long history in many cultures.[524] In the Roman period, various kinds of hunters employed fire to coerce animals into traps on land and in the sea. Fishermen in Euboea reportedly had a unique method of catching fish at night by dazzling them with fire-lit lanterns (Ps.-Opp. *Cyn.* 4.140-144; Ale. *NA* 2.8). 'Fire fishing', as it is known in modern times, remains a traditional method of catching fish in parts of East Asia (Fig. 125).[525] The light from the fire acts as a stimulus by driving the fish to the surface in large schools, thus making them easier to prey upon.[526]

Of all animals, the lion was perceived by the ancient Greeks and Romans as the most fearful of fire (Plin. *NH* 8.19; Ael. *NA* 6.22; Ps.-Opp. *Cyn.* 4.145-146). Pseudo-Oppian describes how horsemen in the Euphrates region would drive lions into nets using blazing torches (visual), while simultaneously clashing their shields (auditory) (Ps.-Opp. *Cyn.* 4.112-139).[527] A representation of this method is depicted on a hunting mosaic from Annaba, Algeria (Fig. 6).[528] A group of wild beasts, including lions, leopards, ostriches, and antelope attempt to escape from a band of mounted hunters, who have the animals trapped between a large net and a wall of shields and torches. The fire is pointed directly at the animals to coerce them towards the net, where a large, open cage awaits them. The presence of the cage indicates that the animals were intended to be captured alive, probably for use in the arena. Another visual stimulus that functioned in a similar manner as the torchers seen here, but which is absent from this scene, was a cord with scarlet feathers that was stretched along the edge of a wooded area. The unpredictable and rapid movement of this device, known as a *formido* ("scare"), was intended to drive the animals in a certain direction, usually towards hunting nets.[529] Pseudo-Oppian describes this technique being used to capture bears in Armenia (Ps.-Opp. *Cyn.* 4354-424; cf. Sen. *Ira* 2.11.5 on wild beasts generally), and Lucan and Virgil suggest that the same device was also used to capture deer (Virgil *Aen.* 12.749-755, *Geo* 3.371-375; Lucan 4.437-444).

Although fire had the potential to cause acute heat stress, hyperventilation, or loss of coordination if the animals got too close to the flames, its ability to affect animal behaviour

[524] For a recent study on the effects of fire on predator-prey behaviours in the wild, such as movement and habitat use, see Doherty et al. (2022). On the negative physiological effects of fire on wild animals, see Gutierrez and de Miguel (2020).
[525] Patowary (2019).
[526] It is more common now for fishmen to use electric lights powered by diesel generators as opposed to oil lamps or flaming torches.
[527] Both Pliny the Elder and Aelian claim that fire was the lion's greatest fear (Plin. *NH* 8.19; Ael. *NA* 6.22).
[528] For excellent discussions of this mosaic, see Dunbabin (1978) 55, pl. 29 and Coleman (2006) 166-67, pl. 25.
[529] According to Jennison (1937, 144), this particular technique has also been employed by North American Indians, among other indigenous hunters, in deer hunts.

from a distance (via light and smoke) made fire particularly useful in situations where the intention was not to cause physical harm. For example, fire is listed by Columella as one of several goads that could be used to help break in untrained oxen, presumably as a fear stimulus (Columella, *Rust.* 6.2.11)

The effectiveness of fire as a driving aid in the hunting fields and in agriculture may have informed its use in the Roman *venationes.* Jennison speculated that the Romans employed burning straw to coerce wild beasts out of their cages when they first entered the arena.[530] One method of administering the stimulus could have been to brandish it beneath or adjacent to the animals' cages immediately before they were released. Theoretically, the heat, smoke, or sight of the flames would help drive the animals out of their cages in a hasty exit. Once they were in the arena, some animals may have attempted to hide against the *podium* wall. In anticipation of this response, arena attendants could have brandished fire as a visual aid to help steer the animals back into the centre, where visibility of the spectacle was optimal. Fire could also be a source of protection for the attendants, should the animals venture too close to them.[531]

Driven by fear of the flames and forced to look for alternative escape routes, some animals might have turned on the human participants or other animals. Martial reportedly witnessed a bull become agitated after being goaded by flames around the arena (Mart. *Spect.* 22). The bull then tossed a dummy (*pila*) into the air and attempted a similar feat on an elephant, however with little success. In this instance, the bull's acute stress response may have been provoked by either the fire (visual, thermal), the *pilae* (visual, discussed next), or both.[532]

3.3.2. *Pilae*

One widespread myth that dates back to Roman times is the idea that bulls are angered by the colour red. Plutarch, for instance, warned against wearing red whilst standing next to bulls, or white in the presence of elephants, since the colours allegedly incited aggression in the animals (Plut. *Mor.* 330B, cf. 144E). Seneca also contended that red objects stirred bulls into a wild frenzy (Sen. *Ira* 3.30.1). As with other cattle species, bulls are in fact dichromatic,

[530] Jennison (1937) 159-61, 179. Jennison also suggested that water may have been used to entice thirsty animals back into their cages after a show.
[531] Apuleius describes how the "intense light of the flames" from torches could frighten off marauding wolves in the countryside (Apul. *Met.* 8.16).
[532] As a source of heat, fire could also be used to incite displaced aggression, particularly during the public executions. Eusebius mentions the use of hot irons to anger wild beasts in an execution involving five martyrs from Tyre in the 4th century CE (Euseb. *Hist. eccl.* 8.7.5-7). However, on this occasion, the animals allegedly turned on the arena attendants, who were doing the goading.

meaning they can only perceive two colour pigments, which excludes red. Contrary to popular belief, it is not the colour but rather the *movement* of red objects that irritate bovine. In 2015, students from the Instituto Tecnológico y de Estudios Superiores de Monterrey in Mexico carried out an experiment to test how effective moving versus stationary objects were for inciting fight-or-flight responses from bulls.[533] Some of the students were instructed to remain stationary in an arena with a roaming bull, whilst a select few manipulated a flag. The experiment found that only the students waving a flag attracted the bull's attention. Similarly, in Spanish bullfighting the matador employs a muleta (red cape on a stick) to attract the bull in a series of movements, thus demonstrating his control over the animal (Fig. 126).[534]

The Romans employed a similar strategy to provoke bulls in the *venationes* using a stuffed dummy known as a *pila.*[535] Variations of its design seem to have existed. Martial likened a torn toga to a *pila,* which suggests that some may have comprised loose material that fluttered in motion (Mart. *Ep.* 2.43). In the iconography some *pilae* appear human-shaped, such as the models with perforated heads depicted on the consular diptychs of Areobindus and Anastasius.[536] Of particular interest to our inquiry is the association of the *pila* with bulls. In Roman literature, bulls are the primary subjects of dummy-tossing analogies, which suggests that readers were familiar with seeing bulls interact with these objects, presumably from the *venationes*. It was noted above that the bull from *Spect.* 22 by Martial made a futile attempt at tossing an elephant in the same manner that it had previously tossed a *pila.* Ironically, in *Spect* 11 a bull finds itself thrown into the air by a rhinoceros, as if it were itself a dummy. Writing three centuries later, Eusebius used this analogy to describe the fate of Christian martyrs who found themselves at the mercy of an angry bull.[537] In other instances, condemned persons were forced to wave their hands frantically to provoke the animals.[538]

Since movement was key to attracting a bull's attention, it is likely that *pilae* were thrown towards the animal by arena attendants or *venatores,* as opposed to being left on the arena floor. This would have increased the bull's incentive to charge, and subsequently toss, the object. Alternatively, some bulls might have entered the arena with a *pila* strapped to their horns. The fluttering of loose material, alluded to by Martial, presumably kept the animals in

[533] 'ITESM Students Show that Bulls Respond to Movement Only' https://www.youtube.com/watch?v=jMUP-SPAZeA
[534] The red colour of the cape is preserved for tradition.
[535] Coleman (2006) 111. Outside the arena context, the term *pila* referred to a stuffed ball designed to be thrown into the air.
[536] Discussed further in chapter 4 (Appendix III, Fig. 134, 136, 138). Alternatively, these models could be beast fighters or condemned persons in costume.
[537] One martyr named Blandina was reportedly thrown to a bull in a net as if she herself were a *pila* (Euseb, *Hist. eccl.* 5.1.55-57).
[538] Kyle (1998) 186.

a chronic state of excitement and anxiety. A modern comparison can be observed at festivals in parts of Spain, where the horns of bulls are embellished with firebrands and strips of material.[539] Unable to rid themselves of these stimuli, the bulls are driven into fight-or-flight state, thus increasing the danger of the spectacle.

3.3.3. *Mappae*

The *mappa* ("cloth" or "napkin") was another visual stimulus employed by arena attendants to provoke animals, often in tandem with the whip. Its origin is linked to the chariot races, where the *editor* would drop a *mappa* to commence the race, often followed by the sound of trumpets (Suet. *Ner.* 22; Mart. *Ep.* 12.29.9; Ov. *Met.* 10.652; Juv. 11.192-8; Quint. *Inst.* 1.5.57).[540] As with the *pila,* the erratic movements of a *mappa* were observed to have a maddening effect on the animals. Seneca considered lions and bears to be particularly responsive to this stimulus (Sen. *Ira* 3.30.1). In the iconography, these animals are often depicted charging towards an attendant brandishing a whip and *mappa.*[541] Although its primary function in the *venationes* was to provoke wild beasts, there is some evidence that suggests the *mappa* could also be used to subdue them. According to Pliny the Elder, the *mappa* was first used in the hunting spectacles in Rome during the reign of Claudius after it was reported that a Gaetulian shepherd had allegedly thwarted a lion attack by throwing a cloak over that animal's head (Plin. *NH* 8.21). The effectiveness of this method, in Pliny's view, was due to the fact that the lion's strength is concentrated in its eyes. By hindering its vision, one could theoretically subdue the animal quite easily without it putting up a fight (to Pliny's disapproval, however). Interestingly, this method is widely used in modern wildlife management for capturing and translocating wild animals (Fig. 127).[542] The objective of reducing sensory perception is the elimination of perceived threats. By this means, the animal will become less stressed, which reduces the risk of it injuring itself or the handlers. From

[539] On this custom see Mitchell (1991) 15-25.
[540] According to Cassiodorus, this custom was founded on an account that Nero had once thrown down his table napkin to signal the start of a race while he was dining at the Circus (Cassiod. *Var.* 3.51). Images of consuls holding the *mappa* in this context were a common motif in iconography from the Roman East during the Byzantine Period. For discussion of the iconography of *mappae* on consular diptychs, see Cameron (2013) 197.
[541] An excellent example is the 2nd/3rd century CE marble bas-relief from ancient Thracia, which shows three attendants waving a whip and *mappa* in front of big cats and bears (Appendix III, Fig. 114). See also the arena attendants on the Zliten mosaic, Fig. 3.
[542] Animal handling procedures can be found in various wildlife manuals. On giraffes: Fennessy et al. (2022) 28 fig. 7; large canidae: AZA Canid TAG (2012) 50; bears: AZA Bear Taxon Advisory Group (2019) 46-47. Sight restriction is also common in handling domestic cattle, who are especially sensitive to visual motion. See Grandin (1989). In the modern entertainment industry, racehorses will often wear blinkers to prevent the animals from getting distracted or startled by visual stimuli (*pers. obv.*).

experience, this strategy has proven to be effective in subduing especially dangerous species such as alligators and lions (*pers. obv*.) It may be the case that arena attendants used this blindfolding method for re-capturing certain animals after a show; however, at present, evidence for this does not exist.

3.3.4. Capture-Eliciting Devices

As stated earlier, one of the key objectives of environmental enrichment is to encourage increased activity and species-appropriate behaviours that are analogous to those which animals might perform in the wild. For big cat species, capture-eliciting devices (i.e., enrichment that simulates the movement of prey) are especially effective for stimulating hunting behaviours. For example, in some modern zoos zipline courses have successfully been introduced to cheetah exhibits as a way to encourage the animals to chase, attack, and capture artificial prey.[543] As with other big cats, cheetahs are cursorial predators; they stalk their prey up to a certain distance, then chase them down with an explosive burst of speed. The provisioning of a moving bait system therefore affords opportunities for the animals to perform locomotory activity associated with the chase phase of a hunt.

There would have been many components of a *venatio* that stimulated a chase from big cats. Fleeing animals, *noxii,* attendants, and *venatores* could all be perceived as prey by these animals, but some devices may have been specifically designed for this purpose. The small, two-wheeled carts depicted on the western frieze of the Zliten mosaic are both examples of potential capture-eliciting stimuli (Fig. 3b). The carts are unattested elsewhere in the iconography, so their function is not known for certain. Nevertheless, some important observations can be drawn from the mosaic. Firstly, it is clear from the actions of the attendant holding a long pole, which has been inserted into one of the carts, that the device was designed to be manually pushed into or around the arena.[544] Each cart supports only one *noxius,* so it was presumably manageable for one person to handle. The attendant navigating the cart on the right is shown bending his legs as he thrusts the cart towards a leopard who has leapt onto the *noxius.*[545] The second cart has been abandoned by the attendants, and for good reason: a leopard is already feasting on the criminal. From these interactions, we may deduce that one objective of the carts was to precipitate a chase from the leopards to ensure that they attacked the *noxii.* Since the carts were pushed manually, they were presumably not

[543] Quirke et al. (2013) 494. Mechanical lures are also used in greyhound coursing, which stimulates a chase based on visual rather than olfactory stimuli.
[544] Fagan (2016) 360.
[545] Vismara (2001, 48) agrees that the cart is being deliberately pushed by the attendant into the direction of the leopard, though she does not comment on the abandoned cart behind this interaction.

moving very fast. However, even at a slow speed they could probably stimulate a chase. Alternatively, the carts may have been used only for transporting condemned persons into the arena, though clearly this would not have had the same visual appeal as a chase.[546]

3.4. Auditory: Aversive or Instructional?

The rich and layered soundscape that characterised Roman spectacles exposed the animals to a wide range of auditory stimuli. Like exuberant fans at a football match, spectators expressed their excitement and favouritism towards performers through unified and spontaneous shouting, which was amplified by the enclosed features of the buildings.[547] Contributing to the noisy atmosphere were the distress calls from wild beasts who awaited their release. Such commotion must have generated considerable fear and confusion for the animals on the arena floor. It is no wonder that Probus' lions were reluctant to leave their cages (SHA *Prob.* 19).

3.4.1. Music

Music was another audible ingredient of the spectacles that affected animal behaviour. Musicians are often represented in the visual evidence accompanying chariot races, athletics, executions, *venationes,* and gladiatorial contests.[548] Fagan suggested that some musicians might have been tasked with dramatising the movements of performers and punctuating dramatic moments, like when a contestant fell.[549] Such a moment is depicted on a relief in the Glyptothek in Munich, where a defeated gladiator sits submissively below his opponent, who lifts his sword; to the left of the gladiators, two trumpets are raised in concert in anticipation

[546] Execution scenes on a 3rd century CE mosaic from the Sollertiana House in Thysdrus show attendants pushing criminals towards leopards without the assistance of the carts (Appendix III, Fig. 81).
[547] Claudius is reported to have encouraged vocalisations at his games and responded to the crowd's requests by granting freedom to certain gladiators (Suet. *Claud.* 21.5). Rhythmic chanting (*acclamationes*) was a particularly vital element of the games, as it helped reinforce collective identities and feelings of empowerment among the spectators. On the importance of communication at Roman spectacles, see Fagan (2011a) 146 and Parker (1999) 168-71. See also Aldrete (1999, esp. ch.3) on the versatility of acclamations at public games, and how they served to both praise and criticise the emperor at these events.
[548] For discussions of the practical, emotional, and ritualistic function of music in the amphitheatre, see Wille (1967) 202-4; Ville (1981) 372-75; Simpson (2000) 635-36; Fagan (2011a) 225-27; Coleman (2018); Morgan (2023) 215-24. Musicians were also essential to the *pompa* that preceded the spectacles. The deployment of musicians in this context is most clearly illustrated on a funerary relief from the necropolis outside the Porta di Stabia at Pompeii, preserved in the Museo Archeologico Nazionale, Naples. On the role of music in the *pompa,* see Wiedemann (1992) 94.
[549] Fagan (2011a) 226.

of the decisive blow.[550] Though no scores have survived in the historical records, it is possible that melodic motifs were associated with certain moves to guide the spectators' responses.[551] Blows may have been accompanied by exhilarating tunes that encouraged louder acclamations, and different stages of a fight might have been marked by various tones.[552] The most popular instruments employed in the arena were the *cornu* (horn), *tuba* (long trumpet), *tibia* (flute), *hydraulis* (water-organ), and percussion for keeping a steady beat (Juv. 3.34; Petron. *Sat.* 36.6; Ov. *Fast.* 6.657-60; Apul. *Met.* 10.31).[553] Particularly good representations of arena musicians are found on the south side of the Zliten mosaic, which depicts trumpet players, seated horn players, and a woman who plays a water-organ (Fig. 3e). A *cornicen* and organist are also paired together on a medallion surrounded by amphitheatre scenes on a Roman mosaic from Nennig in Germany (Fig. 128).

For most animals, music was probably perceived and experienced as an auditory stressor. Most species have evolved advanced sensory mechanisms which receive auditory stimuli that remain undetected by human receptors. This means that sound pressures generated from elements of the games, such as instrumentation, acclamations, and mechanical staging, would have been substantially greater and more pervasive for the animals than they were for the human performers. Many animals presumably froze from fear of these sounds, while others might have attempted to alleviate the stress by removing the source causing the noise. Tigers, for instance, were believed to grow especially fierce at the sound of beaten drums (Plut. *Mor.* 144E, 167C), just as lions and bears were maddened by the *mappa* (Sen. *Ira* 3.30.1).

Just as modern circus and zoo animals can become accustomed to loud noises from repeated exposure, so too may trained animals have learnt to endure aversive noises in the Roman *venationes*.[554] In some performances, music may have even served as an accompaniment to animate the animals' routines. Sometime in the late 3rd century CE, the emperor Carus staged a spectacular series of games in Rome with displays from tightrope walkers, wall climbers, pantomimists, actors, gymnasts, musicians, and dancing bears (SHA *Car.* 19). The SHA specifies that 400 musicians were present at these games, including trumpet players, horn-blowers, and flautists. The text does not mention in what capacity the

[550] See Coleman (2018, 2-3) for a discussion of this relief and similar iconography depicting musicians accompanying violent spectacles.
[551] Fagan (2011a) 226-27. It has also been suggested that music was used for imitating or cloaking the cries of injured performers. For discussion see Simpson (2000) 635.
[552] According to Philostratus, the flute accompanied jumpers who carried a weight (*halter*) in the Greek pentathletics, since it was believed that the sound made him appear lighter (Philostr. *Gym.* 55).
[553] On the iconography of these instruments in Roman art, see Alexandrescu (2007).
[554] For comprehensive reviews on the effects of zoo visitors and associated auditory stressors on captive primates, see Hosey (2000) and Birke (2002). On big cats specifically, see Spiezio et al. (2023). On the effects of noise levels in zoos on mammal behaviour generally, see Quadros et al. (2014).

musicians performed; however, some may have supported the bears' act by anthropomorphising their movements, such as when they stood or walked on their hind legs like humans.[555] Thus music, as an accompaniment, helped to create the pretence that the animals were in fact professional dancers.

There is some literary evidence to suggest that the Romans trained domestic and captive-wild animals to respond to musical cues, often in agricultural or military settings. Varro once marvelled at the sight of stags, boars, and other wildlife responding to the sound of horns during feeding time on a private game-park owned by Quintus Hortensius (Varro, *Rust.* 3.13). The keeper, Varro informs us, was adorned with a robe and harp as if he were Orpheus, and even insisted on his guests referring to him as such.[556] This spectacle made such an impression on Varro that he considered it on a par with the *venationes* held in the Circus Maximus, though without *Africanae*. According to Pliny the Elder, the cavalry of the army of Sybaris in southern Italy had allegedly been trained to perform a ballet to the accompaniment of a band (Plin. *NH* 8.64, cf. Ath. 12.19), and Martial composed an epigram about an Asturian horse from Spain who could stamp her hooves to a rhythm (Mart. *Ep.* 14.199). Similar feats have been observed in the modern equestrian circus, where horses trot, canter, or gallop to musical ensembles.

The elephant was another animal that was renowned for its musicality in both ancient and modern times. Strabo reported that in India, war elephants were trained to obey orders that were communicated through the sound of beaten drums (Strab. 15.42). Similar methods are still used for training elephants in Thailand at the annual Surin Round-up Festival, which has its origins in the royal hunts conducted in the Surin Province during medieval times. During this festival, hundreds of elephants from all over the country are brought together to re-enact historical battles (Fig. 128).[557] The event is as much an auditory spectacle as it is visual, featuring choirs, musicians, and cannons, all of which are tolerated by the performing elephants. Drums and other musical accompaniments are central to the displays and assist the elephants by setting the pace for the mock combats.

Our best evidence for the use of music as an instructional cue in the Roman *venationes* is the show produced by Germanicus in 12 CE, which featured a troupe of highly trained elephants who swayed and marched in time to a rhythmical dance (see also chapter 2 section 2.6.1 for a discussion of this display). Fictionalised though it may be, Aelian's description of the spectacle reveals some underlying truths about the musicality of these animals. Musical

[555] This may have been the function of the musical instruments shown alongside the bears (CRVDELIS and OMICIA) and *venatores* (BONIFA [TIUS] and F…S) on a mosaic from the Maison du Paon at Carthage.
[556] Cf. Mart. *Ep.* 14.166, *Spect.* 24 and 25.
[557] Ringis (1996) 28.

accompaniments are not specified by Aelian; however, they are strongly implied, for he attributes the elephants' immaculate performance to their tractability and fondness for music (Ael. *NA* 2.11):

> χορείαν γὰρ καὶ ὀρχηστικὴν καὶ βαίνειν πρὸς ῥυθμὸν καὶ αὐλοῦ ἁσμένως ἀκούειν καὶ συνιέναι ἤχων διαφοράς, ἢ βραδύνειν ἐνδιδόντων ἢ ταχύνειν παρορμώντων, μαθὼν οἶδεν ἐλέφας, καὶ ἀκριβοῖ καὶ οὐ σφάλλεται.
>
> The movements of a chorus, the steps of a dance, how to march in time, how to enjoy the sound of flutes, how to distinguish notes, when to slacken pace as permitted or when to quicken at command – all these things the elephant has learnt and knows how to do, and does accurately without making mistakes.[558]

In the passage above, Aelian suggests that the elephants were able to execute such complex movements because of their innate appreciation for, and understanding of, music and rhythm. He even compares the elephants' rhythmic gift with that of musical specialists such as Damon, Spintharus, Aristoxenus, and Philoxenus. From this, we may deduce that musicians were likely to have accompanied the elephants' performance.

The Surin Round-up Festival in Thailand attests that elephants are capable of understanding rhythm. Empirical studies on elephant behaviour have also shown that elephants are capable of perceiving music and moving in rhythmic synchrony with melodic beats (BPS).[559] In fact, the phenomenon of musicality in elephants has been readily exploited by entertainment industries for centuries and across different cultures. Dancing elephants were particularly popular acts in European and North American circuses during the early 20th century.[560] In 1942 the Ringling Bros. Barnum & Bailey Circus staged the famous Circus Polka, which featured fifty elephants dressed in decorative frills simulating professional dancers to the accompaniment of music composed by Igor Stravinsky (Fig. 129).[561] One of the acts involved the animals stamping in time to a beat while holding each other's tail with their trunk as if they were ballerinas linking arms. Although the animals had been taught the dance,

[558] Trans. Scholfield (1958) 100-2.
[559] BPS: Beat Perception and Synchronisation. See Patel et al. (2009) 872. Experiments from the early 1980s identified harmonic discrimination abilities in pigeons, who were trained to respond to various styles of classical composers. See Porter and Neuringer (1984). More recently, certain primate species have exhibited preferences for consonant versus dissonant music. See Mingle et al. (2014). Non-vocal learning species, such as the California sea lion, have also been observed performing trained and spontaneous entrainment. For examples see Cook et al. (2013). For relevant studies on biomusicology, see Gupfinger and Kaltenbrunner (2018) and Hoeschele et al. (2015).
[560] Tait (2012) 74-107. See also chapter 2 section 2.6.1 for discussion of the suitability of elephants in Euro-American circus acts of the 19th and 20th century.
[561] Tait (2012) 81.

sources report that the circus band sometimes had to alter its tempo to match the elephants' pace, particularly when the animals became nervous and raced through the choreography.[562] The role of instrumentation in this instance was two-fold: it animated the elephants' movements and guided them through what appeared to be a highly complex choreography and orchestration. Modern testimonies of the elephant's rhythmic cognition suggest that Germanicus' elephants were at least *capable* of learning how to entrain their locomotion to auditory accompaniments, if indeed the performance took place. Aelian mentions that the elephants had received training in Italy from an experienced handler when they were calves, during which time they may have learnt how to discriminate auditory patterns.

The exploitation of music as a tool to guide animals in the *venationes* raises an important practical issue. As Coleman has pointed out in her study on music in the amphitheatre, exactly where the musicians stood in relation to the performance is never represented in the artistic evidence.[563] If their function was to provide cues and accompaniment for the animals, as some musicians appear to have done in the gladiatorial contests, then we might suppose they were stationed somewhere on the arena floor: close enough for the animals to hear the cues, not so close as to put them in direct line of danger if the animals unexpectedly turned aggressive. Even highly trained elephants were liable to stampede in panic from frightening or novel stimuli. The logistics of Germanicus' spectacle, indeed its historicity, remains speculative.

Many scholars have argued that spectators and human performers were highly sensitive and responsive to the emotional effect of music in the arena, but so too were the animals. Although the relationship between musicians and animals remains inconclusive, we know from ethology that, as a result of their biology, most animals would have probably perceived and experienced music, along with other noises in the arena, as auditory stressors. This may have aggravated the already tense environment, causing some animals to freeze in fear or launch an attack on nearby performers. We also know from comparative material that certain species, like the elephant, were capable of performing learnt or spontaneous entrainment, a skill which afforded the Romans opportunities to exploit the elephant for theatrical effect. In such instances musicians were likely deployed to guide or anthropomorphise the animals' behaviours, perhaps even altering their tempo in accordance with the animals' pace and thus affording them *some* agency in the performance.

[562] Forum Angel Corella: https://forumangelcorella.weebly.com/circus-polka.html.
[563] Coleman (2018) 26-27.

3.5. Olfactory: Penetrating Smells

Many Greek and Roman writers were mindful of the olfactory acuity of animals and frequently capitalised on their own inferior sense of smell compared to that of animals. Aristotle considered smell to be the weakest out of the human senses (Arist. *Sens.* 441a 1-2, *Hist. an.* 2.421a 10-12), and Lucretius looked towards the animal kingdom, rather than humankind, to understand the physics of smell (Lucr. 4.673-705).[564] Some animals were celebrated for their ability to navigate nutritious substances using scent (Lucr. 4.684-6; Plin. *NH.* 10.279; Plut. *Mor.* 87E, 710E; Ael. *NA* 3.7, 4.18.), others for their ability to repel predators using their own robust aroma (Plin. *NH* 8.23 on leopards; 8.56, 30.21 on hedgehogs; 8.57 on lynxes and badgers). Certain species were thought to be particularly sensitive to odours. Hunting dogs, as we have already seen, were widely praised for their keen sense of smell (Xen. *Cyn.* 4.5.8), as were elephants who, of all animals, possessed the most dynamic nose. The elephant's love of fragrances was common knowledge among natural and scientific writers such as Aristotle, Pliny the Elder, Aelian, and Galen. However, what impressed them most was the trunk's multisensory function as a hand, mouth, and nose (Arist. *Part. an.* 659a, *Hist. an.* 429b 13-21; Plin. *NH* 8.9, 8.29; Ael. *NA* 1.38, 9.56, 13.8; Gal. *UP* 17.1).

Given their sensitivity to scent, animals were likely the most affected by the pungent smells that permeated the air at the Roman *venationes.* Some *editores* had saffron mist sprayed over the *cavea* to cloak the stench of sweat and blood, but this was very much for the spectators' benefits, not the performers'.[565] Even so, the scent of perfume could have been just as pervasive for the animals as the smell of bodily fluids. Some attendants were tasked with raking the blood and urine-soaked sand but, unless fresh substance was dispersed throughout the arena floor, such efforts might have actually had the reverse effect of releasing foul odours (Mart. *Ep.* 2.75). The lingering of novel or predatory smells presumably deterred some species, particularly herbivores, from going near certain areas of the arena. While invisible to the spectators, olfactory stimuli almost certainly created barriers for the animals.

3.5.1. Biostimulation

There are some recorded instances where olfaction was deliberately manipulated to influence animal behaviour in the games at Rome. During the reign of Nero, a group of

[564] This judgement was echoed by Aristotle's pupil, Theophrastus, who acknowledged the superiority of animal olfaction over the human sense of smell (Theophr. *Sens.* 4). See Johansen (1996) and Baltussen (2015) 40-42 on Aristotle and smell.
[565] Calp. *Ecl.* 7.71-2; Lucr. 2.416-17; Mart. *Spect.* 3, *Ep.* 3.8; Apul. *Met.* 10.34; Ov. *Ars am.* 1.104; Plin. *NH* 21.33.

Christians were allegedly forced to wear animal skins in a public spectacle as a lure to attract the attention of hunting dogs (Tac. *Ann.* 15.44). The *venator* holding a curved sword on a mosaic from the Maison des Autruches in Hadrumetum is also cloaked in an animal skin (Fig. 75). This technique may have been inspired by a similar method used by hunters, who wore deer skins either as a disguise for when stalking herbivores or as bait to entice predators towards a trap (Plut. *Mor.* 330B).[566]

A far more complex use of animal skins might have been attempted in an execution recorded by Martial, where a bull was forced to copulate with a criminal disguised as Pasiphae in the Colosseum (Mart. *Spect.* 6). Coleman proposed the compelling theory that 'Pasiphae' was cloaked in a cowhide and rubbed with oestrus fluids as a strategy to stimulate the bull to mount the woman.[567] This process is known as 'biostimulation' in animal science. Biostimulation is a common strategy employed in livestock management for controlling and enhancing reproductive performance in bovine and ungulate species. Experimental studies on chemical communication in cattle have reported that precopulatory behaviours are significantly influenced by chemosignals produced by cows when they are in heat (oestrus).[568] Bulls detect oestrus by performing a behaviour known as 'Flehmen', which helps them to perceive olfactory signals from urine, faeces, saliva, and other bodily fluids (Fig. 130).[569] Pheromone detection is vital for hormonal stimulation as it enables the bull to discriminate oestrus from non-oestrus cows and mate successfully. Livestock industries widely exploit the chemosensory systems of cattle by stimulating bulls with excretory products to control, and thus maximise, reproductive performance.[570] Significantly, experimental studies on cattle pheromones have also reported that dummy cows containing oestrus urine are effective in inducing reproductive behaviours.[571] This indicates that fresh fluids are not necessary for the perception of chemosignals. It also means that a bull can be stimulated to perform Flehmen without the presence of a live cow.

Thus, all that was needed in the arena was a ready supply of excretory products that could be rubbed onto 'Pasiphae' or onto her costume (i.e., the cowhide) prior to the

[566] The hides of harvested animals continue to be used by modern-day hunters in North America as effective tools for baiting predators, such as coyote, bobcats, and foxes. Food substances wrapped in animal hides can also be a form of olfactory enrichment to stimulate hunting behaviour in captive carnivores (*pers. obv.*).
[567] Coleman (1990) 64, (2006) 65. It is interesting to note that the woman who paid a large price to sleep with Lucius (in the form of an ass) in Apuleius' *Metamorphoses*, and who was compared with Pasiphae, was lavishly anointed with fragrances and balsam oil to arouse Lucius (Apul. *Met.* 10.21). This may allude to the importance of odour in stimulating animal copulation. Cf. Apul. *Met.* 10.34.
[568] Archunan et al. (2014).
[569] Flehmen behaviour involves the cattle baring gums, wrinkling the nose, and retracting the upper lip.
[570] Archunan et al. (2014) 461.
[571] Archunan and Rameshkumar (2012).

spectacle.[572] If this method was used, the fluid and/or hide might have been obtained from the same source that supplied the bull. Indeed, there is evidence to suggest that olfactory stimulation was employed by Roman farmers in livestock management. Columella, for instance, advised farmers to rub the nose of new cattle and sprinkle unmixed wine onto their hides so that they might learn to recognise their master by his scent (Columella, *Rust.* 6.2.5-6). Similar strategies allegedly worked for stimulating copulation between livestock. Aelian suggested rubbing perfume and other ointments onto the nostrils and chin of a goat to encourage reproductive behaviour (Ael. *NA* 9.54). The scent of a female ass was thought to have the same arousing effect on a stallion before it would be paired with a mare (Columella, *Rust.* 6.36.4). On the other hand, the scent of a lamp-wick apparently had the powerful effect of causing mares to miscarry (cf. Arist. *Hist. an.* 604b 30). Whether or not these strategies actually worked is irrelevant; what they suggest is that odour was recognised and exploited by the Romans as a stimulus for manipulating animal behaviour. Theoretically, by taking advantage of the bull's chemosensory systems the Romans may have succeeded in re-creating the myth of Pasiphae and the bull.

3.6. Gustatory: Delayed Gratification

The discussion so far has focused on how animals might have responded to stimuli from the external environment (e.g., physical stimulation, movement, music, odours). However, animal behaviour is also affected by the physiological and neurological workings going on inside the animals. Hunger is without question the most powerful internal stimulus that motivates behaviour.[573] Studies have shown that when hunger intensifies from food deprivation or malnourishment an animal is more likely to be indiscriminate with their food consumption while, conversely, satiation decreases the range of objects that are accepted as food.[574] In this respect, if predators in the arena were withheld food for a long period, there was a greater chance that they might predate on something that was not their typical food source, such as humans.

While there are some references to 'man-eating' animals in ancient literature, we need not speculate that predators wholly consumed the bodies of human victims.[575] Most

[572] Coleman theorised that the urine might have been smeared onto the criminal's genitalia (1990) 64, (2006) 65.
[573] Burnett et al. (2016) 187.
[574] Curio (1976) 12. For specific case studies, see Kniprath (1969) on kingfishers; Beukema (1968) on sticklebacks. Aelian recorded the octopus' extreme and unusual habit of eating its own tentacles during periods of hunger when prey was difficult to come by (Ael. *NA* 1.27).
[575] See Ael. *NA* 12.41 on man-eating crocodiles; Amm. Marc. 29.3.9 on the man-eating she-bears of Valentinian I; Cass. Dio 60.13.5 on the man-eating lion ordered to death by Claudius.

descriptions of *damnatio ad bestias* reveal that the animals tore, gouged, or mutilated the condemned; rarely do the animals actually consume and digest the bodies. Martial, for instance, commonly employs the verb *lacerare* ('to lacerate', 'mangle') to describe the savage actions of bears that were set upon criminals dressed in mythological attire (Mart. *Spect.* 9 'Laureolus', *Spect.* 10 'Daedalus', *Spect.* 24 'Orpheus', cf. *Spect.* 21 tigress mauls a lion). One of the alleged 'man-eating' (*hominum ambestrices*) she-bears owned by Valentinian I was released back into the wild after the bear had torn apart enough corpses for burial (*post multas quas eius* ***laniatu*** *cadaverum viderat sepulturas…*) (Amm. Marc. 29.3.9). The tearing apart of human (and animal) flesh is prevalent in the iconography of *damnatio ad bestias*; however, never do we see whole corpses being eaten. The criminals gathered for Democharès' spectacle in Apuleius' *Metamorphoses* were expected to provide a "banquet of themselves to fatten the beasts", figuratively speaking (Apul. *Met.* 4.13 cf. Artem. 2.54 the *venator* "nourishes the beasts with his own flesh"). In this instance, the image of a human banquet was more likely intended to evoke the horrors of the arena, rather than to suggest a literal feasting on human flesh.[576]

Contrary to popular belief, there is relatively little evidence that suggests wild beasts were starved prior to their release into the arena. Animals need food to convert into energy, without adequate sustenance the animals would not have been able to perform the roles that were expected of them. Aelian mentions starvation as an effective method for draining the excessive strength of captured elephants, for by this means the animals "gradually reduce their spirit and their inflexible determination, so that they forget their hitherto indomitable fierceness and abandon their former temper" (Ael. *NA* 10.10; cf. Plin. *NH* 8.7). Similarly, Philo of Alexandria suggested that temporarily withholding food from elephants during training made them more compliant with their *magister* (*De anim.* 90; cf. Columella, *Rust.* 6.2.11-12 on fasting livestock).[577] Most animals who appeared in the *venationes,* however, *were* expected to retain their fierceness, especially in the hunts and executions. In this respect, depriving predators of food may not have been the most effective strategy.

In fact, there is some literary evidence indicating that *editores* placed considerable importance on feeding their animals in the lead-up to a spectacle. Caligula allegedly fed

[576] Fears of consumption and digestion by wild beasts found particular expression in Christian literature, where it was closely linked with resurrection. Early Christian writers such as Tatianus and Tertullian were especially disturbed by the spectators' cannibalistic consumption of wild beasts, who had previously fed on human victims (Tatianus, *Ad. Gr.* 23.3.27; Tert. *De Spect.* 2.13.85). For discussions of Christianity, cannibalism, and the games, see Gilhus (2006) 200 and Devoe (1987) esp. ch. 5. See also Arrowsmith (1966, 315) on the theme of cannibalism and performing animals in Petronius' *Satyricon.*
[577] Diodorus Siculus (3.36-37) believed that a large snake in possession of Ptolemy II was made tame by meagre feeding. However, as Jennison (1937, 36) rightly pointed out, the effects of underfeeding (i.e., weakness) might have been "mistaken for tameness".

criminals to his private collection of wild beasts as a substitute for cattle meat due to the high costs of food (Suet. *Calig.* 27). Notwithstanding the credibility of this report, it suggests that the expenditure of food for performing animals was a serious and costly business.[578] Epplett speculated that the carcasses of animals killed in the arena, particularly those of stags and boars, may have been fed to carnivores in the city's animal enclosures as a cost-saving measure. By this means, the amount of meat that was purchased by officials tasked with feeding the animals could have been reduced.[579] Although the literary evidence for this practice does not exist, it seems highly possible given the expense of meat in Antiquity.[580] It was previously noted that Symmachus dispatched a large group of crocodiles, which he had painstakingly obtained for his son's praetorian games, after the animals refused to eat for fifty days (Symm. *Ep.* 6.43; see chapter 1 section 1.3). The extremity of this action suggests that Symmachus felt it was important that the crocodiles were sustained for the upcoming games and, further, that he believed the animals were unlikely to put on a good display in their current 'emaciated' state.[581] By ordering the crocodiles to be killed, Symmachus removed the risk of public humiliation if their subsequent performances turned out to be a disappointment, as was the case with Probus' lions.

While the likelihood of animals entering the arena with full bellies seems doubtful, the provision of food was evidently an important aspect of their management. Food may have even been incorporated into the design of the *venationes* themselves as bait to lure the animals into certain areas of the arena. Evidence for the use of fresh meat to attract wild beasts is clearly represented on a 4th century CE mosaic discovered on the Esquiline Hill depicting a bear hunt (Fig. 131).[582] The scene shows hunters and dogs driving a group of bears towards a man who stands above an open crate holding up a sliding door; a ramp leads into the crate while a large piece of ham dangles in the doorway. A bear, whose eyes appear fixed on the ham, is about to advance up the ramp. Since bears have the habit of eating little but often in the wild, they are especially responsive to food stimuli.[583] The manipulation of food

[578] Kyle (1988, 186) interpreted this serious allegation made by Suetonius to suggest that arena animals were typically fed non-human meat. In other words, they did not feed on the victims of the arena.
[579] Epplett (2001a) 102.
[580] While MacKinnon does not go into detail about the specific costs of meat, he provides an excellent discussion of the provision of food for wild beasts during other stages of their exploitation, such as their transportation to the arenas. See MacKinnon (2006) 12, 19-20.
[581] Cf. Democharis, who tended to his bears with the utmost care (*sollicite nutriebat*) but could not revive them after they fell ill from the poor conditions of captivity (Apul. *Met.* 4.14).
[582] The hunting scenes are highly reminiscent of those of the Bear Hunt mosaic from Campania (Fig. 23) and the exquisite 'Great Hunt' mosaic from Piazza Armerina, Sicily (Fig. 1).
[583] Hediger (1968) 123.

is one of the most commonly used forms of enrichment in modern bear exhibits for this very reason.[584]

Big cats are also opportunistic feeders and will respond optimally to food. A similar representation to that mentioned above is illustrated on an early 4th century CE hunting mosaic from Dermech, Carthage (Fig. 132). On the top left corner, a lioness is enticed into a crate by a goat exposed as bait, where a hunter kneels ready to drop the trapdoor. The use of live kids or lambs to attract big cats is also mentioned in the hunting texts ascribed to Oppian (*Cyn.* 4.77-111, 212-229; *Hal.* 3.386-395). Once fastened to a crate or similar trap, the sound of the animal bleating in pain or from fear of its surroundings would lure the predators towards the decoy. Groups of sheep and goats on the hunting mosaic from Annaba, mentioned earlier, might also allude to the use of live bait to attract big cats. Such prey could have also been consumed at a later stage by carnivores on their journey to the arena. Though we have no evidence of live bait being used in the *venationes* themselves, *editores* who could afford to provision their games with meat might have done so.

What we should imagine, therefore, is that most animals probably entered the arena hungry to some degree, some possibly malnourished, but not completely starved. With increased hunger, predators such as bears and big cats would have been more responsive to food stimuli and less selective with their prey, to a point where even a human tied to a stake might have been perceived as an acceptable source of food.

3.7. Conclusion: Considering Wild Sensibilities

Animals, like humans, use their keen senses to adapt to, engage with, and extract information from their immediate environment. Different species of animals rely more heavily on different sense receptors to find prey, interact with mates, and avoid threats, which also means they perceive the world in vastly different ways. Such diversity in animals brings a myriad of challenges when it comes to understanding *their* experiences in the *venationes*. However, to dismiss these experiences and their historical significance to the Roman games would be, as Haraway once argued, a denial of the shared and often messy entanglements between humans and non-human animals.[585] This chapter aimed to provide new, interdisciplinary interpretations of the types of entanglements that took shape inside the arena by considering how human performers benefited from the animals' sensory engagement with the games. Using environmental enrichment as a model for animal stimulation, this chapter found that sensory information associated with touch, sight, sound,

[584] Shepherdson (2013) 399-400.
[585] Haraway (2008) 226-27.

smell, and taste were probably manipulated by animal handlers, attendants, and *venatores*. If we assume from the previous chapter that each animal was given a particular role to play in the arena, it seems reasonable that these strategies were deliberate attempts to elicit behaviours that were appropriate to those roles. Thus, animals cast as quarry, combatants, or executioners were often provoked using aversive or enticing stimuli that induced aggression or predation.

While some stimuli, such as the whip, were valued for their versatility, others were instrumental in bringing about a specific response from the animals. The *pila,* for example, was explicitly associated with bulls as its visual properties stimulated charging, tossing, and bucking behaviour. Similarly, it was argued that music could have been deployed as an auditory cue in some elephant displays because of the animal's capability of learnt entrainment. The unique sensory orientations of different species thus afforded human performers opportunities to heighten the intensity of the animals' responses. Evidently, some degree of empirical knowledge of animal behaviour was required to execute this effectively. It is therefore unsurprising that many of the same strategies that were used to incite these behaviours were also found in other contexts of Roman-animal interactions, particularly in livestock management and hunting activities. The ingenuity of the Romans was in their ability to adapt these strategies to work on a more diverse and dangerous group of animals and in nuanced ways.

Not all strategies worked on the animals as anticipated and, on some occasions, attempts to control the animals collapsed unexpectedly and spectacularly. Martial, among other alleged eyewitnesses at the games, was not shy of highlighting accidents that occurred in the arena. Evidently, such incidents were just as exciting for the spectators. However, they were also a reminder that animals had the power to resist conditions in the arena which they did not like and influence the development and outcome of a performance. Indeed, it was often the case that stimulation was administered *in response* to the animals' refusal to cooperate. This suggests that, however unequal the power relations between man and beast on the arena floor, both parties had a strong influence on events that unfolded during a performance.

The sensory approach taken here to extrapolate the animals' experiences is naturally limited by the lack of empirical observation of the historical animal actors and the limitations our own unique perception of the sensory world. However, some understanding can be developed of how animals in the arena may have thought and behaved by considering their affective encounters. By recognising that animal sensibilities played *some* part in shaping these encounters, we can better appreciate their active role in spectacle design.

CHAPTER 4.

To Spear or to Spare? Practical Considerations of *Venationes* in Late Antiquity

This final chapter focuses on practical considerations governing the *venationes* staged from the late 3rd century CE to the early 6th century CE, when animal displays ceased altogether. The reason for this focus comes down to the shifting economic, political, and environmental climate of the later Empire, which had a profound impact on the exploitation of animals for spectacle; from the venues they appeared in (chapter 1), to the roles they played (chapter 2), and their interactions with human performers (chapter 3).

One of the most notable changes in the later *venationes* is that many performances were significantly reduced in size, often to one-on-one human-animal interactions that rarely ended with the animals' deaths. Hunting displays were still periodically held in both western and eastern parts of the Empire in association with consular appointments and the imperial cult. However, much of the evidence from this period attests to a significant shift towards more intimate types of displays that placed a greater emphasis on provoking the animals rather than killing them. Another important shift is the range of species being exploited for spectacle. The large variety of exotic animals that characterised the late Republican and early imperial games seems to have no longer been readily available to *editores.* Instead, bears emerged as popular candidates for public games throughout much of the Mediterranean, where such animals could be sourced locally.

These changes to spectacle design raise a number of important questions regarding the exploitation of wild beasts in Late Antiquity: what new expectations did Roman spectators have of both human *and* animal performers, now that killing animals was no longer the primary objective? How did *editores* benefit from using animals in repeat shows and what were their motives for sparing them? Why were bears so often represented in the late arena games, and what about these animals made them so appealing to exploit? Finally, in what ways did the shifting economic and environmental climate of the later Empire contribute to the shaping of small-scale *venationes?* This chapter will trace some of these developments by first examining the objectives of the later *venationes,* which I term 'games of evasion'. This will be followed by an examination of the possible motives for these changes, with consideration given to the growing pressures on wildlife trafficking, particularly in the western Empire, and whether or not the animals' biological demands exacerbated challenges in supply. A discussion on bears and their ability to meet the kinaesthetic demands of the later *venationes* concludes the chapter.

4.1. Games of Evasion

An early 4th century CE marble relief from Sofia in Bulgaria represents a curious medley of human-animal and animal-animal interactions which provides a good starting-point for our inquiry (Fig. 2). A basic, though important, observation from the relief is that bears figure in almost all the interactions. From the top of the relief moving clockwise, bears are shown interacting with a pole-vaulter, a bear-baiter wearing boxing gloves, and a performer who hides behind a rotating screen called a *cochlea.* One-on-one combats between bears and bulls occupy the bottom corners of the relief, while a fight between a bear, a crocodile, and a heavily armed beast fighter takes place at the centre. Directly above the latter interaction, a stag bolts towards the right with a bear in tow, and another bear falls upon a performer who holds a whip and *mappa.* At the centre bottom, a curious farce involving a seated bear-cub (?) and small, costumed figures, possibly apes dressed in human clothes or children wearing simian masks, takes place on a raised stage.[586] To the left of the stage, another of these unusual figures hastens towards the right on horseback.

The Sofia relief provides an informative composite picture of some of the repertoires of *venationes* that were trending in the late imperial spectacles. We still see many of the familiar displays from earlier periods such as hunts, combats between bears and their traditional opponent, the bull, and farces with trained animals. The relief also shows other varieties of human performers, whose aim was to provoke the animals and evade capture by means of speed, agility, and deception (Cassiod. *Var.* 5.42.1). Many of these performers, such as the individual wielding the *cochlea,* employed a variety of non-lethal apparatuses that were specially designed to excite frustration in the animals, rather than maim them. Consequently, this placed the performers in greater danger, which often gave the animals the upper hand in a combat.

Unfortunately, little is known about the lives of these performers from the extant evidence. Epplett called them "animal acrobats"[587] for reason that they often performed acrobatic skits (such as pole vaulting and tightrope walking) in the company of animals. It is quite possible that some were professional acrobats, such as the *salitores* ("leapers"), who may have been hired on occasion to participate in the *venationes* (below, 4.1.1). Bomgardner envisaged them as "roving entertainers"[588] who moved around cities much like a modern travelling circus. In ancient literature, they are sometimes referred to as *bestiarii,* although this covered a broad group of individuals who worked with animals. Based on iconographic

[586] On the possible identity of these small figures, see Toynbee (1973) 97-98 and Fagan (2016) 359.
[587] Epplett (2001a) 92-96.
[588] Bomgardner (2000) 224.

evidence, they had very little in the way of protecting themselves from the animals. Some wore long loose tunics, but there is little indication of leg or arm padding (with the exception of the boxer) nor do they wield offensive weapons. The lack of bodily protection may have stemmed from the need to remain flexible in their exercises. At most, some performers, such as the fallen individual on the Sofia relief, held a whip and *mappa* depending on the nature of their exercise. As noted in the previous chapter, the whip and *mappa* were both common tools used for getting the animals' attention by means of tactile or visual stimulation. It is likely that they maintained this important function in the late imperial games.

Parallels for the representations from the Sofia relief survive in a wide range of material evidence from Late Antiquity, including oil lamps, relief art, coinage, and wall paintings. Most informative are the richly decorated diptychs of the consuls Areobindus (506 CE; Figs. 134-136) and Anastasius (517 CE; Figs. 137-138). Consular diptychs were private productions of the 4th-6th centuries CE that commemorated public activities sponsored by Roman magistrates, most often in Constantinople and Rome, in connection with appointment to high office.[589] Each diptych consisted of two hinged plaques; the outer face was often richly carved with acts of generosity by the benefactor, such as public games and gift distribution.[590] Their material alone made them expensive objects; most were made of ivory carved from especially large elephant tusks, though cheaper materials such as terracotta were also used by less eminent officials.[591] From the Letters of Symmachus, we learn that diptychs were distributed by *editores* as gifts or souvenirs to close friends (Symm. *Ep.* 7.76), suppliers who contributed performers or equipment towards the displays (*Ep.* 2.81), and even contacts who missed the events.

By their very nature, diptychs are particularly useful for dating the activities that they represent. Those commissioned by Areobindus and Anastasius provide a composite portrayal of the full range of spectacles that could have been offered by the consuls, presumably during their respective consulships. The selection of spectacles offers an invaluable insight into the relative prestige that each carried; the prominent position which *venationes* are given in the diptychs' imagery suggests that animal displays were one of the most prestigious offerings.[592] The human-animal interactions are exceptional for their variety, but they also point to the imminent risk of human life. As will be shown below, more often than not it was the animals who appeared triumphant in their efforts to capture their taunters. Although many of the

[589] Cameron (2013) 182.
[590] Olovsdotter (2005) 114. Scenes from the arena including *venationes,* acrobatic contests, and pantomimes were especially popular in diptychs from the eastern Empire, while images of chariot-racing were favoured in the west.
[591] Dunbabin (2016) 240-41.
[592] Dunbabin (2016) 257.

same dangers could be found in the traditional hunting spectacles, the diptychs convey important attitudinal changes towards the exhibition value of both human and animal performers.

The study of these hair-raising feats has been greatly aided by a letter written in the early 6th century CE by the Ostrogothic King Theodoric to the consul Maximus. The correspondence is preserved in a collection of letters (*Variae Epistulae*) composed by the Roman statesman Cassiodorus, who served Theodoric's government in Rome. Letter 5.42 records the exercises of at least five different types of animal acrobats who performed at the *ludi* that Maximus staged in Rome for his consulship in 523 CE. Remarkably, these appear to be the same class of performers that are illustrated on the diptychs of Areobindus and Anastasius. As with these illustrations, Theodoric's letter is filled with tantalising details of the unavoidable risks that performers were expected to take for the sake of entertainment. Not everyone appreciated the inherent dangers of these exercises. Near the beginning of his letter, Theodoric expresses his displeasure at watching the performers risk their lives to satisfy the crowds, who secretly wished for them to get caught (Cassiod. *Var* 5.42.1):

> *Voluptatem praestat sanguine suo et infelici sorte constrictus festinat populo placere, qui eum non optat evadere. actus detestabilis, certamen infelix cum feris velle contendere, quas fortiores se non dubitat invenire.*
>
> He offers pleasure with his own blood and, constrained by an unfortunate lot, he hastens to please the people, who do not wish him to escape. A detestable act, an unlucky battle, to want to contend with beasts, which he does not doubt he will find stronger than himself.[593]

In a later passage, the king raises concerns about the payment of performers for their labours: "If there would be any consideration for equity, as much wealth ought to be given for the life of men as seems to be poured into their deaths" (Cassiod. *Var.* 5.42.12). Cruel though they were, games of evasion afforded human performers opportunities to show off their mastery at cheating death without the aid of traditional weapons.

While similar types of interactions had periodically been staged in Rome and in the provinces as early as the 1st century BCE, they are more prevalent in the evidence of the later periods. This strongly suggests that *editores* increasingly placed a higher premium on the lives of animals. Possible reasons for this will be discussed in the following section; here, it will suffice to say that the evasion of death had now become a purely human objective. Naturally,

[593] All passages from Letter 5.42 are translated by Bjornlie (2019) 240-42.

with this came new strategies of engaging the animals and stimulating them to actively participate.

4.1.1. Pole Vaulting

> *Prinms fragili ligno confisus currit ad ora beluarum et illud, quod cupit evadere, magno inpetu videtur appetere. pari in se cursu festinant et praedator et praeda nec aliter tutus esse potest, nisi huic, quem vitare cupit, occurrerit. tunc in aere saltu corporis elevato quasi vestes levissimae supinata membra iaciuntur et quidam arcus corporeus supra beluam libratus, dum moras discedendi facit, sub ipso velocitas ferina discedit.*
>
> The first man, trusting in a slender beam, rushes upon the mouths of beasts, and he is seen to head for that which he hopes to evade with great impetus. Both predator and prey hasten upon each other in equal speed; nor is it possible for the one to be safe, except that he should meet in that spot the beast that he desires to escape. Then, with an elevated leap of the body, his upward prone limbs are cast into the air, as though the lightest of cloth, and poised in a kind of corporeal vault above the beasts, the onslaught of the animals passes under him, while he makes a delay of descending. (Cassiod. *Var.* 5.42.6)

The first type of exercise mentioned by Theodoric in his letter to Maximus is that of pole vaulting (*contomonobolon*), which was performed by acrobats known from the *Corpus Glossariorum Latinorum* as *salitores* ("leapers").[594] Pole vaulting is listed in the *Corpus Juris Civilis* as one of the five games of chance regulated by the emperor Justinian I in the early 6th century CE, around the same time when Theodoric may have seen it performed in Rome (*Cod.* 3.43.3). *Salitores* chanced their luck at dodging claws or horns by hurling themselves over a charging animal, often with the aid of a flexible pole (*contus*) which was driven into the ground. Theodoric emphasises that, to successfully execute this manoeuvre, both man and beast had to follow through with their charge at equal speed, otherwise the *salitor* risked landing directly on the animal. By this means, the performer would have forced his way into the animal's critical distance, thereby stimulating immediate fight responses; for instance, charging, leaping, bunting, or bucking behaviour, depending on the species.

Excellent representations of *contomonobolon* are preserved on the diptychs of Areobindus (Fig. 135) and Anastasius (Fig. 138). In both *venatio* scenes, the *salitores* are shown using the *contus* to leap over bears who snap their jaws at the acrobats. Their bodies are extended vertically in the air to gain momentum while their hands are placed at the top

[594] Goetz (1965) 240.

of the *contus* to allow them to achieve great heights.[595] On the Areobindus diptych, a bear stands on its hind legs to strike its tormentor. An adult brown bear can reach heights of 1.5-2.5 metres from a standing position, a height which the *salitor* presumably had to exceed if he were to successfully evade capture. In the wild, bears habitually stand on their hind legs to make themselves appear more intimidating, but also to better identify that which has attracted their attention. Once curiosity gave way to fear, a *salitor* was more at risk of the bear launching an attack. Though bears are not morphologically adapted for vertical jumping, an angry bear might attempt to jump in an effort to remove the performer.

A similar scene is illustrated in a fresco on the *podium* of the theatre at Corinth (discussed also in chapter 1 section 1.2.1). Here, an acrobat uses the *contus* to hurl himself over a charging leopard.[596] The alarming proximity of the acrobat to the leopard (both represented in mid-air) illustrates the value of the *contus.* In contrast to bears, leopards can jump at exceptional heights of up to 3 metres from a stationary position, and possibly more with a run-up. Without the aid of a *contus,* the *salitor* evidently stood little chance of escape. Capture was also a possibility if he miscalculated the distance of his opponent or failed to plunge the pole securely into the ground. If he descended too quickly, as Theodoric warns, the performer also risked falling directly on the animal who passed beneath him. Therefore, in the game of *contomonobolon* the chances of evading capture depended largely on the locomotor abilities of both acrobat and animal.

There are surviving representations of *salitores* performing this exercise without a *contus,* however never in the company of big cats. One reason for this may be due to the advanced jumping abilities of these animals. In representations where the *contus* is absent, the *salitor* is always shown in a compact, curled-up position, with both knees brought close to their chest. A particularly good example is seen on a 5th century CE marble relief from Byzantium, where a pair of *salitores,* each holding a whip, jump over two small bears without the aid of a pole (Fig. 139). One of the bears appears to have captured the acrobat's whip within its mouth. Alternatively, this may represent the moment when the whip struck the bear. Similar interactions are depicted in a series of reliefs from the ancient city of Kibyra, which date between the 2nd and 3rd centuries CE. On one relief an acrobat is shown somersaulting over a bear, unassisted by a *contus,* while a second performer (possibly an arena attendant) attempts to distract or provoke the animal using a whip and *mappa* (Fig. 115).

[595] At the top of the Sofia relief, an acrobat is shown holding the top of the *contus*. This might represent the moment right before they were about to jump, or the moment when they had just landed.
[596] Shear (1926) 452, fig. 7; Capps (1949) 69. A comparable scene is depicted on a 4th century CE *contorniate* medallion, however involving a lion. See Saglio (1962) 1483.

What is clear from this hair-raising variation of *contomonobolon* is that the acrobats relied primarily on their own strength and agility to leap over the animals. In this respect, their technique strongly resembles that performed by modern-day recortadores, who evade bulls by dodging, jumping, and somersaulting over the animals without carrying props (Fig. 140).[597] What is interesting to note about these performances is that the type of jump that is executed depends largely on the energy levels of the bull, not the recortador. After repeated attempts at charging the recortador, a bull might lose its motivation to attack, which naturally results in its charges becoming significantly slower. The slower the bull, the less dramatic the encounter will be since the recordator requires speed (from both man and beast) to jump over the animal. In such instances, the agency of the bull plays an important role in guiding the choreography of the recordator's act. As such, the recordator is required to pay close attention to not only the animal's behaviour, but its psychological state as well. This might have been the case in the Roman games, although bulls were generally not associated with *contomonobolon.* However, that *salitores* altered their technique according to the species they fought and the animals' capabilities is evident from the variations of this exercise depicted in the iconography.

4.1.2. The *Cochlea*

> *Alter angulis in quadrifaria mundi distributione conpositis rotabili facilitate praesumens non discedendo fugit, non se longius faciendo discedit, sequitur insequentem, poplitibus se reddens proximum, ut ora vitet ursorum.*
>
> Another man flees not by veering away; holding four-part screens distributed in a circle with angles arranged on a rotating mechanism, he does not escape by holding himself at a distance but pursues the one following him, bringing himself nearly to his knees, so that he may avoid the mouths of bears. (Cassiod. *Var.* 5.42.7)

The next exercise mentioned in Theodoric's letter involved a revolving screen called a *cochlea* (lit. "snail"). The instrument derived its name from its spiral design which consisted of two or four wooden panels fastened to a rotating pole. Performers who operated the *cochlea* would taunt the animals by repeatedly turning each panel, thus thwarting any attempts by the animals to capture them.[598] According to Varro, the *cochlea* was originally a

[597] This style of Spanish bullfighting is called 'Los Recortes' and takes place in the same venue as the traditional bullfights.
[598] One of the *venatores* from the large *venatio* scene on the Kos mosaic bears a name that derived from the *cochlea.* It has been suggested that this performer specialised in the use of the *cochlea,* although the device is not depicted in the scene. For discussion see Epplett (2001a) 119.

low, narrow doorway of an aviary that was designed to prevent birds from escaping.[599] Interestingly, its spiral design also made it appealing to use in bull displays during the late Republic (Varro, *Rust.* 2.5.3). This is not all surprising given that bulls are particularly reactive to motion, as we saw in the previous chapter. Just like the *pila,* the sight of the revolving panels presumably had a maddening effect on the bulls, causing them to charge and attempt to toss the performer who hid behind the *cochlea.* Unfortunately, Varro is the only authority on the *cochlea* in *venationes* from this period. Thereafter, the device becomes obsolete in ancient literature until it reappears in Theodoric's letter and in the iconography of the late imperial games.

Illustrations of the *cochlea* survive in several types of media from the later Empire: in the consular diptychs, in relief art, Roman lamps, and coinage. On the bottom right corner of Areobindus' diptych (Fig. 136), a performer is shown leaping off the ground as he turns the panels of the *cochlea* to escape from a bear who has taken hold of his right leg. The performer's lively and exaggerated movements suggest that once the animals made contact with the device the performer had to keep the panels (and himself) in motion in order to evade capture. If the panels came to a stand-still, the animals had a greater chance of seizing their prey.[600]

Efforts to rotate the *cochlea* may have been hampered by attempts from the animals to manipulate the device themselves. A representation of a bear turning a *cochlea* can be seen on the far right of the Sofia relief. The bear stands on its hind legs and uses both forepaws to hold onto the device. A performer on the other side simultaneously clutches onto the *cochlea* with both hands in a mirror image of the bear. One rotated the panels to capture its adversary, the other to evade capture. The manipulability of the *cochlea*'s design effectively afforded both performers opportunities (though not necessarily equal) to control the *cochlea* and demonstrate their agility.[601]

In addition to turning the panels, Theodoric indicates that the performer "pursues the one following him", presumably referring to the animal. Being wooden, the *cochlea* was probably light enough to have been carried around the arena while in pursuit of the animals, who were perhaps unwilling to engage. Alternatively, more than one *cochlea* could be positioned at different points in the arena. This arrangement is alluded to in a later passage from Theodoric's letter (Cassiod. *Var.* 5.42.8-9):

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[599] Interestingly, revolving doors are still used in some modern aviaries to contain birds.

[600] Epplett (2001a, 120) speculated that performers clung onto the very top of the *cochlea* as it spun to escape from the bears. Epplett based this theory off a line in the passage discussed in 4.1.3 below, which describes the act of balancing on a thin beam that I have interpreted as tightrope walking.

[601] In addition to the artefacts mentioned above, representations of bears engaging with the *cochlea* also survive on three Cypriot oil lamps that date between the 4th and 5th centuries CE. See Lightfoot (2021) cat. 317, 318, 319.

Alii tribus ut ita dixerim dispositis ostiolis paratam in se rabiem provocare praesumunt, in patenti area cancellosis se postibus occulentes, modo facies, modo terga monstrantes, ut mirum sit evadere quos ita respicis per leonum ungues dentesque volitare.

Three others, just as I shall describe, each positioned at an assigned door, dare to call upon themselves the waiting fury, hiding themselves behind doorposts with bars in the open arena, now showing their faces, now their backs, so that it is a marvel that you should behold them dodging and dashing among the claws and teeth of lions.

The passage above is particularly interesting for two reasons: firstly, it suggests that more than one performer could participate in this exercise; and secondly, the performers coordinated their movements, taking turns to reveal themselves and taunt the animals. Whether more than one animal participated in this exercise is difficult to tell, since the iconography only ever depicts one-on-one interactions and the consular diptychs portray a composite view of the shows. However, the more animals that participated, the clearly increased risk of capture.

Although bears are well represented alongside the *cochlea* in the visual material from Late Antiquity, big cats, among other animals, are rarely shown. A small group of late 4th century CE bronze medallions, known to modern scholars as *contorniates,* contain the image of an unidentifiable felid (possibly a leopard) engaging with a *cochlea* and a performer who wears a Phrygian cap (Fig. 141). Only three copies of this representation have been discovered in Rome, which may indicate that the coins were commissioned to mark a historic performance inside the arena.[602] As with the consular diptychs, the *contorniates* were private productions of the mid-4th to mid-5th centuries CE and often contained images associated with games from the circus and amphitheatre.[603] Judging by the unusual attire of the costumed performer, it would seem that the *editor* wished to commemorate a particularly memorable performance from the games that he sponsored, one that featured the 'trending' *cochlea.* Alternatively, the motif may have been chosen for the popularity of the exercise among the public generally.

[602] Locations of the three coins: Museo Teatro della Scala, Milano; BnF Cabinet des Mèdailles, Paris; The British Museum, London. See Alföldi and Alföldi (1990) 216-20.

[603] The exact function of *contorniates* is still debated among modern scholars, with theories ranging from propaganda tools to game counters and private gifts. Alföldi 2 vols. (1976-90) remains the authority on this material evidence. For a review of the various interpretations proposed by scholars, see Mittag (1999) 227-38. For a recent discussion of the *contorniates,* see Dunbabin (2016) 258-62.

4.1.3. Tightrope Walking

> *Ille in tenuem regulam ventre suspensus invitat exitiabilem feram et nisi periclitatus fuerit, nil unde vivere possit adquirit.*
>
> Another man suspended from a thin beam on his stomach incites a deadly animal, and unless he puts himself in danger, he does not gain anything from which he might live. (Cassiod. *Var.* 5.42.7)

Tightrope walkers (*fūnambuli*) were another class of acrobats that periodically performed in *venationes* in the late Empire. Their specialty-act was to entertain the audience by balancing on a rope (*funis*) whilst suspended high above the ground. The popularity of tightrope walkers in Roman society dates back to the early 2nd century BCE. Terence, for instance, begrudged cancelling his first production of the *Hecyra* due to rumours of highly anticipated performances from tightrope walkers, boxers, and gladiators (Ter. *Hec.* 34). *Fūnambuli* seem to have been popular entertainers even among some members of the upper classes. Pliny the Younger, who wrote towards the end of the 1st century CE, expressed his admiration for their eloquence and agility in a letter to Lupercus (Plin. *Ep.* 9.26.3-4). The intervals of chariot races were an apt context for such performers to enact their exercises among other comic entertainers such as pantomimists, mimes, and trained animals. For example, tightrope walkers featured in the games of Carus in the late 3rd century CE together with dancing bears, gymnasts, and wall-climbers (SHA *Car.* 19). Epigraphic and pictorial evidence attests their popularity in the provinces. Tightrope walkers appear in a diverse chariot-race program from the 6th century CE in Oxyrhynchus (Egypt) along with mimes, athletics, and *venationes* (*P.Oxy* 2707).[604] Inscribed into the surface of the stage of the Roman theatre in Aphrodisias is a graffito representation of an acrobat balancing on a rope that is strung between two triangular posts.[605] It may have been possible to extend these posts as the performance developed to increase the risk and excitement of the exercise.

It is not until the late Roman Empire, however, that we find evidence for tightrope walkers performing in the company of animals. What is particularly unusual about Theodoric's account of this exercise is that the performer does not walk down the rope, as one might expect from a *fūnambulus.* Rather, he balances on his stomach above the animals. Until very recently, there had been no visual reference for what this technique might have looked like. However, in 2020, a collection of marble reliefs depicting gladiatorial contests

[604] Cameron (1976) 213. For evidence of mixed programs featuring acrobats in the eastern provinces, see Roueché (2007) 62.
[605] Roueché (1993) 36-37, pl. 2, fig. 8.b. ii.

and *venationes* from the ancient city of Mytilene on Lesbos was published by Karambanis, casting new light on the nature of the exercise described by Theodoric.[606] The reliefs have been dated to the late 2nd/early 3rd century CE, around the time when the orchestra of the Mytilene theatre was adapted for Roman-style spectacles (see chapter 1 for similar examples).[607] Animal displays are represented on five reliefs, one depicting an unusual interaction between a bear and an acrobat who balances on his stomach along a beam that is suspended above the ground (Fig. 142). Another figure is shown running away from the bear on ground level towards the bottom right of this relief, which has been badly damaged. Without the complete scene, it is difficult to discern if the running figure is a criminal condemned *ad bestias* or another animal acrobat.[608]

The identity of the performer on the raised beam is more peculiar: he wears small wings and holds a palm in his left hand and a victory wreath in his right. Based on these characteristics, the winged figure could be Eros, which might indicate that the performance was a mythological enactment.[609] Representations of Erotes fighting wild and fantastic beasts were popular motifs in Graeco-Roman art, but it was not uncommon for performers (particularly *noxii*) to be dressed in mythological attire either, as we saw in chapter 2.[610] There is no reason to doubt that certain acrobats also wore costumes to enhance the visual appeal of their acts. In the case of the Mytilene relief, the winged figure might be an acrobat in the guise of Eros who performed in the Mytilene theatre.

Following this interpretation, Karambanis suggested that 'Eros' from the Mytilene relief was pole vaulting over the bear.[611] However, if that were the case, we would expect him to be shown in a flexible position with his back arched, as indicated in the iconography of pole-vaulters. Instead, the performer is rigidly aligned with the beam and holds two objects (palm and wreath), which would have prevented him from holding the beam altogether. Nor is the beam driven into the ground like the *contus* but rather disappears behind an architectural feature, which could be a scaffold or the *podium.*[612] That this stunt clearly differs

[606] Karambanis (2020) 73-103.
[607] The orchestra of the Mytilene theatre was enclosed by a 1-1.30-metre-tall *podium* with large rectangular holes spaced at regular intervals for a post-and-net system. The marble slabs that crowned the *podium* carry an inscription, dated to the late 2nd century CE, that honours a certain Tryphonianos and Ioulios Leonteus. Karambanis (2020, 78) argued that the inscription might relate to the construction of the *podium,* which consequently allowed for more dangerous displays to be staged inside the theatre.
[608] The grounded figure appears to be holding a small prop (possibly a whip or *mappa*), which suggests he may not have been a *noxius.*
[609] Karambanis (2020) 87.
[610] A particularly good representation of Erotes fighting wild beasts is seen on a large bas-relief from the theatre in Miletus, Turkey. See Ritti and Yilmaz (1998) 509-10, fig. 30. For discussion on the Erotes motif in North African art pertaining to *venationes,* see Dunbabin (1978) 81.
[611] Karambanis (2020) 88.
[612] Karambanis (2020, 100) suggested that the architectural feature could also be an animal cage.

from pole vaulting is further supported by Theodoric's differentiation between the two in his letter: the acrobat does not escape the animals by jumping over them like a *salitor* but remains suspended on a *tenuem regulam* like a tightrope walker.

If the acrobats from the Mytilene relief and Theodoric's letter are indeed tightrope walkers, we might then ask why they are balancing on their stomachs. With animals now included in this exercise, the objective had probably changed so that now the acrobat had to keep his balance whilst also maintaining the animals' curiosity. To prolong the animals' attention, one technique may have been to dangle themselves (or a small prop) below the beam as bait. This is one way of interpreting the *venatio* scene on the Mytilene relief. As the palm and wreath were lowered, the bear advanced towards the acrobat who balanced precariously on the slanted beam. Naturally, the closer the acrobat got to the animal, the more dangerous and difficult it would have been to evade capture. Failure to attain the animal's attention could also result in a poor performance or even a reduction in payment: "unless he puts himself in danger, he does not gain anything…" (Cassiod. *Var.* 5.42.12). Since this letter partially concerns the subject of payment for performers, this may be what is implied here.[613] Juvenal also commented on the profession of tightrope artists, noting that their skill provided them with an income: "yet the person who places his steps with balancing foot earns his living from that work. With that tightrope of his, he avoids cold and hunger" (Juv. 14.272-4). Animals that were best suited for this exercise were those who stood some chance at capturing the performer, either by jumping (big cats) or standing on their hind legs (bears).

4.1.4. The *Ericius*

> *Alter se gestabili muro cannarum contra saevissimum animal, ericii exemplo, receptatus includit, qui subito in tergus suum refugiens intra se collectus absconditur et cum nusquam discesserit, eius corpusculum non videtur. nam sicut ille veniente contrario revolutus in sphaeram - naturalibus defensatur aculeis, sic iste consutili crate praecinctus munitior redditur fragilitate cannarum.*
>
> Another man encloses himself against the most savage of animals with a potable wall of reeds, hidden away after the example of the hedgehog (*ericius*), who, withdrawing under his own back and gathered up within himself, thus hides his body, while he never runs away. For just as the one, having rolled into a sphere against an approaching enemy, is protected by natural spines, thus the other, girt with a sewn-together wicker work, is rendered more defended with the fragility of reeds. (Cassiod. *Var.* 5.42.8)

[613] Prudentius also wrote about the legal requirement of payment for tightrope walkers and pole vaulters, who suffered at the hands of beasts in public shows (Prudent. *Hamatigenia* 369-374).

The fourth exercise mentioned in Theodoric's letter involved a sphere-shaped barrel that is likened to a hedgehog (*ericius*). Based on the passage above, the *ericius* was made of wood and had the space to hold a performer inside it. As with the *cochlea,* movement seems to have been key to getting the animals' attention and encouraging interaction. From inside the *ericius*, the performer could control its speed and direction as it rolled around the arena, all the while remaining hidden from the animals. The sight of the moving barrel could entice curious or frustrated animals towards the device, who might then try to push or roll the *ericius* around the arena themselves.[614] If the *ericius* became stationary, the performer was probably more at risk of being caught.

A clear illustration of the dangers involved in this game is seen on an incised marble tablet from Narbonne, France, dated to the 1st century BCE (Fig. 143). The tablet depicts two performers, both inside their respective barrels, confronted by bears. In the background, a third figure (possibly an arena attendant) stands next to a large, barred cage, which may have remained on the arena floor for the duration of the performance until the bears were ready to be summoned back. The centre of the tablet shows a bear on its hind legs towering over an *ericius* which has been flipped upright, thus exposing the performer. The performer wears no headgear or shoulder padding to protect himself from the bear's sharp claws.[615] A possible scenario is that the bear caught up with the rolling barrel and managed to overturn the device using its powerful forepaws. The apparent vulnerability of the performer indicates that one, or possibly both, ends of the *ericius* were completely open. This suggests that part of the challenge was to not only evade capture, but also remain inside the moving barrel without falling out. In the foreground, another bear stands over an *ericius,* which is still on its side with the head of a performer seen poking out from one end.[616] This may represent an earlier moment when the bear tried to overturn the barrel or, alternatively, a second performer who has also found himself in trouble.

The *ericius* is also represented on the diptych of Areobindus (Fig. 134), though its design is slightly different. It maintains the characteristic sphere shape but with the body of the barrel comprised of wooden bars, as opposed to being solid like the *ericius* from the

[614] Jennison (1937) 180.

[615] Although it is difficult to discern from just his upper body, the figure in question might be a criminal condemned *ad bestias.* Toynbee (1973, 96) also suggested that the unarmed man could be the bear's trainer, in which case the pair could be "playing". Considering Theodoric's description of the *ericius* and its dangers, this explanation seems unlikely.

[616] There has been some confusion among scholars over the interpretation of this scene. Toynbee (1973, 96) suggested that the foreground of the tablet shows a bear balancing on a horizontal bar under the instruction of its trainer, whereas Epplett (2001a, 95) contends that the foreground shows a tree trunk that was part of the act of a different class of performer: a tree-climber (*arborarius*). However, the scene clearly shows a barrel-shaped apparatus being manipulated by a bear with a performer inside. For clarity, this study interprets the two apparatuses incised on the Narbonne tablet as an *ericius.*

Narbonne tablet. In this instance, the performer peers through various openings as if he were in a cage. Through these openings, the performer may have waved a small prop (such as a *mappa*) to entice the animals or jabbed them with a short, blunt spear. If the openings were large enough for a bear or big cat to reach inside, it would have been crucial to keep the *ericius* in motion to avoid a fatal swipe.[617] Once the barrel was captured, a bear would have little trouble in breaking apart the wooden bars, which seem to have been relatively fragile based on Theodoric's description. Big cats and bears may have dismantled the *ericius* by simply throwing it around the arena using their powerful shoulder muscles and jaws, as they are often seen doing with boomer balls, beer kegs, and other physical enrichments in modern zoos (*pers. obv*).[618]

A number of scholars have pointed out similarities between this particular game of evasion and the performances from modern rodeo clowns known as 'barrelmen'.[619] In western rodeo, the primary role of the barrelman (besides entertaining the crowd) is to aid the safety of cowboys when they get thrown from their bull. To dissuade the bull from trampling the cowboy, the barrelman will draw attention to himself using a number of goading methods, including slapping the barrel, waving props, shouting at the animal, or chasing it whilst remaining inside the barrel (Fig. 144).[620] In response, the bull will often fixate on the new target and pursue the barrelman until it has satisfied its frustration by tossing the barrel around the arena (Fig. 145). To avoid falling victim to the bull, the barrelman must anticipate the animal's behaviour and always be on the move. Whether the *ericius* was used as a diversion like the barrel in modern rodeos, or was a spectacle of its own, is difficult to know. In any case, holding the animals' attention, by whatever means, seems to have been an important objective of this exercise.

4.1.5. The Ancient See-Saw

> *Alter labenti rota feris offertur: cadem alter erigitur, ut periculis auferatur. sic haec machina ad infidi mundi formata qualitatem istos spe refovet, illos timore discruciat: omnibus tamen vicissim, ut decipere possit, arridot.*

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[617] Jennison (1937, 180) suggested that performers may have suffered the loss of a limb but that the risk of death was not as high as it would have been in the hunting displays.
[618] These types of enrichments are particularly common for stimulating bears, elephants, and big cats. Zookeepers will often fill these devices with food or enticing scents as a lure to encourage investigation. The goal is to keep the animals occupied for longer periods, which also makes them more attractive for visitors who get to see the animals performing a range of behaviours. On the use of barrels in captive lion habitats, see AZA Lions Species Survival Plan (2012) 103.
[619] Bomgardner (2000) 218; Epplett (2001a) 120.
[620] The type of barrels used in modern rodeos were open at both ends, which enabled the barrelman to run while remaining inside the device.

> One man is offered to the wild beasts by sliding down a wheel, while another is raised at the same time, so that he is snatched away from danger. Thus this machine, fashioned in the characteristic manner of a treacherous world, restores some with hope, tortures others with fear, nevertheless satisfying all in turn so that it might deceive them. (Cassiod. *Var.* 5.42.10)

The last exercise mentioned in Theodoric's letter was a curious type of balancing act. The main contraption, which Theodoric refers to as a wheel (*rota*), was operated by two performers who either stood or sat on opposite sides from one another so that as the device turned, one performer was raised, while the other was lowered. The performer who was lowered was at a greater risk of being captured by the animals, while the other remained out of harm's way, that is, of course, until the device turned once again. The design of this contraption might have been similar to the treadwheel of a *polyspastos* (crane), which could be rotated manually from the inside.[621] However, there is no visual reference to the treadwheel ever being used inside the arena.

Variations of this peculiar contraption can be seen in the diptychs of Areobindus (Fig. 135) and Anastasius (Fig. 138). At first glance, one may liken the device to a modern-day see-saw. Each performer sat inside a basket that was elevated above the arena floor by two inclined posts that were attached to a central pole.[622] At the top of the pole was a rope pulley, which allowed the performers to raise the baskets up and down or pivot the posts around the central pole. In this instance, the performers could take turns in taunting the animals (in this case bears) by lowering and raising themselves using the pulley. To avoid capture, the pair had to work together to keep the posts in motion. If one performer fell victim to the animals, it might have upset the balance of the entire contraption.

A similar apparatus, known to modern-day daredevils as the 'Toro Totter', was recently added to the growing repertoire of bovine rodeos in North America (Fig. 146).[623] The activity involves two or four cowboys manipulating a large see-saw while a bull charges beneath them, attacking anyone low to the ground. To dismount a cowboy from his position, the bull would use its powerful shoulder muscles to bunt its horns against the cowboy's seat,

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[621] The *polyspastos* was used in Roman construction in the early Empire for hoisting machinery and excavating public works. According to Vitruvius, the drum of the crane could be rotated mechanically (using ropes and a capstan) or it could be moved manually by 2-5 workers stationed inside the drum (Vitr. *De arch.* 10.2.7). A good representation of workers stationed within a treadwheel is seen on the funerary relief from the tomb of Haterii in Rome.

[622] Epplett (2001a, 127) refers to the baskets as "crows-nests". Epplett notes that the bases for these baskets have been discovered in the theatre at Mytilene. These findings await publication.

[623] The contraption appeared in the film *Jackass Number Two* (2006), which featured Johnny Knoxville, Bam Margera, Ryan Dunn, and Chris Pontius riding a Toro Totter in a bullring. This stunt has since been replicated in bovine rodeos throughout North America. For footage of the original stunt, see https://www.youtube.com/watch?v=ADLAfdLw4hA.

consequently forcing the apparatus into motion. If the cowboy fell, his colleague on the opposite end would abruptly descend, thus placing both performers in danger of becoming trampled or gored (Fig. 147). If we assume that the see-saws on the consular diptychs operated in a somewhat similar manner as the Toro Totter, then it might have been possible for the animals to manipulate the contraption themselves, just as with the *cochlea* and *ericius.* How this played out ultimately depended on the species of animal being exploited. Unlike the bull, a bear or lion had the advantage of being able to pull down one end of the apparatus by standing on its hind legs or jumping directly at it. This meant that, unless the apparatus exceeded the animals' height or jumping capacities, even the elevated performer was at *some* risk of getting caught. If these efforts failed, a bear or lion may have also attempted to climb the central post in their frustrated state. The complexity of the ancient see-saw contraption, and the multifarious possibilities of capture, certainly made this one of the more elaborate games of evasion.

There is one more variation of this exercise which has gone largely unnoticed by scholarship. Two Roman lamps, dated to the 1st century CE, contain a representation of Cupid and an unidentifiable animal (possibly a dog or big cat) who are both individually tied to a swivelling post by ropes that wrap around their waists (Figs. 148-149).[624] The two figures are depicted in motion, but the animal appears to have caught up with Cupid and has seized his left leg with its paws. Bussière and Wohl interpreted the scene as a "playful version" of an arena game.[625] Alternatively, the illustration may represent a costumed criminal condemned *ad bestias*. Considering that the lamps pre-date the consular diptychs by about five centuries, it is possible that many variations of the ancient see-saw existed. Those depicted on the diptychs of Areobindus and Anastasius may represent the complex culmination of earlier designs.

4.1.6. Wall-Climbers

There is one more group of performers that seem to have become popular in the *venationes* of Late Antiquity, though they are not mentioned in Theodoric's letter. In the literature, they were sometimes known as *toechobates* ("wall-climbers") and, as their name suggests, their means of escaping the animals set against them was by climbing physical structures inside the arena.

The SHA mentions performances from *toechobates* who evaded bears at the elaborate games sponsored by Carus in the late 3rd century CE (SHA *Car.* 19.2). A large masonry

[624] The tail is too long to have belonged to a bear.
[625] Bussière and Wohl (2017) 133-34.

structure, which may have been used for a similar exercise, is depicted in a diptych of Areobindus (Fig. 136).[626] In front of the structure, a performer is shown leaping into the air with a bear in tow. Despite his efforts to escape (presumably by scaling the masonry building), the bear has seized the performer's left leg.[627] A climbing apparatus is preserved on another diptych of Areobindus (Fig. 135). The bottom left corner of the *venatio* scene shows a pair of asymmetric bars that were clearly intended for climbing; one performer has made it 'safely' onto the lowest bar, while a second reaches for the upper bar to elude a bear.[628]

Given the exceptional climbing abilities of most bears, the design of these structures raises doubts about whether they were of any help to the performers. As any advent hiker will probably know, one of the least effective methods of escaping bear attacks in the wild is by climbing a tree, since most bears will simply pursue their quarry.[629] So proficient are bears at climbing trees that modern zoos will incorporate climbing bars of varying heights into captive bear exhibits as a form of physical enrichment for the animals (i.e., 'furniture'; see chapter 3 section 3.2.4) (Fig. 150). Based on ursine behaviour, the structures depicted on the consular diptychs probably did little to deter a bear from scaling them, but perhaps that was not the intention. The sight of a bear (or any non-climbing species for that matter) pacing around the base of a structure presumably did not have the same spectator appeal as watching the animal follow its tormenter. In this respect, the purpose of these structures may have simply been to add variety to a spectacle whereby both human and animal performers could demonstrate their climbing skills.

4.2. Beyond the Arena: Contextualising Games of Evasion

A salient feature of all the exercises discussed above is that the animals were not killed in combat and, by implication, could be reused for subsequent performances. This raises the question of why Roman *editores* may have felt it necessary to spare animals in the first place. Despite the continued popularity of *venationes* in Late Antiquity, there is strong evidence that suggests they were becoming increasingly strenuous for Italian and provincial elites to produce, particularly in terms of the supply and investment of both human and animal

[626] The masonry structure also contains a rectangular door, which may have been used by performers or arena staff to hide from the animals or collect new equipment. For discussions of this structure, see Toynbee (1973) 96-97 and Dunbabin (1978) 72. It is also possible that animal cages were left inside the arena to be used as climbing apparatuses.
[627] Epplett (2001a, 123-24) suggested that these performers may have used climbing tools like iron spikes to scale the structures, though direct evidence for this has yet to be found.
[628] Epplett (2016, 164) interpreted this structure as a railed bridge or "pulpit".
[629] The *Codex Glossariorum Latinorum* lists a type of performer called an *arborarius* ("tree-climber"), who climbed trees to elude capture from wild beasts. For discussion of these performers see Goetz (1965) 240.

performers. From the 3rd century CE, the Roman Empire was struck with a myriad of crises, not least of all large-scale assaults and migration of barbarians along the frontiers, which ultimately took a heavy toll on the economy and, consequently, the production of spectacles. The western Empire was arguably hit the hardest by such troubles, as attested by the 'fall' of Rome towards the end of the 5th century CE. However, the endurance of barbarian raids, especially by the Sassanid Persians and Germanic coalitions, caused considerable unrest in the eastern part of the Empire as well.[630] Economic instability, attributed largely to on-going civil war and frequent barbarian assaults, put enormous strains on the infrastructure of wildlife trafficking across the Empire. Correspondence between *editores* and their agents reveal anxieties regarding the cost and supply of animals, while imperial legislation bears witness to attempts to regulate inflation and safeguard depleted populations of ferocious animals for the emperor's games (discussed below). Amongst all this, the Roman state experienced a major religious revolution as Christianity emerged as the official state religion, setting in motion a succession of judicial decrees which attempted to restrict the production of public spectacles.

It is important to note that none of these changes were instantaneous nor did they impact all types of spectacles the same way throughout the Empire. Gladiatorial combat as a formal institution appears to have ceased, at least in Rome, by the early 5th century CE partially on account of the growing cost of gladiators and in addition to Christian criticism of the arena.[631] Yet wild beast displays, chariot racing, and theatre performances persisted across the Empire for another two centuries, although on a reduced scale.[632] Previous research has indicated that the infrastructure required to produce *venationes* would have made these kinds of displays particularly challenging to accommodate in light of the shifting economic and environmental climate.[633] However, whether the characteristic demands of different species contributed to these challenges has not yet been considered. Examining these characteristics in the unique context of the later Empire can help us better understand

[630] Christie (2011) 4.

[631] According to the Christian writer Theodoret, Honorius ordered a universal ban on gladiatorial combats in 404 CE after an incident that occurred in Rome (possibly in the Colosseum) which resulted in a Christian monk, named Telemachus, being fatally wounded by spectators after he attempted to stop a gladiatorial combat (Theod. *Eccl.* 5.26). Many scholars now argue that this ban was only temporary, as there appears to have been at least one gladiatorial combat produced in Rome in the 430s CE. On the decline of gladiatorial combats, see Ville (1960) 326-29; Wiedemann (1992) 128-64; Brown (1995); Kyle (1998) 54-55.

[632] In 536 CE, the Christian emperor Justinian proclaimed that consuls were not to deprive the populace of chariot races, beast fights, and theatre (Just. *Nov.* 105.1). The last recorded instance of *venationes* in Constantinople took place a year later, during the consular games of 537 CE. In 550 CE, the Ostrogothic King Totila staged the last known chariot race inside the Circus Maximus at Rome (Procop. *Goth.* 3.37.4).

[633] Bomgardner (2000) 201-10; Epplett (2016) 146-66; Nelis-Clément (2017) 254-55.

why *editores* may have found 'recycling' certain animals a more lucrative alternative to having them killed in the arena.

4.2.1. Strains on Wildlife Trafficking: Costs, Supply, and Adaptations to Spectacle Design

In 398 CE, Symmachus began preparations for a series of games that would be staged in Rome in honour of his son's praetorship in 401 CE. The Letters inform us that, as part of these preparations, Symmachus had to jump through all sorts of political and financial hoops, including sending agents into the provinces in search of animals, writing to friends for help, securing imperial permission to use the Colosseum and to obtain valuable exotica such as *leopardi* from Africa and *Libycae ferae* (likely big cats from Libya) (Symm. *Ep.* 4.8, 4.12, 7.59).[634] Among the animals which he collected from abroad were Spanish horses (*Ep.* 5.56), topi and impala from Africa (*Ep.* 6.144), crocodiles from Egypt (*Ep.* 6.43), and bears from Italy, Dalmatia, and possibly some from the Balkan peninsula (*Ep.* 7.121, 9.135, 9.142). Bears were also collected for his son's quaestorship celebrations in 393 CE (*Ep.* 2.76), alongside Irish wolfhounds from Scotland (*Ep.* 2.77).

Symmachus' letters bear witness to the enduring aspiration of *editores* in Rome to display exotic animals of different varieties in the late Empire. Just as in earlier periods, the ability to procure animals from abroad continued to serve as affirmation of the *editor*'s wealth and political connections overseas. A similar variety of animals was obtained for the games celebrating Stilicho's consulship in 400 CE. According to Claudian, lions and leopards were collected from Libya and Ethiopia, bears from Spain, wild boars from Germany, deer from Corsica and Sicily, and tigers from India, along with other species such as snakes, lynxes, and unnamed creatures (possibly bears) from Italy, Gaul, and Dalmatia (Claud. *Cons. Stil.* 3.237-369). The exquisite 'Great Hunt' mosaic from the Villa Romana del Casale in Piazza Armerina, Sicily, gives a good idea of the variety of animals which could still be obtained from North Africa and the eastern Mediterranean in the 4th century CE (Fig. 1). The mosaic is now generally interpreted by scholars as a representation of the activities in which the owner of the villa might have been involved such as supervising the live capture of wild animals, most likely for the *venationes* in Rome.[635] Among the species being hunted, captured, or loaded onto ships are ostriches, blackbuck, oryx, wildebeest, camels, elephants, lions, leopards,

[634] For comparison, see Apul. *Met.* 4.13 on the preparatory activities of Democharis, who received assistance from friends in the acquisition of bears for an upcoming spectacle in Plataea.
[635] Toynbee (1973) 27-29; Dunbabin (1999) 130, (2016) 214; Christie (2011) 135-36; Epplett (2014) 512-13, (2016) 138; Harden (2013) 175.

hippopotami, rhinoceroses, and tigers (presumably from the East).[636] Diversity is also represented in the types of personnel involved in the operation; there are servants and hunters armed with tethering implements, soldiers wearing military armament, and officials dressed in ornamented tunics bearing exquisite brooches and accessories.[637] That the patron of the mosaic wished to commemorate the intricate process by which exotic beasts were acquired throughout the Mediterranean, rather than scenes of the *venationes* themselves, is significant and suggests that a sophisticated beast trade was still in operation at this time.[638]

As the Urban Prefect of Rome in the late 4th/early 5th century CE, Symmachus would have been well-connected across the Empire. Yet, interestingly, he had rather unfortunate luck in obtaining the kinds of animals he so desired. For the *ludi* of 393 CE, Symmachus had hoped to obtain lions but instead had to settle for only a few malnourished bear-cubs who showed up on the eve of the games while the other animals were lost by shipwreck (Symm. *Ep.* 9.117; cf. Apul. *Met.* 4.13).[639] For the games of 401 CE, Symmachus wrote to no fewer than eight contacts asking for their help to supply Spanish horses but, of the sixteen animals that were promised, only eleven survived the journey to Rome and still more died upon their arrival.[640] His crocodiles did not fare well in captivity either; these he had hoped to exhibit in more than one spectacle, but at the second games all but two of the crocodiles were killed in combat.[641] While Symmachus was probably not unique in his misfortune of losing precious cargo at sea, the tone of his letters suggest that wild beasts were no longer readily available to his agents overseas nor were the available animals in an acceptable condition.

Compounding the issue of supply was the rising cost of animals, which skyrocketed from inflation in the 3rd century CE. Diocletian's Edict on Maximum Prices *(Edictum de pretiis rerum venalium*), a decree issued by the emperor in 301 CE, is one of the most widely cited

[636] The extraordinary diversity of wild beasts is echoed in the range of hunting techniques employed to capture them, many of which belonged to a long tradition. See Dunbabin (2016) 211.
[637] It has been suggested that the villa owner is the figure of an elderly man wearing an exquisite, embroidered mantle and leaning on a mushroom-headed staff at the southern end of the corridor which contains the mosaic. See Toynbee (1973, 27-29) and Dunbabin (2016, 211) for alternative interpretations.
[638] Evidence that Africa continued to supply Rome with wild beasts under Vandal rule in the 6th century CE (even if no-longer the primary supplier) is also attested by a passage from Cassiodorus' *Chronicle,* which recounts the elaborate consular games given by Eutheric, the son-in-law of Theodosius (Cassiod. *Chron.* 519).
[639] In addition, a troop of Saxon prisoners-of-war committed suicide, much to Symmachus' disappointment (Symm. *Ep.* 2.46). On the archaeological evidence for shipwrecks from Mediterranean trade in Antiquity, see Parker (1992) and Jurisic (2000).
[640] On the difficulties of transporting live animals on long journeys in Antiquity, see MacKinnon (2006) and (2021). For modern examples, see Jennison (1929/2013) on the challenges of translocating wildlife to captivity. See also Meadows and Henderson (1996) on the conservation efforts of Operation Noah, which was conducted in the late 1950s and early 1960s in the Zambesi River Valley, Zimbabwe, to rescue animals from flooding while the Karibu dam was being built.
[641] We learn this from a letter written to the sons of Nicomachus, whom Symmachus had hoped to show the crocodiles to once they had returned to Rome (Symm. *Ep.* 6.43).

documents used by modern scholars to investigate the inflated prices of commodities in Late Antiquity.[642] The objective of the edict was apparently to stop, or at the very least slow down, inflation by stipulating maximum prices not only on animals, but raw materials, transport, labour, and even slaves. Passage 32 concerns the maximum prices of wild beasts, which are categorised into two groups: Libyan beasts (lions, leopards, ostriches) and Herbivores (bears, boars, stags, onagers) (see Appendix II, Table 2).

Sparreboom suggested that the types of animals on the list were probably the most popular species purchased for the *venationes*.[643] Unsurprisingly, then, big cats, whose exotic provenance and ferocious nature made them particularly valuable for hunting displays and executions, are the most expensive group of animals, with a first-class lion valued at 150,000 *denarii* and 100,000 *denarii* for a first-class leopard. By way of comparison, just a few decades earlier a leopard might have cost an *editor* only 500 *denarii,* according to the Magerius mosaic from Smirat.[644] What is particularly interesting about the prices of big cats is how they differ between species, sex, and grade. A second-class lion cost the same amount as a first-class lioness (125,000 *denarii*), while a first-class leopard was the same price as a second-class lioness (100,000 *denarii*). The edict does not specify exactly what distinguished a first-class from a second-class specimen, though clearly this was significant enough for there to have been an additional expense of 25,000 *denarii* for the former.

The dietary requirements of these animals might go some way to help explain the differences in price. Firstly, is should be noted that all felids are obligate carnivores, meaning they depend *only* on meat for survival as their bodies cannot digest plants properly.[645] They may eat other sources of food, such as plant matter and fungi, but they are unable to get the nutrients they need from these substances alone. Thus, big cats had to be fed a high-protein, carnivorous diet if they were to remain alive and in reasonable condition before a show.[646] This, naturally, rendered them expensive commodities.[647] Second to tigers, lions are one of

[642] Bomgardner (2000) 211-12; Epplett (2016) 160-61; Sparreboom (2016) 71-72. Bubb (2022) 104. Fragments of the edict have been found at various sites in the eastern part of the Empire, where Diocletian resided, although scholars suspect that the edict would have carried over to the western Empire.
[643] Sparreboom (2016) 71.
[644] Bomgardner (2009) 168-69. The inscription on the mosaic specifies that Magerius paid 1,000 *denarii* for each of the four leopards, double the contractual price.
[645] Crocodilians are also considered obligate carnivores, though they have been known to occasionally feast on fruit. Compare, for example, dogs and wolves, who are facultative carnivores. This means they do best on a meat-based diet but can survive, though not thrive, on a non-carnivorous one.
[646] Horse and beef are the predominate types of meat given to lions in most modern zoos. Other meats include pork, chicken, rabbit, and guinea pig. See AZA Lions Species Survival Plan (2012) 49-55 for a breakdown of diet composition for big cat species.
[647] Meat is also difficult to preserve as warmer temperatures can result in the growth of harmful bacterial organisms.

the largest cat species, which means they also consume more meat than leopards.[648] On average, an adult male or female lion can eat between 5 and 8.5 kilograms of meat per day, while leopards consume around 1.6 to 4 kilograms.[649] Whether the Romans took into account the differences in body size and food intake between these species is unknown, though male lions, being the largest, were probably fed larger portions.

The physical characteristics of lions may have been another factor influencing their price. Lions are unusual amongst the order Carnivora in displaying a striking sexual dimorphism, reflected in the male's distinctive mane that develops during puberty. In addition to giving the lion an impressive and intimidating appearance and providing it some protection in intraspecific fights, the mane is also an indicator of its general health.[650] Although mane length, thickness, and colour vary considerably between individuals and populations, recent studies suggest that the mane is condition-dependent, meaning that its appearance is often related to the lion's underlying condition which depends on factors such as hormones, health, and nutrition. As such, malnourished and sick lions with copper and zinc deficiencies often develop rough, unhealthy-looking hair. Furthermore, since mane growth and pigmentation are influenced by testosterone, its quality is also related to aggression, which might signal a lion's fighting ability.[651] Pliny the Elder even noted that the lion was particularly high-spirited at the time when it developed its mane (Plin. *NH* 8.17). Whether the Romans were aware of other correlations is unknown; however, the size of a lion's mane might have played some role in determining a first-class from a second-class specimen.[652] This seems plausible given the close relationship between mane length and lion health. It is also worth noting that there is no difference in price between female or male leopards in Diocletian's Price Edict. This may be due to the fact that leopards are not sexually dimorphic

[648] Lions: Male: 150-250 kg; Female: 120-180 kg. Leopards: Male: 37-90 kg; Female: 28-60 kg.
[649] These estimates were taken from the database on lions (*Panthero* leo) and leopards (*Panthera pardus*) provided by the San Diego Zoo Wildlife Alliance Library.
[650] Darwin (1871) was the first to suggest that male lions might benefit from a shield (i.e., the mane) for protection during fights against rival males, since they take a frontal approach to attack (aimed towards the neck and head). Recent studies have focused more closely on variation in mane characteristics between lion populations in Africa and India and correlations between mane quality and sexual selection by lionesses. See Blanchard (2010) for an excellent overview of the evolution of the mane and recent hypotheses on its function. See Schaller (1972) for a detailed case study of the Serengeti lions, which pioneered empirical research on African prides in the late 20th century.
[651] One study conducted in the Serengeti National Park in Tanzania found that lions with darker manes had higher levels of testosterone and were on average better fed throughout the year. These results suggest that the lions demonstrated either general dominance or superior hunting abilities. For discussion see West (2005).
[652] Specialists involved in the hunting and capture of lions may have used their own discretion to decide whether a lion constituted a first-class or a second-class specimen. It would be interesting to know whether juvenile males were classified as 'second-class' lions, given the possibility that their manes had yet to grow.

(i.e., both sexes look the same), which is further reason to believe that the lion's distinctive mane heightened its exhibition value, and consequently its cost, over other big cat species.

The dietary requirements of the remaining species on the list can also help explain their associated cost. A first-class bear was the next most expensive animal after leopards, valued at 25,000 *denarii*, where a second-class bear could fetch a lower cost of 20,000 *denarii.* Unlike big cats, bears are omnivorous, meaning they eat and thrive on both meat and plant-based food. The percentage of plant-to-meat consumption varies widely between individuals depending on their habitat and seasonal changes. Bears are foragers and will typically excavate their environment for fruits, seeds, roots, insects, fish, and, occasionally, mammals and carrion. These substances would have been considerably easier (and cheaper) to obtain and preserve than meat, which may partially account for the bear's low cost in comparison to big cats. As would be expected, herbivores are the cheapest category on the list. Again, this might have been a result of their relatively undemanding diet, which consisted mostly of roots, fruit, nuts, seeds, fungi, browse, and other plant-matter. Much of this produce could presumably be sourced from local crops.[653]

Notably absent from this list is the elephant. As mentioned in the Introduction, elephants require substantial quantities of hay, grass, and browse per day (up to 270 kilograms) to get the nutrients they need to fuel their enormous bodies. In addition to food, the provisions required to house captive elephants can also entail large costs, thus rendering the elephant a high-maintenance commodity. It is interesting, though perhaps unsurprising, that the elephant rarely appears in the literary evidence of the later *venationes*. We have reports of elephants being hunted in small numbers in Rome at the games of Commodus (180-193 CE), Septimius Severus (193-211 CE), Caracalla (211-217 CE), and Elagabalus (218-222 CE), but they disappear from the arena around the mid-3rd century CE onwards.[654] To judge from the consular diptychs, elephants were evidently still valued for their ivory tusks. This suggests that these animals *were* being killed, though perhaps not for spectacle.[655] In any case, their absence from Diocletian's Price Edict suggests that elephants no longer carried the same exhibition value as they formerly did in the high empire.

Continuing concerns over the price of wild beasts in the 4th century CE are found in numerous letters written by Libanius to his contacts overseas. In these letters, Libanius desperately asks for financial assistance in the collection of animals for an upcoming spectacle

[653] Epplett (2016, 144) suggested that the enormous supply of grain that was regularly shipped to Rome and other major cities in the Empire may have also fed herbivores exploited for spectacle.
[654] Commodus: Cass. Dio 73.10.3; Septimius Severus: Cass. Dio 76.1; Caracalla: Cass. Dio 78.6; Elagabalus: Cass. Dio 80.9.
[655] Elephant tusks were sometimes displayed inside the arena during the games: Calp. Sic. *Ecl.* 7.50; Claud. *Cons. Stil.* 345-355.

in Antioch (Lib. *Ep.* 218 to Eusebius, 544 to Antiochus, 1399 to Caesarius). Interestingly, specific reference is given to the acquisition of bears rather than the popular big cats. Since bears were more affordable, and their population more geographically widespread, than big cats, Libanius' contacts presumably had a greater chance of obtaining them.

Several scholars have reasoned that the worsening supply of animals, especially lions and leopards, might also be associated with a depletion of animal populations across the Empire.[656] As early as the mid-1st century BCE, leopard populations in parts of the East appear to have been under duress, potentially as a result of overhunting. Cicero, for instance, had difficulty sourcing *pantherae* (most probably leopards) for the shows of Marcus Caelius Rufus in 51 BCE. According to Cicero, the felines had allegedly relocated to Caria from fear of the locals and had thus become too difficult to obtain. Furthermore, hunting *pantherae* would take a toll on the community's resources, which Cicero contended he was not prepared to do (Cic. *Fam.* 6.5, 8.2.2, 8.10, 9.3). Since large predators naturally pose a threat to farmers, it is difficult to know for certain whether a shortage in supply was attributed to livestock protection or the wild beast trade.

References to dwindling feline populations appear more frequently in the later periods. At the games of Philip the Arab in 248 CE, lions, tigers, and leopards, among other species, appeared in the arena in their tens, rather than the hundreds as previously seen in the high empire.[657] Most notably, a large portion of these felines were tame specimens which suggests they may have been trained and reserved for repeat shows due to a shortage in supply of new, wild animals. The Egyptian city of Oxyrhynchus, once famous for producing a variety of species in the early Principate, now exhibited more diversity in the human acts rather than in the animal shows. A 6th century CE circus program from this city promised displays of athletics, chariot races, processions, tightrope walkers, and a *venatio* with gazelle and dogs, but none of the popular big cats (*P.Oxy* 2707).[658] Similarly, scarcely any big cats featured in the quaestorian and praetorian games of 393 and 401 CE respectively, despite Symmachus holding the governorship of Africa in 373 CE.[659]

Concerns for the preservation of big cats are also detected in the tone of imperial legislation. In 414 CE, Honorius and Theodosius introduced a law that prohibited individuals throughout the Empire from hunting and selling lions without imperial permission (*CTh.* 15.11.1). While the edict does not directly attest to a depletion of lions, since evidently there

[656] Auguet (1972) 107; Hughes (1994) 105-07; Bomgardner (2000); 214-16; MacKinnon (2006) 16-18; Epplett (2016) 160-62; Nelis-Clément (2017) 252-53.
[657] SHA *Gord.* 33.1: 32 elephants, 10 elk, 10 tigers, 60 tame lions, 30 tame leopards, 10 hyenas, 6 hippopotami, 1 rhinoceros, 10 wild lions, 10 giraffes, 20 wild asses, 40 wild horses, and various other herbivores.
[658] Roueché (2007) 62; Nelis-Clément (2017) 254.
[659] Barrow (1973) 1.

were still enough of them to cause trouble in local communities, the ban on indiscriminate hunting may suggest that the value of the animals' lives had shifted from earlier periods. Nelis-Clément argued that the edict could have been a way of preserving some of the more attractive and fearsome species for the imperial shows in Rome and Constantinople.[660] Since lions were highly valued by *editores* for the dangerous and dramatic interactions they afforded in a spectacle, it is understandable why such measures were taken to safeguard these particular animals. Similar actions might have been implemented a century earlier to slow down the decline of other, potentially endangered species. Themistius, a 4th century CE orator from Paphlagonia, central Turkey, lamented the disappearance of elephants from Libya, lions from Thessaly, and hippopotami from the marshes of the Nile. However, he was encouraged by the fact that now "we spare for ourselves the fiercest animals… so that by procreation they might be preserved and remain" (Them. *Or.* 10.140).

Unfortunately, Themistius does not elaborate on what exactly these measures entailed. It is possible that breeding programs were established in Italy to preserve animal populations that were at risk of depletion. Two spectacles in Rome are reported to have featured captive-born elephants and a rhinoceros respectively, although these could have been isolated events (Ael. *NA* 2.11; Plin. *NH* 8.29). Elephants, for example, have the longest gestation period of any living mammal (between 18 and 22 months on average), which makes them one of the most difficult species to breed in captivity. The Romans might have had some success in breeding animals that could acclimatise to the Italian conditions.[661] Jennison suggested that such conditions would have been suitable for keeping ostriches in permanent Italian aviaries.[662] Ostrich breeding remains a vibrant business in parts of northern Italy in modern times, so there is no reason to doubt that such animals were farmed locally for their meat, eggs, and feathers, or for exploitation in the arena.

In addition to climate, there were many other factors governing the success of breeding programs in the Roman world. Unsuccessful attempts to breed exotic wildlife in modern zoos, for example, have often been linked to inadequate or misinformed knowledge about an animal's reproductive biology.[663] Knowing when a female is in estrus (reproductive receptivity) is crucial to identify the best time to begin breeding introductions and predict when offspring would be born. This is not always possible for some species, however. Lions,

[660] Nelis-Clément (2017) 252; cf. Jennison (1937) 141-42; Epplett (2001a) 227.
[661] With regard to breeding livestock, Columella (*Rust.* 7.2.2-4) emphasised the importance of selecting sheep that were well suited to the local terrain, since not all breeds thrived in the same conditions.
[662] Jennison (1937) 115-16.
[663] A study carried out at the Smithsonian National Zoo in Washington, DC, found that the major cause of poor breeding attempts between lions was the loss of expert knowledge of lion reproductive biology as keepers and veterinarians retired or relocated to other departments of the zoo. See Pukazhenthi (2013).

as with most felids, are induced ovulators, meaning they ovulate in response to copulation. Some females can also ovulate spontaneously, which makes it extremely difficult to predict a pregnancy. Brown bears, on the other hand, are polygamous seasonal breeders and mate only during certain times of the year.[664] Predictions of animal births would have been important for keepers in Antiquity if the animals in question were being bred specifically to supply the *venationes.*

Gene diversity might have been another practical issue. Limited access to wild populations could have led to inbreeding between captive specimens, which may have caused offspring deformities and/or major health issues.[665] Even if the Romans did enjoy some success in breeding certain species, there was no guarantee that the animals would survive to an age where they could participate in the arena, presumably as trained performers. Furthermore, those that did make it may have undergone phenotypic changes as a result of captivity that could disadvantage them in the arena. Captive-born carnivores, for example, have been known to develop smaller mandibular and maxillary regions of the skull and, by implication, a weaker bite force than wild conspecifics.[666]

There is also the fact that some species or individuals are simply too difficult to breed in captivity due to their social habits, behaviours, and temperament. Bears, for example, are solitary animals and generally only interact with conspecifics during mating season or when a female has cubs. As a result of their solitary lifestyle, bears do not naturally conform to a social hierarchy, which makes it extremely difficult (and dangerous) to introduce individuals who are not familiar with each other. In contrast, it is the complex social and cognitive needs of primates that render this group of animals challenging to breed in captivity.[667]

Considering that many of the difficulties of breeding wild animals have yet to be fully understood or have only been studied in certain species in modern times, it seems unlikely that the Romans had much success in breeding exotic animals*.* Whatever measures were taken to address the apparent depletion of wildlife, if any, the prospect of there being enough captive specimens to regularly supply the *venationes* seems highly improbable.

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[664] However, females do not generally ovulate again for 2.5 to 6 years after giving birth, although this varies according to the survival of offspring as well as environmental conditions.
[665] Modern zoos keep 'studbooks' of their breeding animals to ensure that the animals are healthy, sexually mature, capable of breeding, and, importantly, contain genetic diversity.
[666] Crates and Stojanovic (2022) 438. Unfortunately, there is no way of knowing exactly how captive born animals in the Roman world differed from their wild counterparts, if at all. Poor conditions of captivity could also lead to phenotypic change, such as in those animals reused for performances.
[667] In the wild, most primates will stay with their mother until sexual maturity (which can be as long as four years depending on the species) in order to learn important survival skills. Removing young primates from their mothers can consequently hinder social and cognitive development. In the long-term, orphan primates might find it difficult to interpret social cues during reproductive seasons.

Efforts to safeguard valuable animals for the games were probably also hampered by dramatic changes to the environment in the later Empire. Some of our literary sources from this period attribute the decline of wildlife populations to agriculture production, especially in regions that supplied animals for the arena.[668] It is no coincidence that most of our evidence for this trend comes from Roman North Africa, where both agriculture and wildlife trafficking were managed on a large scale. Since the late Republic, North Africa, along with Egypt, Sicily, and Sardinia, had exported enormous quantities of grain every year to feed Rome's growing population and mobile army.[669] Under the emperors, agricultural exploitation across north-western Africa intensified as a result of efforts to maximise productivity.[670] Imperial legislation increasingly allowed for uncultivated or marginal land to be used for the production of wheat, olive groves, and vines. By the end of the 2nd century CE, two-thirds of the grain supply that fed Rome was provided by Africa alone.[671] Untouched woodlands thus made way for farms and grand countryside villas that were laden with floor mosaics reflecting a 'Golden Age' of hunting, horticulture, and agricultural prosperity. As a consequence, the animals that once inhabited these areas progressively found themselves in direct conflict with herds and farm labourers, which may have prompted systematic efforts to eradicate wild beasts.[672] The co-existence of these groups is most clearly illustrated on a 2nd century CE mosaic from the House of the Laberii in Oudhna, south of Tunis, where leopards and wild boars are hunted amid various farming activities including herding sheep, milking goats, ploughing wheatfields, and rounding up partridges (Fig. 151).

With agricultural productivity came a dramatic boom in urban construction across North Africa. By the 3rd century CE, Tunisia alone boasted around 200 cities, many of which were equipped with entertainment buildings.[673] Unsurprisingly, cities that served as major centres of grain and olive production such as Thysdrus (modern El Djem) received

[668] Strabo, for example, suggested that the hunting spectacles may have had a positive impact on farming communities that supplied wild beasts for the games in Rome: "depredations of those who collect animals for the shows in Rome might have the effect of encouraging agriculture in places where it was otherwise made difficult by the number of destructive wild animals" (*Geo* 2.5.33).
[669] According to Aurelius Victor, Rome received 20,000,000 *modii* (ca.135,000 tons) of grain annually from Egypt under Augustus (Aur. Vict. *Caes.* 1.6), while Josephus reported that North Africa fed the Roman population for eight months of the year in this period and Egypt for four (Joseph. *BJ* 2.383). For discussion of the grain dole (*annona*) in the Roman Empire, see Rickman (1980) and Erdkamp (2014).
[670] Bomgardner (1992) 161-66, (2000) 216-17.
[671] Rickman (1980) 108-12; Raven (1969) 89. The *lex Manciana* was one law that dealt with agricultural activity on imperial estates within the region of northern Tunisia. The so-called Henchir Mettich inscription (116-17 CE) indicates that tenant farmers on the *Fundus Villae Magnae Varianae* were authorised to cultivate swamp and woodlands for olive production in accordance with the *lex Manciana.* Trimalchio's lavish banquet of exotic fruits including figs, pomegranates, and truffles from the markets of North Africa attests to the region's rich horticulture and the Roman taste for such delicacies (Petron. *Sat.* 35-38).
[672] Bomgardner (2000) 215-17.
[673] Raven (1969) 101.

monumental amphitheatres and accommodated some of the largest *venationes* in the Empire during this period.[674] It is reasonable to assume that urban development around these areas affected the behavioural patterns and spatial dynamics of animals to some extent.[675] Modern studies have shown that, while urban wildlife communities can coexist with people, the effects of urbanisation can drastically shape predator-prey relationships and, consequently, the availability of food sources.[676] Urban construction across Tunisia therefore had the potential to indirectly affect wildlife populations. Indeed, Tertullian remarked on the intensification of human activity in North Africa in the early 3rd century CE, noting that "smiling estates have replaced the most famous deserts, cultivated fields have conquered the forest, flocks of sheep have put wild beasts to flight… certain proof of the increase of humankind!" (Tert. *De anim.* 30.3).[677] Awareness of the symbiotic relationship between agricultural production and the *venationes* is found in an epigram composed by the late 5th century CE poet Luxorius, who attributes agricultural efficiency around a private seaside villa in Africa to trapping expeditions for the local *venationes* (*Anth. Lat.* 60):

> *Amphitheatrales mirantur rura triumphos*
> *et nemus ignotas cernit adesse feras.*
> *Spectat arando novas agrestis turba labores*
> *nautaque de pelago gaudia mixta videt.*
> *Fecundus nil perdit ager, plus germina crescunt.*
> *Dum metuunt omnes hic sua fata ferae.*
>
> The countryside marvels at the triumphs of the amphitheatre and the forest notices that strange wild beasts are there. The many farmers look at new struggles while ploughing and the sailor sees varied entertainments from the sea. The fertile land loses nothing, the plants grow in great abundance while all the wild beasts fear their fates here.[678]

Similar sentiments are found in a poem from the *Anthologia Palatina,* which commends the emperor for enabling the Nasamonians to graze their cattle without fear of attacks by wild beasts (7.626):

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[674] Epplett (2001a) 230. The amphitheatre at Thysdrus was constructed in the first half of the 3rd century CE while the amphitheatre at Carthage (built in the 1st century CE) received extensions during this period. On the *venationes* staged inside the amphitheatre at Carthage, see Bomgardner (1989).
[675] Shaw (1981) 387; Bomgardner (1992) 164; Epplett (2001a) 230. For a useful comparison, Nelis-Clément (2017, 232-33) breaks down the impact of building activities on deforestation in the Roman colony of Arles (Gaul), which possessed an amphitheatre, theatre, and circus in the imperial period.
[676] For case studies on the effects of urbanisation on wildlife in recent times, see Fischer et al. (2012) and Maurer et al. (2022).
[677] Trans. Cilliers (2019) 27.
[678] Trans. Rosenblum (1961) 147.

Ἐσχατιαὶ Λιβύων Νασαμωνίδες, οὐκέτι θηρῶν
ἔθνεσιν ἠπείρου νῶτα βαρυνόμεναι,
ἠχοῖ ἐρημαίαισιν ἐπηπύσεσθε λεόντων
ὠρυγαῖς ψαμάθους ἄχρις ὑπὲρ Νομάδων,
φῦλον ἐπεὶ νήριθμον ἐν ἰχνοπέδαισιν ἀγρευθὲν
ἑς μίαν αἰχμηταῖς Καῖσαρ ἔθηκεν ὸ παῖς·
αἰ δὲ πρὶν ἀγραύλων ἐγκοιτάδες ἀκρώρειαι
θηρῶν, νῦν ἀνδρῶν εἰσὶ βοηλασίαι.

Borders of the Libyan Nasamonians, your plains are no longer impassable because of the races of wild beasts; no longer will you echo to the roaring lions in the desert, way beyond the sands which belong to the Nomads, since the lad Caesar has captured a group without number and made them all face his fighters. The mountains which were once home to wild beasts now provide cattle-pasturage for men.[679]

While there can be no denying that populations of wildlife in Roman North Africa were adversely affected by the intensification of urban and agricultural development, as they continue to be in modern times, our ability to accurately measure (in a scientific manner) the impact of deforestation on wildlife depletion and, by extension, the supply of animals for the *venationes* throughout the Empire is complicated by the fact that much of our evidence is anecdotal. Furthermore, in considering this impact we must also be mindful of regional differences. Given its importance as a supplier of wild beasts, North Africa has received the most scholarly attention. Bomgardner, an important authority on this subject, argued that the gradual decline of big cats and other species in Africa from habitat destruction resulted in the increase use of local and trained animals for *venationes* throughout the Empire.[680] While this may have been true in the case of trained specimens, it is important to keep in mind that most provincial *editores* were likely already using native species as their main supply of performing animals, as we saw in chapter 1. Major centres such as Rome and Constantinople, both of

[679] Trans. Wiedemann (1992) 64. On the dating of this poem, see Ville (1981) 112; cf. Claud. *CS.* 280-284: "While we track out the dread progeny of Libya do you hunt the glades and rocks of Europe. Let joy banish fear from the shepherd's breast and his pipe hymn Stilicho in the dreadless forests. As his laws have given peace to the cities so let his shows give peace to the mountains." *Dum nos horribiles Libyae scrutamur alumnus, / Europae vos interea perquirite saltus / et scopulos. posita ludat formidine pastor / securisque canat Stilichonem fistula silvis. / pacet muneribus montes qui legibus urbes.*
[680] Bomgardner (1992) 164; cf. Nelis-Clément (2017) 252.

which imported *Africanae bestiae* on an extraordinary scale, were probably hit the hardest by the shifting environmental and political climate of North Africa.[681]

By the 5th century CE, the system of wildlife trafficking across the Empire had clearly taken a toll on cities that accommodated (and partially covered the costs for) animals and their various escorts during transit.[682] In 417 CE, a decree was issued by the emperor Theodosius II imposing a penalty on any military governor of the frontier zones who stayed in a city with their caravan of animals destined for Rome for longer than seven days (*CTh.* 15.11.2). The terms of the decree ensued from a complaint by the civil officials of Hierapolis in the Euphrates that a caravan of animals under the authority of the military governor's department had stayed in the city for three or four months, thus creating a burden for the city's citizens. Not only that, but the military governors had also demanded the city provide cages for the animals. Since carnivores could only be housed individually, and required a meat-based diet, the cost of keeping such animals in transit for lengthy periods would have been especially high.

As the conditions for wildlife trafficking became increasingly disrupted (and disruptive) in the late Empire, some *editores* may have looked more favourably towards games of evasion as a cost-saving measure to mitigate pressures pertaining to inflation and supply. Since the goal was no longer to kill animals outright, these exercises facilitated the reuse of wild beasts for future performances. This, in turn, may have allowed *editores* to purchase or hire animals that were perhaps cheaper than new, wild specimens obtained from abroad. Since breeding exotic animals was evidently not a lucrative or sustainable solution to these problems, recycling animals - especially big cats, whose dietary and husbandry requirements made them particularly expensive - was a practical alternative. Although we have no evidence, it would be interesting to know if the conditions of captivity in private or state-owned *vivaria* improved in response to the need to keep animals alive for longer periods.[683] It is important to emphasise that, if a higher premium was in fact placed upon the lives of wild beasts, this was not due to a change in Roman attitudes about the ethics of killing animals. Rather, the sparing of animal lives should be seen as an adaptation to meet new

[681] Of course, wild beasts could also be acquired from other parts of the Empire: leopards could be procured from Mesopotamia and Turkey in addition to North Africa, while India provided elephants, tigers, rhinoceroses, and various kinds of ungulates. It is possible that these regions gradually felt similar strains from the shifting economics of wildlife trafficking as well as the expansion of urbanisation.

[682] For a breakdown of the associated costs of animal caravans, see Bomgardner (2000) 211-14 and MacKinnon (2006) 12-13.

[683] Such developments can be observed in British zoos beginning in the late 19th century. See Jennison (1929/2013) for discussion of improvements made at Belle Vue Zoological Gardens in Manchester. Captive animals nowadays generally have a longer life expectancy than their predecessors, largely due to improvements to their housing, diet, and medical care, which have been driven by conservation efforts.

challenges that arose from the shifting economic and environmental climate of the late Empire.

In many respects, games of evasion were also more accommodating than hunting displays; not simply because of the cost-factor, but since it was not essential for them to be held in large venues. As we saw in earlier discussions, these exercises were specially designed for intimate interactions between humans and animals. Unlike the *venatores,* who pursued wild beasts in a manner that generally simulated the thrill of a chase, animal acrobats provoked their adversaries by entering the animals' critical distance, which did not require a large performance area. This rendered games of evasion highly compatible with many theatres, particularly those in the Greek East that were adapted for Roman-style spectacles in the high empire. As the artwork in the theatre at Corinth indicates, a small orchestra was sufficient for accommodating exercises like *contomonobolon*, provided it was equipped with appropriate safety provisions (see above, 4.1.1).

It is also important to not forget the element of competition in the later *venationes*. Just as in earlier periods, the desire of *editores* to compete with their predecessors and contemporaries was still a driving force behind spectacle design. Representations of the extraordinary variety of human-animal interactions and the apparatuses used reflect this desire. With the lives of animals no longer on the line, human performers had to find creative ways to hold the animals' curiosity while still maintaining an element of risk in their exercises. On the other hand, animals were often expected to perform complex kinaesthetic tasks, many of which the bear was highly skilled at. It is now this animal to which we shall turn our attention.

4.3. The Bear Necessities

The unrivalled appearance of bears in the literary and visual evidence is another characteristic feature of the games of evasion. Many scholars attribute the bear's prevalence in these displays to its omnipresence throughout the Roman world, where their geographic range extended from the tundra lands of the arctic north down to the mountainous regions of

North Africa.[684] In the west, bears inhabited vast territories in Europe, such as the woodlands of Scotland, Spain, and Germany, while in the east they were found all over the province of Asia Minor, including Mysia, Babylon, and Armenia.[685] The Mediterranean was also home to numerous bear populations, where Greek and Roman writers reported their appearance in Arcadia and Thrace and their native residence in the Italian countryside was well known, not least of all to the farmers who resided in their territory.[686] Naturally, the ubiquity of bears throughout the Empire would have made them staple candidates for the *venationes* when exotic species were harder to come by.

Historically, bears had always been popular in the arena - as quarry, combatants, executioners, and trained performers - but the demand for bears appears to have grown in the high empire. This is attested by the occupation of specialists who dealt specifically with the capture, transportation, and/or maintenance of bears. Epigraphic evidence commonly refers to such specialists as *ursarii,* though the term is rather ambiguous as it could refer to performers who specialised in fighting bears (such as the boxer from the Sofia relief) or bear-capturers (civilian or military).[687] By the 2nd century CE, the Roman imperial army was appointing *ursarii* to capture live bears, presumably for the emperor's games and menageries in Rome.[688] Evidence of this activity is found in numerous military inscriptions along the German frontiers, where bears were abundant. One inscription from Cologne celebrates the achievements of a centurion named Tarquitius Restitutus Pisauro who claims to have captured fifty bears within a 6-month period (*CIL* 13.12048, cf. 13.5243, 13.5703, 13.8174).

[684] Toynbee (1973) 93-100; Bomgardner (1992) 164-65; Epplett (2001a) 38; Nelis-Clément (2017) 252; Rea (2020) 83. There has been much debate about the presence of polar bears in the arena games at Rome. According to Martial, the famous *venator* Carpophorus killed a bear in the Colosseum who once dwelled under the 'Arctic sky' (Mart. *Spect.* 17). However, as Toynbee pointed out, this may in fact refer to Caledonia or northern Germany (Toynbee 1973 94; cf. Coleman 2006, 144). *Eclogues* 7 by Calpurnius Siculus describes bears chasing seals in a wooden amphitheatre, which led Jennison to interpret the bear as a polar bear (1937, 71, 189). References to Libyan and Numidian bears are abundant in Graeco-Roman literature: Strab. 17.3.7; Verg. *Aen.* 5.37; Mart. *Ep.* 1.104; Juv. 4.99.100; Cass. Dio 53.27.6. Unusually, Pliny the Elder contends that bears did not inhabit Africa, though he recalls that Domitius Ahenobarbus displayed 100 Numidian bears in the games celebrating his aedileship in 61 BCE (Plin. *NH* 8.54).

[685] A *Caledonicus ursus* was one of several bears employed as an executioner in the inauguration games of the Colosseum in 80 CE (Mart. *Spect.* 9); Claudian wrote about Spanish bears who dwelled in caves of the Pyrenees Mountain range (Claud. *Cons. Stil.* 3.309-313); the occupation of 'bear specialist' (*ursarius*) is well-attested along the German frontiers (e.g., *CIL* 13.8639); Hadrian hunted bears in Mysia (SHA *Hadr.* 20.3); during emperor Julian's invasion of Babylonia in 363 CE, Ammianus Marcellinus reported the savagery of bears that were kept in the royal game reserves of the Babylonian court (Amm. Marc. 24.5.2); and Pseudo-Oppian provides a detailed account of strategies that were used for hunting bears in Armenia (Ps.-Opp. *Cyn.* 4.354.355); cf. Juv. 4.99-100.

[686] Pausanias locates bears in the region of Mount Taygetus (1.32.1) and Thrace (8.17.3), the latter of which contained bears with pale or whitish pigmentation. Horace describes the threat from bears that lurked around sheepfolds at night in the countryside (Hor. *Epod.* 16.51); cf. Mart. *Spect.* 10.

[687] Epplett (2001a) 42.

[688] Jennison (1937) 140-41; Bomgardner (2000) 212; Epplett (2001b) 210-22.

Epplett argued that the imposed timeframe suggests *ursarii* were probably given quotas of animals to capture, and that Pisauro had clearly exceeded his.[689] Another inscription, found near Trier in the ancient city of Colonia Ulpia Traiana, records a dedication to the forest deity Silvanus by an *ursarius* named Cessorinius Ammausius (*CIL* 13.8639). A visual representation on an engraved glass dish produced in Cologne (ca. 350 to 375 CE) of a mounted hunter hurling what appears to be a rope or lasso over a bear may also attest to the prevalence of bear specialists in the Rhineland during this period.[690]

By the 5th century CE, circus factions, specifically the Greens and Blues, had become increasingly involved in the organisation of spectacles in the amphitheatre, including the supervision of wild beasts.[691] Acacius, father of the future Empress Theodora, held the title of 'Master of Bears' (ἀρκτοτρόφον) for the Greens at Constantinople in the 6th century CE (Procop. *Anecd.* 9.2). Though Acacius appears to have been responsible for a variety of different species (θηριοκόμος τῶν ἐνκυνηγεσίῳ θηρίων), his explicit association with bears may reflect the importance and popularity of this animal in the spectacles at Constantinople (indicated also by the consular diptychs discussed above).[692] There is no record of what Acacius' duties were; whether he had direct contact with the animals, oversaw their husbandry, or possibly both. Nonetheless, to hold such a title one would expect Acacius to have possessed some knowledge of the bear's dietary needs, behaviours, and housing requirements. If the animals under his care were destined to be used in repeat performances, it would have been imperative that he, or anyone associated with this role, understood the provisions needed to keep the animals alive and in reasonable condition.

Symmachus reports doing business with bear-dealers (*ursorum negotiatores*) in the lead up to his son's *ludi*, though, interestingly, there was a two per cent tax to which only bear-dealers were liable (Symm. *Ep.* 5.62). This may provide further evidence that such animals were in high demand in the later Empire. Despite the additional levy, bears were still considerably cheaper to procure than big cats, as indicated by the Price Edict of Diocletian (301 CE). As noted earlier, bears are omnivorous so their dietary requirements would have been noticeably more affordable than the meat-based diet of a lion or leopard. Even if the carcasses of herbivores killed in the arena did help reduce some of the costs of feeding big cats, as Epplett proposed, a bear's plant-based diet was far more sustainable from an economic standpoint.[693]

[689] Epplett (2001b) 214.
[690] Epplett (2001a) 178.
[691] Cameron (1976) 193-229.
[692] Epplett (2001a) 38; Roueché (1993) 73.
[693] Epplett (2001a) 102.

To judge from the frequency with which bears appear in his letters, Symmachus clearly thought of these animals as valuable subjects for his games and went to great lengths to obtain large quantities of bears from overseas (*de transmarinis locis ursi*) as well as locally (Symm. *Ep.* 7.121, 9.135, 9.142). However, his letters also draw attention to the inconsistent quality of bears. For one of his spectacles, Symmachus is said to have requested Italian bears but was anxious about them being fraudulently replaced by inferior ones on the way to their destination (*ne qua eos fraus avara commutet*, *Ep.* 7.121). It should be remembered that Symmachus had unfortunate luck in receiving malnourished bear-cubs on the eve of his son's games in 393 CE when he had requested lions (*Ep.* 9.117) and, on another occasion, the bears which he had ordered never arrived (*Ep.* 2.76). Thus, it is understandable why Symmachus had reservations about the legitimacy of the Italian bears, especially if he had purchased first-class specimens.[694] Clearly, such fraudulent acts were common enough to raise concerns among *editores.* Since bears were relatively widespread throughout Italy, it was presumably not so difficult for animal dealers (hoping to make a profit) to replace first-class specimens with inferior ones. Such inferior animals might have been malnourished or captive raised, as opposed to being freshly caught from the wild. It is possible, then, that Symmachus was concerned that his bears would share a similar fate as those acquired by Democharis, which perished from prolonged captivity (Apul. *Met.* 4.13).

In previous chapters it was noted that bears are highly food-orientated and thus respond optimally to human-controlled food conditioning. Bears are also intelligent and inquisitive by nature, which plays a vital role in their survival in, and adaptation to, new environments. These characteristics make the bear relatively easy to control (i.e., tractable) and train to mimic human behaviour, which might explain their transcultural and transhistorical exploitation in the entertainment industry. The existence of professional bear troupes, such as those represented on several late 3rd/early 4th century North African mosaics, discussed in chapter 2, may suggest that the Romans also regarded the bear's tractability as a valuable affordance.[695] Being tractable was not a necessity for all performing animals, but it probably made the bear more lucrative to exploit, especially in the context of the later Empire. Indeed, some scholars have argued that the popularity of bear troupes in Late Antiquity may also point to growing concerns about supply, since evidently these troupes could have been reused for subsequent performances.[696]

[694] 25,000 *denarii,* cf. 20,000 *denarii* for second-class according to Diocletian's Price Edict.
[695] For example, the Radès Mosaic (late 3rd century CE) and Korba Mosaic (mid-4th century CE). See chapter 2 section 2.6.1 for discussion of these mosaics.
[696] See Bomgardner (1992) 164 and Nelis-Clément (2017) 252.

While the ubiquity of bears throughout the Roman world, alongside their affordability and tractability, helps to elucidate their prevalence in the later *venationes,* it remains to be seen why bears were so well-suited to the types of exercises that characterised games of evasion. A closer look at the bear's cognitive abilities and behavioural flexibility may shed some light on this matter. To date, much of the scientific literature on enhanced cognition and innovation in animals has focused on primates, birds, domestic dogs, and some mammalian carnivores, such as spotted hyenas and big cats.[697] Until very recently, bears have been overlooked in cognitive research as they do not conform to the 'social brain' hypothesis by not living social lives despite possessing large brains (relative to body size).[698] Increasingly, bear studies have looked at how the diverse environments in which they live and diet specialisation condition their behavioural flexibility.[699] Brown bears (*Ursus arctos*) are the most widespread bear species, occupying diverse seasonal habitats where the availability of plants and prey constantly shifts. In order to exploit a variety of food sources, bears have developed complex manipulative and extractive foraging strategies, such as excavating, raking, lifting and turning objects, and debarking trees, that enable them to gather food efficiently from a range of environments.[700] Since many of these strategies require advanced cognitive and perceptual faculties, like motor learning and goal-directedness, ethologists now believe that the bear's foraging behaviour promotes the evolution of spatial cognition, which may account for the bear's encephalised brain.[701]

So, what can the bear's cognitive abilities reveal about its performance in the Roman games? Firstly, it is worth remembering that many of the exercises employed within the arena (discussed above) involved the use of non-lethal devices that could be manipulated (i.e., pushed, rolled, turned over, levered, thrown) around the arena by both human *and* animal participants. Assuming that the bears exploited for spectacle did not suffer from severe morphological deformities, it is likely that all were capable of manipulating these devices to some degree using their dexterous forepaws, mouth, or nose, as modern bears can be observed doing with objects in the wild.

A recent study on problem-solving and manipulative ability in captive brown bears conducted across seven zoological parks in the United Kingdom provides further insight into

[697] Primates: Boesch (2012); birds: Emery and Clayton (2009); dogs: Horschler et al. (2019); spotted hyenas: Benson-Amram and Holekamp (2012); big cats: Borrego (2017); carnivores in general: Benson-Amram et al. (2023).
[698] On this hypothesis see Dunbar (1998).
[699] Deecke (2012); Van Daele et al. (2012); Costello et al. (2016); Mangipane et al. (2020).
[700] For example, the European brown bear (*Ursos arctos arctos*) will spend 45-60% of a 24 hour day foraging for a variety of food sources. Roth (1983) 223-29.
[701] Deecke (2012) 727-28. Encephalisation implies an increase in brain size relative to body size. For discussion of the relationship between innovative behaviours and brain size in primates and birds, see Lefebvre et al. (2004).

how bears may have utilised their cognition and motor skills in the arena.[702] The objective of the study was to present a group of seventeen captive bears with two tasks: to gain access to a baited puzzle box using problem-solving abilities, and to manipulate an object (in this case a tree stump) to facilitate the retrieval of a food reward that was suspended out of reach. This second experiment aimed to examine the ability of 'tool-use' in bears. Although the definition of tool-use remains a subject of debate among scientists, it is generally argued that tool-use comprises "the use of a freely manipulable object to modify the physical properties of a target object through a complex mechanical interaction."[703] This might involve manipulating a rock to relieve an itch, using a stick to test the depth of water, or waving a branch as a form of communication (Fig. 152).[704]

The results from the first experiment found that the bears were able to use their problem-solving abilities to open the puzzle box, in some instances using a latch that facilitated access to the food inside.[705] Most interestingly, it was observed that, with increasing time, the bears utilised a number of different techniques (usually invoking physical force) until one was successful, thus indicating trial-and-error learning. Strategies included tipping, pounding, and shaking the box, as well as clawing at the food stimulus that was visible through the bars of the box. Techniques that proved successful were repeated during subsequent trials, which also suggested the bears remembered previous attempts through 'asocial' learning.[706] This was particularly the case with juvenile bears, who have been found to display greater persistence and exploratory behaviours in the wild than adults. The results from the second experiment proved equally fascinating; though none of the bears utilised the tree stump to access the food reward, they did exhibit significant resourcefulness in the strategies employed to retrieve the reward, such as climbing a tree or apparatus and shaking the food free. While the bears did not show the proficiency in tool-use that other bears studied

[702] Chambers and O'Hara (2023).
[703] Deecke (2012) 725. Beck (1980, 307) classified six different types of tools used in this behaviour: 1) objects thrown at predators or rivals, 2) objects used to hit predators, 3) hunting weapons (only hominids), 4) objects incorporated into social displays, 5) objects to clean body parts, 6) objects made and used to acquire food.
[704] Surprisingly, tool-use is relatively rare among mammalian taxa in the wild. To date, studies have observed tool-use in sea otters: Kenyon (1959), Asian elephants: Hart et al. (2001), bottlenose dolphins: Krutzen et al. (2005), humpback whales: Jurasz and Jurasz (1979), and some species of primates: Breuer et al. (2005); Pika et al. (2003). Only recently has this behaviour been studied in wild bears, specifically the brown bear. On wild bears see Deecke (2012); captive bears: Waroff et al. (2017); Stirling et al. (2021); Chambers and O'Hara (2023).
[705] The bear's ability to manipulate latches to open objects is also reflected in the design of bear-proof bins, which are disturbed throughout public parks inhabited by bear populations in North America.
[706] In contrast to social learning, whereby an animal learns through the influence of the behaviour of conspecifics, asocial learning involves "direct interaction with the inanimate environment." Since bears are considered obligatorily solitary, this does not seem surprising. See Chambers and O'Hara (2023) 54-55.

in captivity and in the wild have, the findings from this experiment highlight the cognitive potential of bears, in particular their ability to problem-solve, innovate, and perform flexible behaviours to achieve a goal.

By applying this study on bear cognition to the games of evasion, we can deduce that bears were highly capable of performing the kinaesthetic tasks that were demanded of them in the arena, such as object manipulation. Theoretically, a bear could turn the panels of the *cochlea* or the posts of the see-saw apparatus with the goal to rid itself of the target object (i.e., the human performer). A bear could also modify these devices and their use depending on the task at hand. For instance, an *ericius* could be pushed, rolled, or thrown around the arena by a bear to break it open or simply to relieve itself of frustration. If the design of the *ericius* made the performer at least partially visible, this might have influenced the bear's persistence at trying to break the device and thus retrieve its 'reward'. Based on modern observations, juvenile bears might have exhibited greater persistence at these tasks than adult specimens. Using their bipedal abilities, bears could also stand on their hind legs to capture a *salitor* in flight or a tightrope walker that balanced precariously above them. The longer the performance went on for, the more varied their strategies might have become, therefore increasing the interest, unpredictability, and novelty of their acts. Although this is only speculation, it is possible that some bears remembered what strategies worked best to achieve their goal and employed them in subsequent performances. The displeasure expressed by Theodoric at watching animal acrobats gamble with their lives implies that it was not uncommon for performers to fall victim to their feral adversaries, perhaps to ones that had former experience in the arena. Most significantly, and despite their tractability, bears did not require training to perform *any* of these behaviours. Rather, their proficiency at object manipulation was a product of their physiology and foraging adaptations.

The bear's ability to effectively respond to the kinaesthetic demands of the exercises discussed above has important implications for spectacle design in Late Antiquity. From a managerial perspective, bears were cheaper to both procure and maintain than other predators, such as the big cats, but they were also probably more reliable when it came to entertaining the crowds. Since bears habitually engage in manipulatory activities, they were naturally proficient at executing many of the tasks presented to them in the arena. These behavioural affordances of the bear made it an attractive candidate to exploit *and* reuse in the Roman arena but especially in games of evasion, where the bear's perceptual motor skills were most useful. Although perhaps only a secondary factor, the bear's behavioural flexibility may also partially account for its popularity in Late Antiquity.

4.4. Conclusion: The Show Must Go On

Between the 3rd and early 6th century CE, *venationes* were more commonly staged as intimate, small-scale performances in which death of the animals was no longer the objective. In this setting the tables had turned, and it was the human performers who found themselves in the greatest danger. Different types of performers tried their luck at evading the attacks of wild beasts by executing daring acrobatic feats, sometimes with the aid of non-lethal and manipulable apparatuses, which became the main attraction of the display. In effect, these exercises ensured that the animals could be reused for subsequent shows. This raised the question of why *editores* may have felt it necessary to spare the animals rather than have them hunted.

These exercises found increasing popularity in a context that was characterised by the shifting cultural, economic, political, and environmental climate of the later Empire. The worsening supply of wild beasts, caused by a combination of pressures including inflation, political unrest, and agricultural intensification, appears to have had a significant impact on the production of *venationes*. Ambitious *editores* in Rome and Constantinople continued to seek animals from abroad for the consular games, but this practice became increasingly difficult over time. Statutes were issued by the emperors to help regulate the inflated prices of animals and safeguard, for their own games, particularly ferocious species. Big cats were highly valued for the dangerous and dramatic interactions they afforded, but their high acquisition and maintenance costs, in particular their carnivorous diet, made them especially expensive commodities. It is possible that breeding programs were established in Italy to preserve species that were at risk of depletion, though it is doubtful that such efforts met the required number of animals demanded of the *venationes.* During the same period, agricultural production, particularly in north-western Africa, intensified as a result of imperial efforts to maximise productivity on uncultivated lands. This might have further impacted the wild beast trade, though to what extent is difficult to discern.

Despite these challenges, *venationes* continued as an important element of the games celebrated in association with consular appointments and the imperial cult at provincial capitals. However, by this time a higher premium was being placed on the lives of the animals. Games of evasion offered an economic solution to the worsening supply of wild beasts, and bears emerged as the most suitable candidate for these displays. This was largely due to their widespread availability across the Roman Empire, their comparatively low maintenance costs, and their tractability. Ursine behaviour and physiology was possibly another reason for their popularity in these games. The bear's characteristic bipedalism and advanced motor skills set it apart from most other species. Using their dexterous forepaws, bears could push,

roll, or throw non-lethal apparatuses around the arena just as they might have done with objects in the wild. While bears were not unique in their ability to manipulate objects, as the ancient and modern evidence attests, their behavioural flexibility and problem-solving skills made bears extremely adaptable to a variety of complex interactions, thus affording human performers more diverse challenges. It would be anachronistic to assume that the Romans were experts on the bear's motor skills, particularly given that such skills are only now being brought to light by modern research. However, the frequency with which bears are represented manipulating devices in the ancient evidence strongly suggests that Roman *editores* exploited this skill at the very least.

To argue that the bear's behaviour and manipulative abilities were the cause for its popularity in the games of evasion is perhaps placing too much significance on the animal's affordances. As we have seen in previous chapters, these characteristics had already been widely exploited by Roman *editores* in the early imperial games where bears could be observed climbing stage apparatuses, pulling reins, and performing on their hind legs. Nevertheless, it is possible that growing pressures on the supply and cost of animals in the later Empire drove *editores* to think more creatively about how the bear's repertoire and physiology could benefit them under these particular conditions. By this means, the Romans made adaptations to the *venationes* that ensured their continuation as a formal institution.

CONCLUSION

A study of animals and their role in shaping the history of Roman *venationes* is long overdue. This thesis aimed to identify the influence of animal behaviour on spectacle design and the relational manner in which the Romans responded to, and accommodated the natural propensities of, the animals they displayed. The central questions were as follows: 1) What behavioural affordances and demands did animals offer, and impose on, the production of *venationes*? 2) What knowledge did the Romans bring to bear in their responses to animal participants, and how was this informed by human-animal interactions beyond the arena? 3) Are new historical interpretations of *venationes* made possible by considering the animals' perspective? Specifically: 3a) What does the evidence say about the animals' lived experiences in the arena? 3b) How does this exposure of the animals' lived experiences provide a new perspective and interpretation of the history of *venationes* that is beyond the human and inclusive of the animals? In the preceding chapters, I have discussed four facets of spectacle design that were influenced to some degree by the biological characteristics and behaviours of the animals. Chapter 1 explored the design and implementation of safety provisions in Roman entertainment buildings. Chapter 2 examined the roles that animals played in the arena. The strategies and equipment used by human performers to interact with the animal participants were presented in chapter 3 and the adaptations to the choreography of *venationes* in Late Antiquity were discussed in chapter 4. Modern animal science knowledge, together with my empirical observations of modern zoo management and practice, were used to help expose and explain the practicalities of spectacle design and provide new interpretations of the ancient evidence from the perspective of animal behaviour. I have drawn the general conclusion that the animals' characteristic behaviours and historical interactions with the Romans had a significant effect on the way that *venationes* were produced.

This thesis has set out the enormous diversity in animal affordances offered to, and animal demands imposed on, the spectacle design process. From the disparate ways they moved, to their different fighting styles, sensory systems, and dietary requirements, animals - in all their variety - pervaded design-decisions. Where the physical arrangements of a venue were not adequate to withstand the strength or locomotor capabilities of the species anticipated for display, design modifications were made prior to the spectacle. In theory, a tall, permanent barrier would have probably been sufficient for containing most animals, but in practice this was not always possible. The archaeological remains of entertainment buildings indicate that the Romans responded to this challenge by designing flexible safety provisions that could be adapted for a wide range of species, venues, and performances. This

also facilitated variety in the ways that animals could be displayed and hunted (e.g., in terrestrial versus aquatic conditions). In some instances, the particular anatomy and/or physiology of an animal limited the ability of the Romans to fully exploit or employ all of the animal's attributes in a spectacle. One such animal was the giraffe, whose unique anatomy and incredible size made it particularly difficult to capture and transport to the arena. The decision to cast the giraffe almost exclusively as a natural curiosity, as the literary evidence clearly indicates, might have been a deliberate strategy to compensate for the animal's inherently complicated husbandry and logistical demands. Despite what some scholars have argued, an animal's docility does not support the assumption that it is easy to manage, or even transport. Although the ancient evidence affords only a glimpse into the animals' general care leading up to a spectacle, diet was likely another factor that hindered efforts to exploit the full range of capabilities for a particular species. Obligate carnivores such as big cats required a strictly meat-based diet, which naturally made them more expensive animals to house than other valued predators, such as omnivorous bears. Towards the end of the 3rd century CE, when inflation was very high across the Empire, the high cost of some dietary needs might have had a significant economic impact on the *venationes.* In particular it may not have been economic to display certain animals. The disappearance of the elephant from the arena in this period, while not conclusive, might have been due to (at least in part) its burdensome husbandry requirements.

While distinctions in the behavioural demands and needs of the animal participants certainly brought challenges to spectacle design, it also afforded opportunities for the *editores* to exploit their subjects in myriad ways. In the most basic sense, different species afforded different kinds of interactions. For instance, big cats and bulls were both regarded as suitable executioners because their lethal weapons (i.e., claws/horns) and high propensity for reactive aggression afforded extremely dangerous interactions. While bulls were notorious for their violent bucking capabilities, big cats could create a more suspenseful and dynamic execution by displays of great agility as they scaled apparatuses. The elephant's natural balancing and object manipulation skills, in addition to their social cognition and rhythmical entrainment capabilities, made them an ideal candidate for theatrical shows. Nevertheless, the elephant was no less dangerous to exploit despite these affordances; its unpredictable aggression and liability to stampede (as observed by the Roman army in their wars against Pyrrhus and Carthage) gave elephant performances an edge of danger. That such attempts were made to train elephants, among other dangerous animals, to perform tricks, demonstrates the Romans' determination to test, manipulate, and exploit the *full* behavioural repertoires of animals for maximum display impact.

Although this thesis has considered a wide range of species, the bear emerged time and again throughout this study as a popular participant not only in the games at Rome, but also in the provinces. I suspect bears were popular for spectacles as a result of their widespread distribution and accessibility across the Mediterranean, and their unique behavioural affordances. Being bipedal, bears could stand and fight on their hind legs, and thus adopt a remarkably human appearance that was appealing to the spectators. Bears were also formidable agents of executions, excellent climbers, and responded optimally to stimuli perceived as food. The intelligence and amenability of bears also made them easy to control and especially lucrative to exploit in repeat performances as trained specimens. Most significantly, their behavioural flexibility afforded kinaesthetic interactions that many other species were unable to emulate. This was most valuable in games of evasion where bears routinely performed agile, manipulative behaviours using their dexterous forepaws, creating interest and variety in their acts without requiring the animals to be killed. If there is any species that provides the most insight into the interplay between animal behaviour and spectacle design, it is unquestionably the bear. The importance of bears prompts a strong recommendation that future work should investigate the cultural reception of bears in different parts of the Empire, drawing comparisons between regional attitudes towards the species and their appearance in public displays.

This study also looked beyond the arena to better understand the thinking behind the design process for the *venationes*. The ancient evidence clearly indicates that the Romans readily drew upon existing strategies and knowledge of interacting with animals from various aspects of daily life to make informed decisions about how to respond to, and accommodate, the animals' natural propensities. Methods of hunting and trapping animals in the wild likely provided some inspiration for the design of safety barriers in Roman entertainment venues. Traditional hunting equipment, weapons, and goads also appear to have been used in the *venationes.* Furthermore, landscaping the arena with live or artificial scenery, however infrequent this practice may have been, increased the methods by which the animals could be hunted, while affording the animals more opportunities to perform a wider range of behaviours. A survey of the arena's sensory properties found that the Romans also used engagement strategies and tools employed in livestock management to stimulate animal participants. Stimuli associated with touch, sight, sound, smell, and taste were probably manipulated to make the animals more interactive, controllable, or dangerous to fight. Such stimulation may well have been instrumental in bringing about specific responses from the animals so they could fulfil their assigned performing role. Significantly, this suggests that the Romans had some understanding of the animals' individual sensory orientations and used this knowledge to exploit them for maximum display impact. The Romans' ingenuity was their

ability to adapt familiar strategies and equipment to respond to a more diverse and dangerous group of animals in nuanced ways.

While investigating the dynamic processes of knowledge exchange in spectacle design, it was also observed that experienced animal handlers and hunters might have had some input in the design and planning of a *venatio,* though to what extent is difficult to say. One major challenge that surfaced time and again throughout this study was the anecdotal and biased nature of the historical sources available. What survives was generally created by, and for, the elite and thus hides the perspectives and actions of any but their own class. Nevertheless, sometimes it was possible to garner insights into the activities of animal specialists in the contextual details provided by these elite authorities. Strabo's description of a semi-aquatic reservoir built for one of Augustus' crocodile displays offered a particularly interesting example. Its unique design, which comprised a pool and raised platform, catered to the highly specialised routine of the crocodile hunters from Tentyra, who dragged their quarry between water and land. Although we lack direct evidence for this, it is not unreasonable to suppose that specialists like the crocodile hunters were actively involved in designing as well as partaking in the *venationes.* Indeed, many of the decisions pertaining to the display of wildlife in modern zoos are made by experienced zookeepers who are attuned to the behaviours of their animals. Without their input, zoo exhibits would not be able to cater to the specific needs of the species on display. It is clear from this study that animal specialists should be included in the list of Rome's 'silent majority', whose lives are increasingly being studied in scholarship. Important works such as Knapp's *Invisible Romans* (2011) have already highlighted the value of seeing aspects of Roman life from the perspective of these 'others' and much can be gained from taking this approach to study the *venationes.* An investigation into the lived experiences of animal specialists and how their empirical knowledge and understanding of animal behaviour informed design decisions has not yet been completed in any real depth and may well prove a fruitful area for future research.

One of the more significant findings to emerge from this study was the close interplay between the roles which animals played in Roman society and those they were subjected to in the arena. This was most clearly seen in the case of the dog, arguably one of the least studied performers of the *venationes.* In the hunting fields, in agriculture, and in the domestic realm, dogs were valued for their keen senses, discipline, loyalty, swiftness, and courage. Based on the literary and iconographic evidence, these affordances rendered dogs as the natural candidates to serve as hunting aids in the *venationes.* I have argued above that the dog's continuity in this role suggests that the *venationes* were also a platform to perform aspects of ancient life where intimate human-animal interactions took shape. Leaving aside the significant animal deaths reported in the literary evidence, which is at times problematic, it

strikes me that the *venationes* were not simply a violent, wasteful phenomenon as some earlier studies have argued. Rather, they were reflections of the multifarious experiences shared between the Romans and the animals that permeated their lives. This interpretation contributes to the growing body of research that is moving away from sensationalist detailing of the violence in the arena and towards approaches that view the *venationes* as a cultural pursuit. It would be constructive to further explore the absence of other well-known species and whether their behaviours and affective encounters with the Romans influenced their exclusion from the games. A good place to start would be with the wolf, who was one of the most conspicuous absentees from the games in Rome.

This study also set out to provide a new perspective and interpretation of the history of *venationes* that is beyond the human and inclusive of the animals. Integrating animals into the narratives of *venationes* in an active, history-shaping way proved to be the greatest challenge and limitation of this thesis. It required the study to consider not only the experiences that animals might have had in the arena, but also question whether it is even possible to accurately represent those experiences at all. Not only do animals lack dedicated archives of their own, but they also possess forms of perception that are subjectively different from anything experienced by humans. This naturally limits our ability to truly understand the world which animals perceive. And yet, to ignore *their* experiences in the arena would be to write only a partial history of the *venationes* and thus only partially understand the composite events and processes that contributed to their production. Although our observations will always be hindered by the anthropocentric nature of our sources, we should nevertheless strive to integrate animals into human histories because those histories were made with historical animal actors. Simply put, to understand the design of *venationes* requires an understanding of the animal participants.

It was noted in the Introduction that previous studies have been largely concerned with the cultural and symbolic roles of animals in the *venationes*, and in this the limits of these studies are revealed. My focus on the sentient animal breaks away from this approach and instead recognises the animals' capacity to actively influence and/or effect change in the arena through their adaptive behaviours and affective encounters. Jennison spearheaded this animal-centred approach in his important study of *venationes*. One of the goals of this thesis was to bring his findings (both zoological and ancient) more up to date. Animal science together with my own observations working in zoos have been fruitful avenues from which to gather current empirical information about the psychology of animal behaviour. This information has been used throughout the study not only to question the validity in historical sources that represent the animal participants, but also to provide new interpretations of the *venationes* from the perspective of animal behaviour.

We have seen that the conditions of the *hypogeum* and other enclosed areas of entertainment buildings probably kept the animals in a chronic state of excitement, thus increasing their incentive to avoid danger by means of escape. Since flight is a survival response of all species, it was possible to hypothesise a range of scenarios that could have influenced the provision of safety measures. A closer inspection of the arena's sensory properties revealed that lighting, music, and other stimuli would have elicited strong fight-or-flight behaviours from animals when they interacted with human performers. Environmental enrichment, a welfare practice implemented by modern zoos, was used to elucidate how these stimuli might have affected different species in different ways. By this means, it was possible to draw some conclusions about the varied experiences of animals and how these were shaped by their individual capabilities, motives, repertoires, and biology. Indeed, we have seen that the Romans readily recognised the individuality and capacity for intentionality in some of the animal participants. On many occasions animal agency proved the undoing of a well-planned performance. Most notable were the animal executioners, who either refused to cooperate or directed attacks towards their exploiters rather than the condemned. While animals were undoubtedly limited in their capacity to change or challenge the conditions of their exploitation, they were not completely devoid of agency. By acknowledging this agency, and thus challenging human exceptionalism, this study has avoided falling into the trap of victimising the animal participants.

This thesis represents only a small glimpse into the contribution of animals to spectacle design. Although the focus has been on animals in Roman entertainment, the methodology used may well have a bearing on research into other aspects of ancient life that were shaped and enriched by historical animal actors. The behaviours of modern animals - in the wild and in captivity - can tell us a great deal about the different kinds of interactions different species may have afforded ancient civilisations. Scholars that research these interactions should strive to learn as much as they can about the behaviour of animals through ethological resources, especially their own behavioural observations of the species under question. It is my hope that this thesis provides an impetus to continue Jennison's trail and collaborate with zoologists to help better understand human-animal relationships of the ancient past.

APPENDICES

Appendix I. Glossary of Zoological Terminology

Arboreality	An arboreal animal spends most of its life in trees and performs many important aspects of its daily life above ground, including feeding, nesting, playing, reproduction. See also *Scansoriality*.
Aestivation	A period of dormancy in the summer, usually experienced by reptiles and amphibians. Aestivation enables animals such as crocodiles to avoid excessive heat or drought. During this period, most crocodiles will not feed as this may cause the animal's stomach to rot.
Animal agency	The ability of animals to actively influence and/or effect change in the *venationes* through their adaptive behaviours that are predicated on their sentience, lived experiences, cognition, individuality, sociality, and culture.
Animal psychology	A multidisciplinary branch of zoology that studies the cognitive processes of animals and animal behaviour.
Asocial learning	A way of learning that involves direct interaction with the inanimate environment. In contrast, social learning involves learning through the influence of the behaviour of conspecifics.
Biostimulation	To biologically stimulate an organism to functional activity.
Brachiation	A form of locomotion that uses only the forelimbs to swing from branch to branch. Many primate species are proficient brachiators.
Bucking	A movement performed by an animal in which it lowers its head and raises its hindquarters into the air while kicking out with its legs. This behaviour is commonly performed by equines, cattle, goat, sheep, and deer. See also *Flank Strap.*
Bullhook	A pain-induced, tactile instrument commonly used by mahouts in the handling and training of captive elephants. It consists of a hook (usually made of steel) and a pointed end attached to a short pole. A mahout will apply the bullhook to sensitive points on an elephant's body to encourage desirable responses from the animal.
Bunting	A type of agonistic behaviour performed by cattle that involves pushing horns.
Canned hunting	A form of trophy hunting that involves hunting within a confined area which prevents the animals' escape, thereby increasing the likelihood of the hunter killing their quarry. In some instances, the animals are also drugged to reduce their aggression.
Captive animal management	A discipline that deals with practical and psychological aspects of managing wild animals in captivity, including exhibit design, veterinary practices, environmental enrichment, husbandry, and education.

Capture myopathy	Also known as 'capture stress'. A condition that arises from inflicted stress and physical exertion that occurs with the prolonged or short intense pursuit, capture, containment, or transportation of wild animals.
Conspecific	An individual of the same species. Contraspecific refers to relations between species of different kinds.
Critical distance	The distance at which an animal's behaviour might shift from escape (flight response) to attack (critical response). The distance is specific to each individual animal and can often be accurately measured.
Critical response	Aggressive behaviour (or attack) that occurs from a threat entering an animal's critical distance.
Death roll	A spinning manoeuvre performed by crocodiles that involves holding its prey under water and rolling several times in quick succession until the prey drowns.
Defensive behaviours	Behavioural actions that aim to minimise the chances of an animal being harmed. Animals can engage in different defensive behaviours when faced with predatory threats, such as escape, attack, freezing, alarm vocalisations, or thanatosis (playing dead).
Displaced aggression	A type of re-directed behaviour that occurs in situations of conflict or thwarting, where the animal has simultaneous tendencies to attack and flee.
Ectotherm	An animal that depends on external sources, such as sunlight or heated rock surfaces, to regulate body temperature.
Encephalisation	Implies an increase in brain size relative to body size. Bears are considered to have an encephalised brain, despite living solitary lives.
Environmental Enrichment	A broad term used to refer to the provision of stimuli that act to enhance the social, cognitive, and physical complexity of a captive environment. The goal is to increase behavioural diversity and species-appropriate behaviours by making the environment more dynamic and providing opportunities for the animals to control social interactions and make choices.
Escape	The act of avoiding harm by increasing the distance of an agent (i.e., the animal) from the source of a threat (i.e., a predator), and possibly finding refuge in a safe location.
Escape vigour	The intensity of the escape action, which can be inferred from the speed of the escape, or the amplitude of movement.
Ethnozoology	A multidisciplinary branch of zoology that studies complex relationships between humans and animals in their environment.

Ethogram	A catalogue of all the behaviours performed by any given species. It describes every unique behaviour seen in that species under every conceivable circumstance.
Ethology	A branch of zoology that studies animal behaviour, usually with a scientific focus on behaviour under natural (though sometimes captive) conditions.
Exhibit furniture	Objects and features (natural or artificial) placed in zoo exhibits for the specific behavioural needs of the animals. Physical installations are designed to increase the complexity of an enclosure, the animal's choices, agency, and their control within that environment.
Facultative carnivore	An animal that does best on a carnivorous diet but can survive, though not thrive, on a non-carnivorous one. Dogs and wolves are both facultative carnivores.
Fire Fishing	A method of fishing, traditionally used by some cultures in East Asia, that involves catching fish by means of bamboo lit with sulphuric fire.
Flank strap	A fleece-lined strip of leather that is tied around the bull's flank (the lower torso, near its hind legs) in bovine rodeos. Its purpose is to encourage bucking, rearing, and kicking behaviour.
Flehmen	A behavioural response in which an animal inhales with the mouth open and upper lip curled to facilitate exposure of the vomeronasal organ to a scent. Bulls will characteristically perform Flehmen to detect oestrus from cows.
Flight distance	The distance at which an animal will flee from the presence of a threat. The distance is specific to each individual animal and can often be accurately measured.
Flight response	A type of defensive behaviour (e.g., escape) that occurs when the presence of a threat enters an animal's flight distance.
Herbivore	An animal that only eats vegetation. These animals have evolved digestive systems capable of digesting large amounts of plant material. Plants are high in fibre and starch, which provide the main energy source of their diet. Herbivores can be further classified into frugivores (fruit-eaters), granivores (seed eaters), nectivores (nectar feeders), and folivores (leaf eaters).
Locomotion	The act of moving from one place to another. Animals perform a variety of methods of locomotion to escape from dangers, such as running, jumping, climbing, swinging, swimming, flying, etc.
Lunge whip	A long whip with a flexible end used for lunging (sending an animal forward without needing to be on their back), typically for training and conditioning horses. In the circus industry, this whip is often used to control or guide animal behaviour, either by directly whipping the animal or waving it in certain directions.

Nuisance animal	An animal that a landowner or community wants removed to protect humans from injury by the specified animal. Asian elephants are frequently perceived as nuisance animals in parts of India due to the damage they cause to crops, livestock, and human lives in villages that overlap with elephant habitats or corridors.
Obligate carnivore	An animal that depends *only* on meat for survival as their body cannot digest plants properly. They may eat other sources of food, such as plant matter and fungi, but they are unable to get the nutrients they need from these substances alone. All felid species and crocodilians are considered obligate carnivores. See also *Facultative carnivore.*
Omnivore	An animal that eats and thrives on both plant and animal-based food. While their food options are greater than those of herbivores or carnivores, they are still limited by what they can find to eat or what they can catch. Bears are considered omnivorous.
Phenotypic changes	Changes to an animal's morphology, behaviour, and health as a result of their environment.
Plantigrade	A form of locomotion that refers to walking with the toes and metatarsals flat on the ground. Bears share this unique ability with humans. Also called bipedalism, which means the ability to stand and walk upright.
Positive punishment (P+)	Adding a stimulus to make a behaviour less likely to happen again. For example, whipping an animal to deter undesirable behaviours.
Positive reinforcement (R+)	Adding a stimulus to make a behaviour more likely to happen again. For example, rewarding an animal with food after it performs a desirable behaviour.
Object manipulation	The action of manipulating one or more objects using dexterous parts of the body. See also *Tool-use.*
Rutting season	A period when male deer (bucks) experience an increase in testosterone, which boosts aggressiveness, leading to fights with other males to establish dominance or access to females.
Scansoriality	A scansorial animal may nest on the ground but acquire some of its resources from trees.
Sentience	In animal studies, sentience is standardly defined in terms of the capacity for conscious suffering and/or enjoyment.
Studbooks	Zookeepers maintain studbooks of their breeding animals to ensure that the animals are healthy, sexually mature, capable of breeding, and contain genetic diversity. By keeping a record of their gene pool zoos can avoid inbreeding, which can cause offspring deformities and health issues for the animals.
Tameness	Tameness in a wild animal is understood by the loss of the flight tendency. It differs from domestication in that a tame animal

	maintains a core of wildness, which can be reactivated under appropriate circumstances.
Tool-use	The use of a freely manipulable object to modify the physical properties of a target object through a complex mechanical interaction (e.g., a bear using a rock to relieve an itch).
Translocation	The physical transfer of an animal from one habitat to another, for instance, from its natural habitat to captivity.

Appendix II. Tables

Table 1. Guidelines for Containing Captive Wildlife in New Zealand

Due to the different locomotor capabilities of animals, there is no single barrier design that meets the needs of all species, nor is there a universal standard for all modern zoos. Rather, there are recommendations, typically published in accredited zoo manuals and databases by zoos and/or zoological associations, that serve as guidelines for institutions and animal professionals to measure their success in managing safe facilities for captive animals.[707] The table below provides a list of selected guidelines from Appendix 2 of the Ministry of Primary Industries Guidance Document: Generally Accepted Practice in New Zealand Zoo Containment Facilities (June 2019).

Animal	Locomotion	Unclimbable Barrier* minimum height	Climbable Barrier** minimum height	Minimum Wet Moat Specifications
Felidae				
African Lion *Panthera leo*	Jumping Climbing	4m	4m 3.6m mesh fence with 900mm internal overhang at 35°-45°	4m wide, 1.8m deep moat with 2m unclimbable barrier
Bobcat *Lynx rufus*	Jumping Climbing	2.9m 2.5m wall with 900mm internal overhang at 45°	Not suitable without electrified wire or unless fully enclosed	2m wide, 1.8m deep moat with 2m unclimbable barrier
Caracal *Caracal caracal*	Jumping Climbing	Not suitable, should be fully enclosed	Not suitable, should be fully enclosed	Not suitable, should be fully enclosed
Cheetah *Acinonyx jubatus*	Jumping Climbing	2.5m	2.5m 2m mesh fence with 500 mm internal overhang at 45°	4m wide, 1.8m deep moat with 2m unclimbable barrier
Leopard *Panthera pardus*	Jumping Climbing	Not suitable, should be fully enclosed	Not suitable, should be fully enclosed	Not suitable, should be fully enclosed

[707] For examples see: Zoo Aquarium Association (ZAA) www.zooaquarium.org.au; European Association of Zoos and Aquaria (EAZA) www.eaza.net; Association of Zoos and Aquariums (AZA) www.aza.org; the Zoo Design Organisation www.zoolex.org.

Serval *Leptailurus serval*	Jumping Climbing	2.9m 2.5m wall with 900mm internal overhang at 45°	Not suitable without electrified wire or unless fully enclosed	2m wide, 1.8m deep moat with 2m unclimbable barrier
Tiger *Panthera tigris*	Jumping Climbing Swimming	4.5m	4.5m 4m mesh fence with 900mm internal overhang at 35°-45°	5m wide, 1.8m deep moat with 2m unclimbable barrier
Ursidae				
Brown Bear *Ursus arctos*	Climbing	-	4.5m 4m mesh fence with 1m internal overhang at 45° and at least three electrified wires at varying heights	3m wide, 4m deep with 2m unclimbable barrier
Canidae				
Wolf *Canis lupus*	Jumping	2.5m	2.5m 2m mesh fence with 500mm internal overhang at 45°	2.5m wide moat, 2m deep with 2m unclimbable barrier
Hyaenidae				
Spotted Hyena *Crocuta Crocuta*	Jumping	2.7m 2.4m wall with 900mm internal overhang at 45°	-	-
Ungulates				
Antelope and deer species	Jumping	1.8m	1.8m	Minimum of 4m wide and 1.2m deep
Giraffe *Giraffa camelopardalis*	Jumping	1.8m	1.8m or 2m steep stone bank, at least 45° from horizontal	Minimum of 4m wide and 1.2m deep
Zebra *Equus quagga*	Jumping	1.8m	1.8m	Minimum of 4m wide and 1.2m deep

Pachyderms				
Asian Elephant *Elephas maximus indicus* Africa Elephant *Loxodonta Africana*	Climbing Swimming Non-Jumping	2.5m	2.5m with single electric wire at top of barrier	-[708]
Hippopotamus *Hippopotamus amphibius*	Non-jumping	1.6m	2m steep stone bank, at least 45° from horizontal	Minimum 1.6m depth with unclimbable wall of 1.6m above maximum water level
White and Black African Rhinoceros	Non-jumping	1.6m	2m steep stone or soil bank, at least 45° from horizontal	5m wide and 1.5m deep
Primates				
Baboon *Papio hamadryas*	Jumping Climbing Brachiation Bipedalism	2.8m Topped with 400mm in-rigger at 45° with at least 6 electrified wires	Not suitable unless fully enclosed	4m wide with 1.2m deep moat with 1.6m unclimbable barrier or 1m unclimbable with an electric wire
Chimpanzee *Pan troglodytes*	Jumping Climbing Brachiation Bipedalism	4m	Not suitable unless fully enclosed	2m wide moat, 1m deep, with an unclimbable barrier protruding 2m above maximum water level, and one electrified wire and earth on unclimbable barrier
Gorilla *Gorilla gorilla*	Climbing Brachiation[709] Bipedalism	4m	Not suitable unless full enclosed	6m wide moat, slope to 2m deep, with 1m marsh area on the animal side.[710] Mesh or

[708] A 1.8m deep moat is sufficiently deep for containing elephants. However, modern welfare standards now consider wet and dry moats inappropriate for containing elephants in zoos. The elephant enclosure at Auckland Zoo currently contains a dry moat (1.7-1.8m deep).

[709] While gorillas are capable of performing this locomotion, they rarely use it as a means to get around as their bodies are simply too large and heavy.

[710] This slows the animals from rushing into the moat.

				netting on moat floor.[711] Unclimbable visitor barrier required
Orangutan *Pongo pygmaeus*	Climbing Brachiation Bipedalism	4m	Not suitable unless full enclosed	6m wide moat, sloping to 2m deep, with a 1m marsh area on animal side, and mesh or netting on moat floor. Unclimbable visitor barrier required
Spider Monkey *Ateles*	Jumping Climbing Brachiation Bipedalism	3.5m	Not suitable unless fully enclosed	4m wide and 600mm deep moat
Reptiles				
Crocodilians with snout-vent length of 3m or more	Swimming Climbing Non-jumping	2m	Climbing ability of crocodilian species varies greatly	-
Flightless Birds				
Ostrich *Struthio*	Jumping	1.8m	-	-
Cranes[712] *Gruidae*	Flying Jumping	1.2m	-	-

* An unclimbable containment barrier usually has a smooth surface that ensures animals are unable to gain any foot or limb holds.

** The most common type of climbable barrier are mesh or netting fences which are suitable for many non-climbing species, such as hoofed animals. Species capable of climbing could do so and therefore this containment method is not suitable for all species.

[711] To enable animals to get back into exhibit if they fall in.

[712] There is only one reported instance of cranes appearing in a *venatio*: at the Colosseum inauguration games of 80 CE (Cass. Dio 66.25).

Table 2. Prices of Wild Beasts According to Diocletian's Edict on Maximum Prices (301 CE), and their Respective Diet

	First-class	Second-class	Weight	Diet
Obligate carnivores				
Lion	150,000 *denarii*	125,000 *denarii*	150-250 kg	Meat-based: medium to large-sized ungulates, insects, reptiles, fish, birds.
Lioness	125,000 *denarii*	100,000 *denarii*	120-180 kg	
Leopard	100,000 *denarii*	75,000 *denarii*	28-90 kg[713]	
Omnivores				
Bear	25,000 *denarii*	20,000 *denarii*	100-355 kg[714]	Fruit, seeds, roots, fish, insects, carrion, small mammals.
Herbivores				
Boar	6,000 *denarii*	4,000 *denarii*	75-200 kg	Fruit, seeds, roots, fungi, insects, grasses. Wild boars will occasionally feed on carrion and small animals, such as birds, rodents, and snakes.
Ostrich	5,000 *denarii*[715]		100-130 kg	
Onager	5,000 *denarii*[716]		200-260 kg[717]	
Stag	3,000 *denarii*	2,000 *denarii*	160-240 kg	

[713] Females: 28-60 kg; Males: 37-90 kg.
[714] Females: 100-250 kg; Males: 265-355 kg. Estimate based on the European brown bear (*Ursos arctos arctos*).
[715] No first/second-class distinction.
[716] No first/second-class distinction.
[717] Estimate based on the Persian Onager (*Equus hemionus onager*).

Appendix III. Figures

(a)

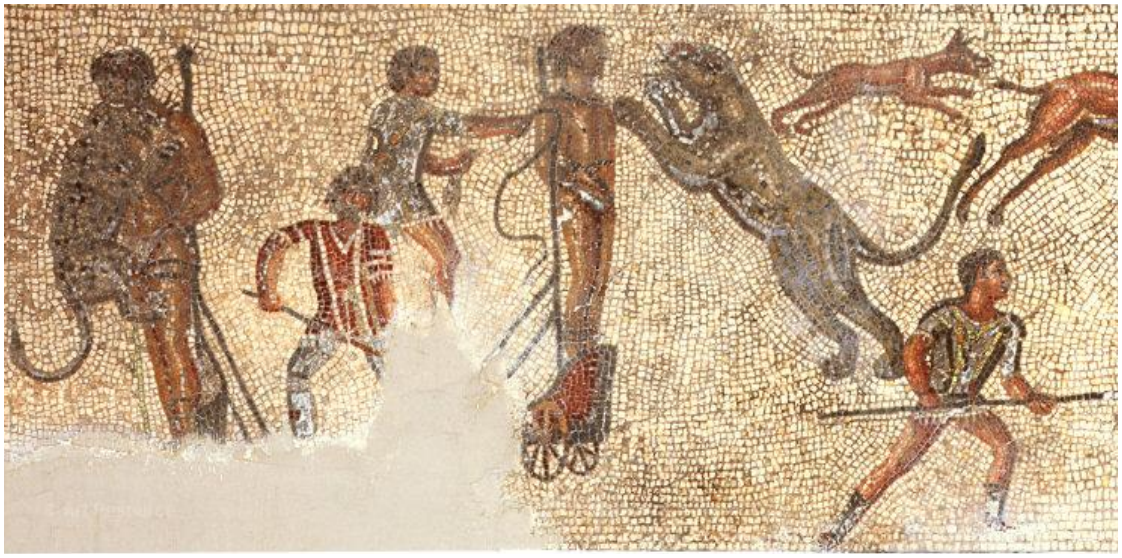
Fig. 1. Sections of the 'Great Hunt' mosaic. (a) Handlers guide ostriches onto a ship; (b) handlers lead a tiger, scimitar-horned oryx, and a wildebeest. Notice the red beams that cap the horns of the two ungulates. This might have prevented the handlers from being impaled. Villa del Casale in Piazza Armerina, Sicily. Mid-4th century CE. Photo credit: Yann Forget (Jan, 2015) Wikimedia Commons.

(b)

Fig. 2. Marble relief from Sofia (ancient Serdica) depicting *venationes.* First half of 4th century CE. National Archaeological Museum, Sofia, Bulgaria. Photo credit: Ad Meskens (July, 2017) Wikimedia Commons.

(a)

Fig. 3. (a) Details of the west side of the Zliten mosaic; (b) *damnatio ad bestias* with leopards and hunts involving dogs and herbivores; (c) a paired combat between a bear and bull chained together, *damnatio ad bestias* with lions. These performances may have formed part of the same spectacle. The date of the mosaic is still debated among scholars though most argue the late 1st or early 2nd century CE. Villa Bar Duc Amméra à Zliten, near Lepcis Magna. Tripoli Museum, Libya. Photo credit: © Gilles Mermet / Art Resource, NY.



(b)

(c)

(d)

(d) Details of the south side of the Zliten mosaic; (e) an orchestra of arena musicians. To their right a referee supervises a combat with an *eques*-type, *retiarius*, and a *secutor*; (f) combats between a *thraex* and *murmillo*, a *murmillo* and *hoplomachos*, and two *provocatores* overseen by another referee.

(e)

(f)

(g)

(g) Detail from the east side of the Zliten mosaic. This section of the frieze is badly preserved; however, it is possible to make out a fight with ostriches. The hunter in this scene employs a weapon with a curved end, which may have been designed to cut off the heads of ostriches. Commodus is reported to have dispatched ostriches in Rome using a similar crescent-shaped tool (Hdn. 1.15.5).

Fig. 4. A tigress and a peacock share an enclosure at Belle Vue Zoological Gardens in Manchester, England. Source: Jennison (1929/2013) p. 70, the *Guardian,* 13 October 1922.

Fig. 5. Magerius mosaic from Smirat depicting a leopard hunt involving four beast fighters from the *Telegenii* association*.* 3rd century CE, Museum of Sousse, Tunisia. Photo credit: © Vanni Archive/ Art Resource, NY.

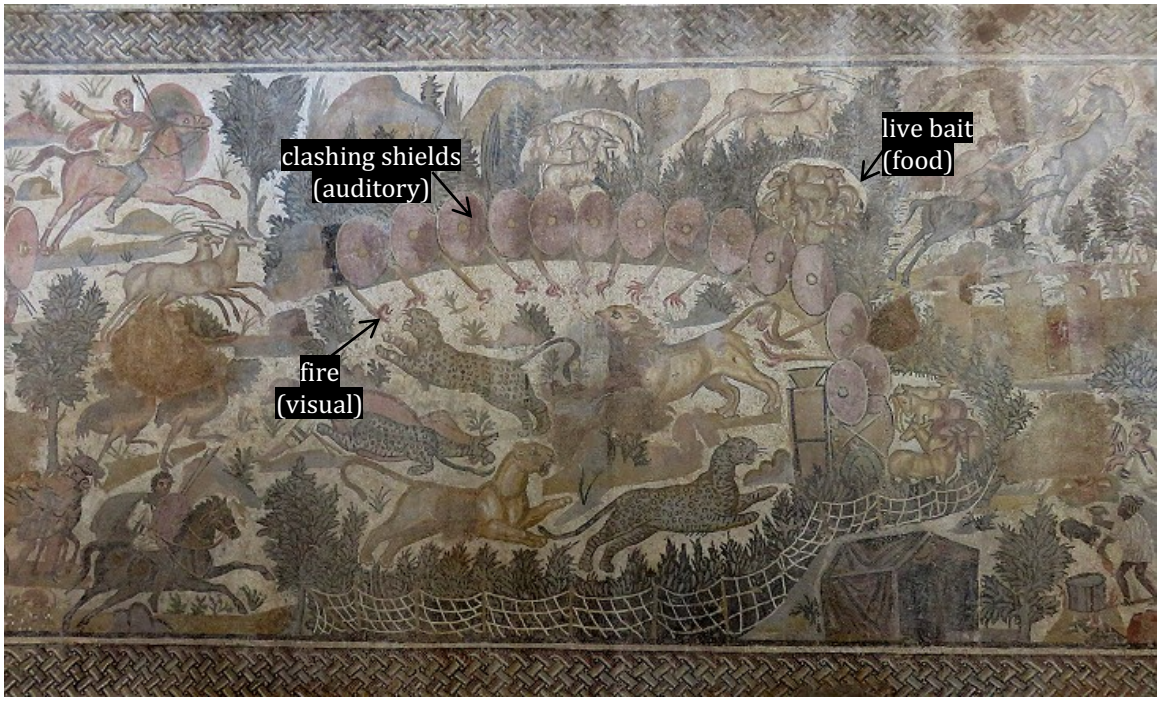


Fig. 6. Mosaic depicting the live capture of wild beasts. Annaba, Algeria, late 3rd /early 4th century CE. Musée des ruines d'Hippone. Photo credit: Roberto Piperno.

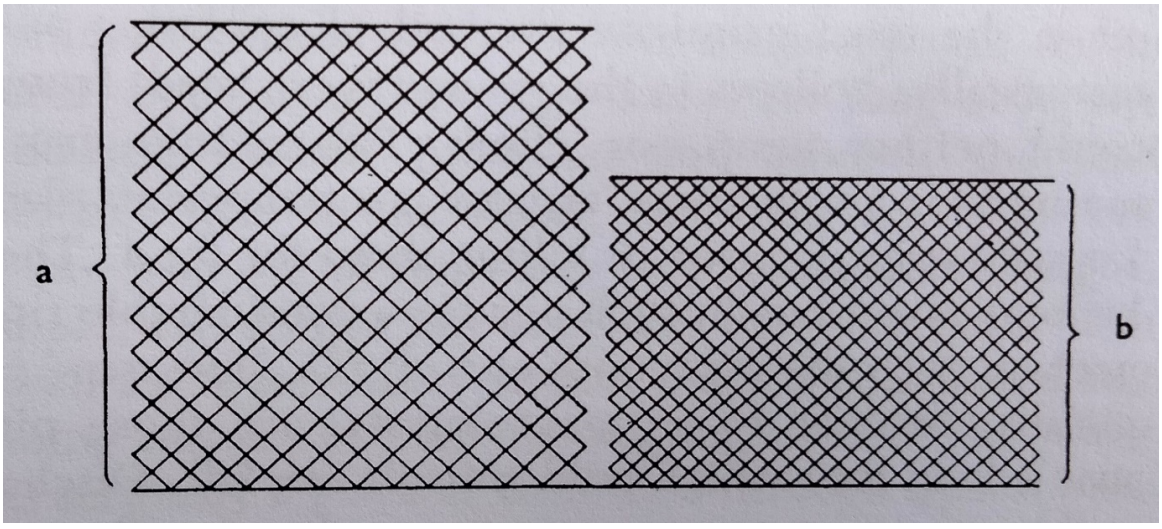


Fig. 7. Difference between the capacity of an animal to clear a wire fence under conditions of excitement (a), and normal conditions (b) according to Swiss Zoologist Heini Hediger (1950) p. 53, fig. 11.

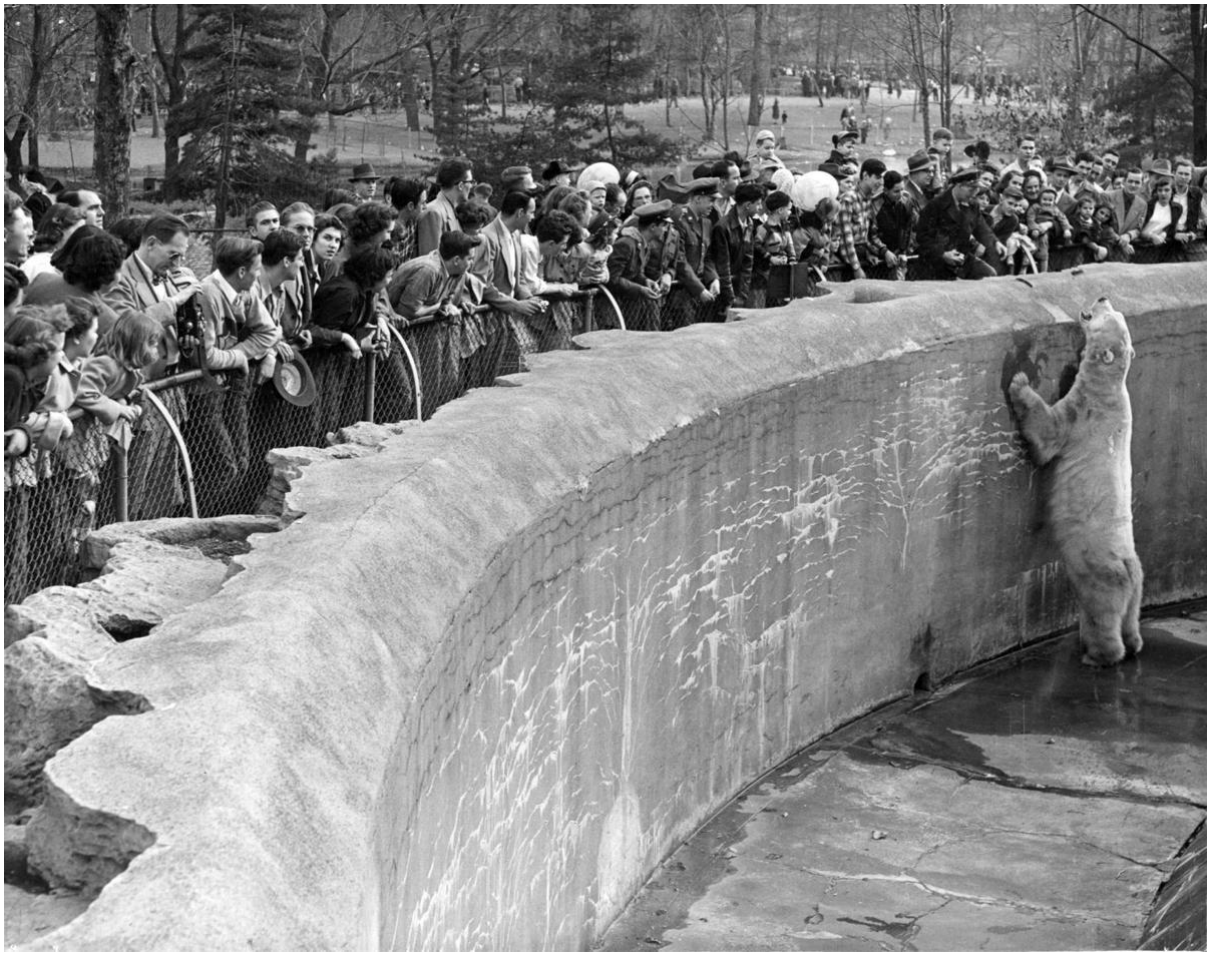


Fig. 8. A polar bear stands on its hind legs to catch fish from zookeeper Walter Burch as visitors look on. St Louis Zoo, February 1951. Bear pits created high viewpoints for visitors, who subconsciously perceived the animals as subordinate beings. In turn, the animals looked up at the visitors or stood on their hind legs. Photo credit: St. Louis Post-Dispatch (June, 2023).

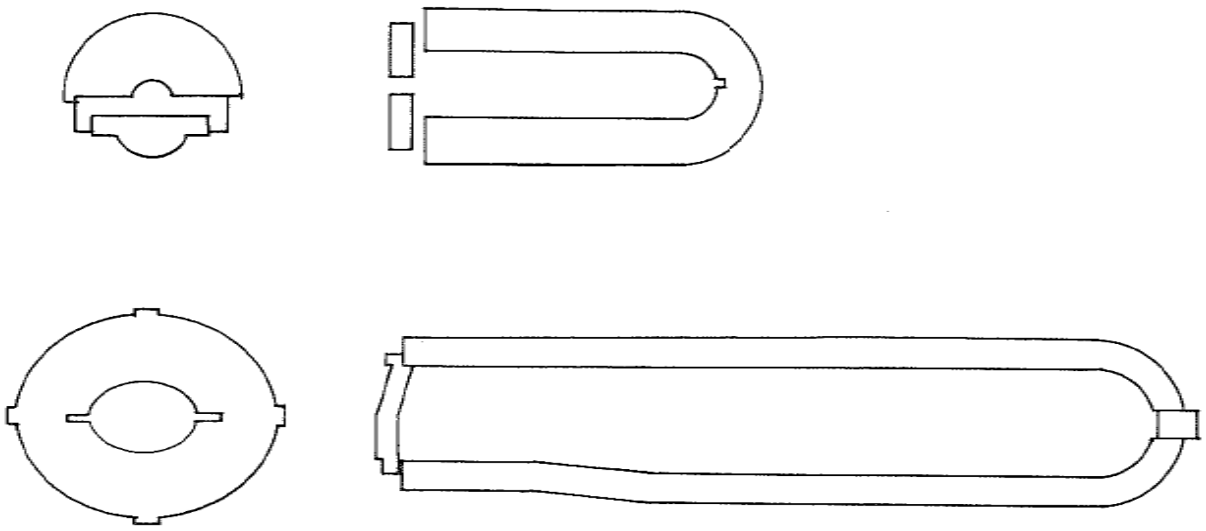


Fig. 9. Plan showing the canonical form of Roman entertainment venues based on: Theatre of Marcellus, Stadium of Domitian, Colosseum, Circus Maximus. Source: Humphrey (1986) p. 2, fig. 1.

Fig. 10. Façade of the Colosseum in Rome, Italy. Construction of the Colosseum began sometime in the early years of Vespasian's reign (69-79 CE) and was completed and dedicated by his son and successor Titus in 80 CE. It comprised four architectural orders made of travertine cut stone that reached a height of about 50 metres, with external dimensions of 188 x 156 metres. Photo credit: Author (May, 2022).

Fig. 11. Aerial view looking down on the Colosseum's *hypogeum.* This extensive two-storey substructure was the largest and most sophisticated of all *hypogea* in the Roman world. It was comprised of a series of intricate pulley systems, cages, and ramps for hoisting animals and stage equipment into the arena. Permanent features were added to the *hypogeum* during Domitian's reign (81-96 CE). What is visible today are the remnants of Late Antique modifications. Photo credit: Author (May, 2022).

Fig. 12. Concave moulding made of marble that capped the 2.18-metre-high *podium* wall of the amphitheatre at Pompeii. This feature may have helped to prevent animals with jumping or climbing abilities from gaining a grip on the wall. Photo credit: Author (May, 2022).

Fig. 13. Close-up of *podium* with moulding in the Pompeii amphitheatre. Photo credit: Author (May, 2022).

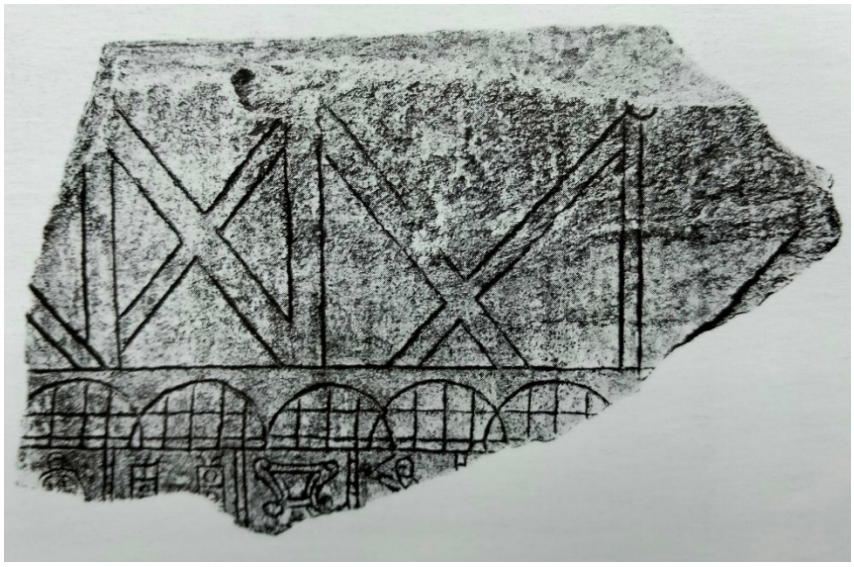


Fig. 14. Fragment of a marble slab depicting the *podium* wall of the Colosseum with a balustrade. Source: Gabucci (2001) p. 127.

Fig. 15. Amphitheatre at Thysdrus, modern El Djem, Tunisia. Notice the entrances to the annular service corridor (used exclusively by arena staff) and the annular corridor beneath the *cavea* (used for spectator circulation). Photo credit: Agnieszka Wolska (April, 2009) Wikimedia Commons.

Fig. 16. The leaf of a diptych made from elephant ivory depicting a *venatio* with stags. Rome, Italy, early 5th century CE. Several figures appear from doors, or so-called "refuges", on either side of the performance. Scholars generally believe that such refuges were used by arena attendants and/or *venatores* to hide from the animals. The ventilated doors likely provided some visibility of the performance, thereby enabling performers to calculate the timing of their entry. National Museums Liverpool, inv. M10042.

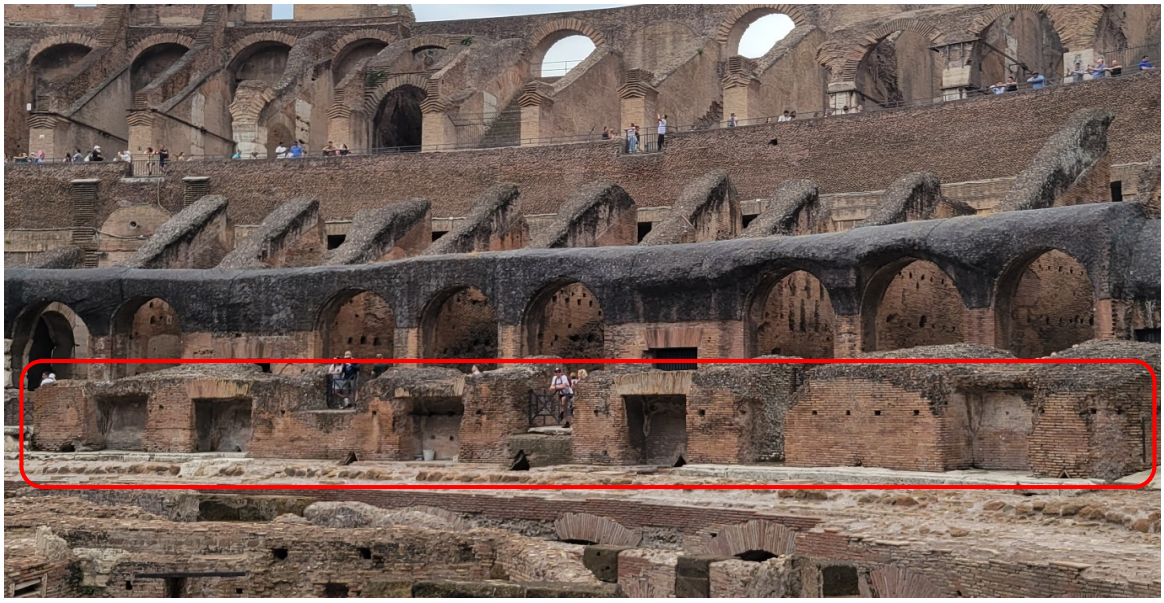


Fig. 17. Rectangular niches (24 in total) line the service corridor of the Colosseum in Rome. In addition to providing a refuge from the animals, some of these niches might have been used by arena staff to store stage props or even animal cages. Photo credit: Author (May, 2022).

Fig. 18. Close-up of a rectangular niche situated inside the service corridor of the Colosseum. Photo credit: Author (May, 2022).

Fig. 19. Theatre at Stobi, near Gradsko, northern Macedonia. Built in the 2nd century CE with a 1.60-metre-high *podium* and post-and-net system. In the 3rd century CE, the post-and-net system was replaced with a new masonry wall which extended the *podium* to over 3.60 metres. Here, you can see the original marble *podium* with the masonry extension. Photo credit: Off Road Macedonia (June, 2019).

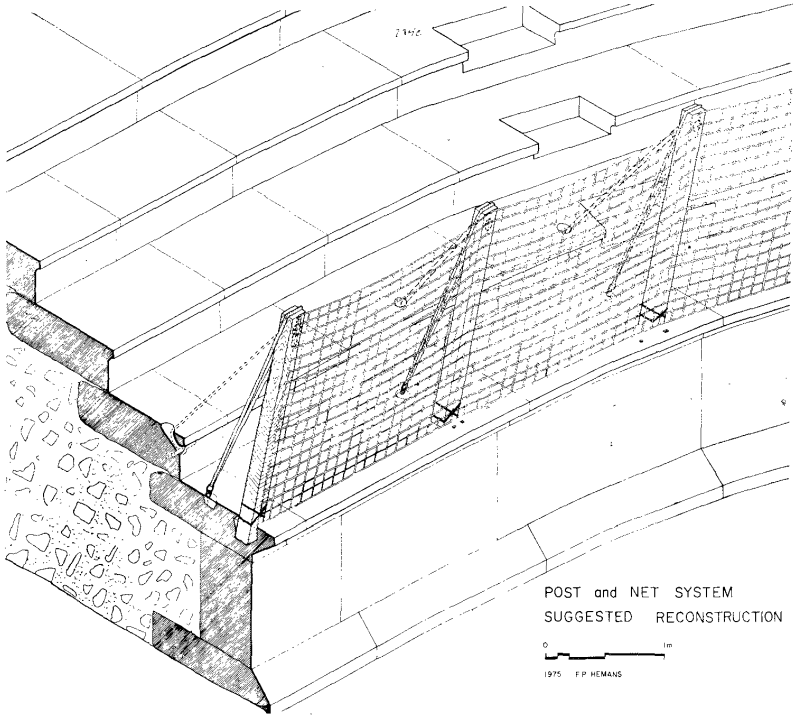


Fig. 20. Suggested reconstruction of a post-and-net system at the Stobi Theatre. Drawing by Federick P. Hermans. Source: Gebhard (1975) p. 51, fig. 4.

Fig. 21. Sumatran tiger exhibit at Auckland Zoo, New Zealand. The primary barrier includes an internal overhang to prevent the animals from climbing over. Photo credit: Author (Jan, 2023).

Fig. 22. Hunting mosaic from Tunisia depicting the capture of wild boar by means of a netted barrier. Ca. 210-230 CE. The design of this provision shares similarities with the post-and-net system that was used in some entertainment venues as an extension of the *podium*. Bardo National Museum, Tunis. Source: Ball (1984) fig. 2.

Fig. 23. Bear Hunt mosaic, Campania, Italy. 4th century CE. J. Paul Getty Museum, Malibu, California, inv. 72.AH.76.

Fig. 24. Detail from the 'Small Hunt' mosaic depicting a group of deer using their antlers to break through a hunting net. Villa Romana del Casale (room 24) in Piazza Armerina archaeological site, Sicily. Early 4th century CE. Photo credit: © Scala / Art Resource, NY.

Fig. 25. Model of a modern anti-climb roller for deterring coyotes. Photo credit: Stephen M. Vantassel (March, 2013) Wikimedia Commons.

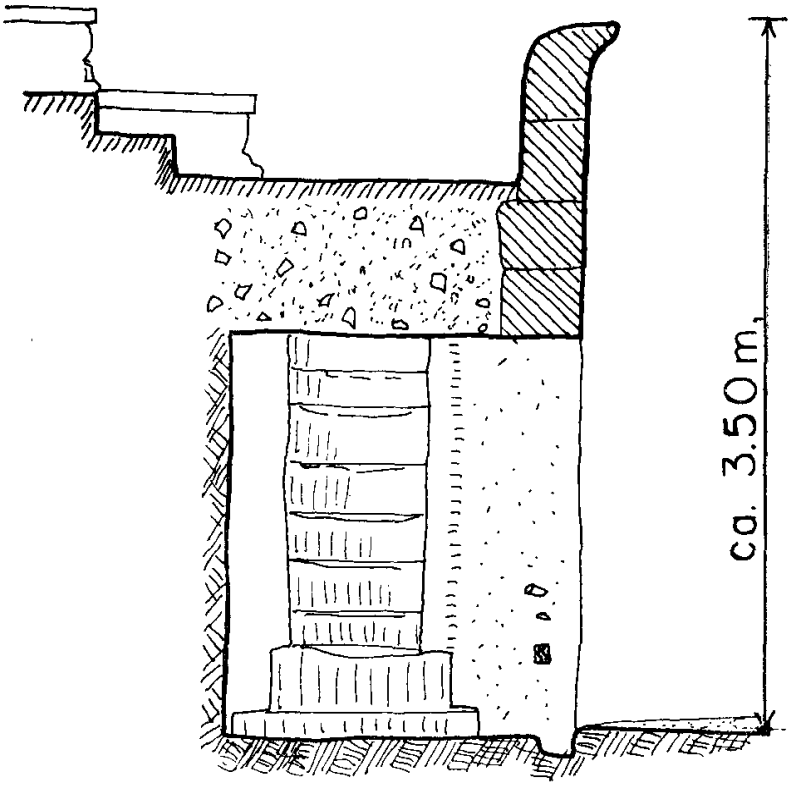


Fig. 26. Suggested reconstruction of the *podium* and parapet wall at the Corinth theatre. Drawing by Stillwell (1952).

Fig. 27. Stadium at Aphrodisias, western Turkey. Built in the late 1st century CE. Photo credit: Carole Raddato (April, 2015). Wikimedia Commons.

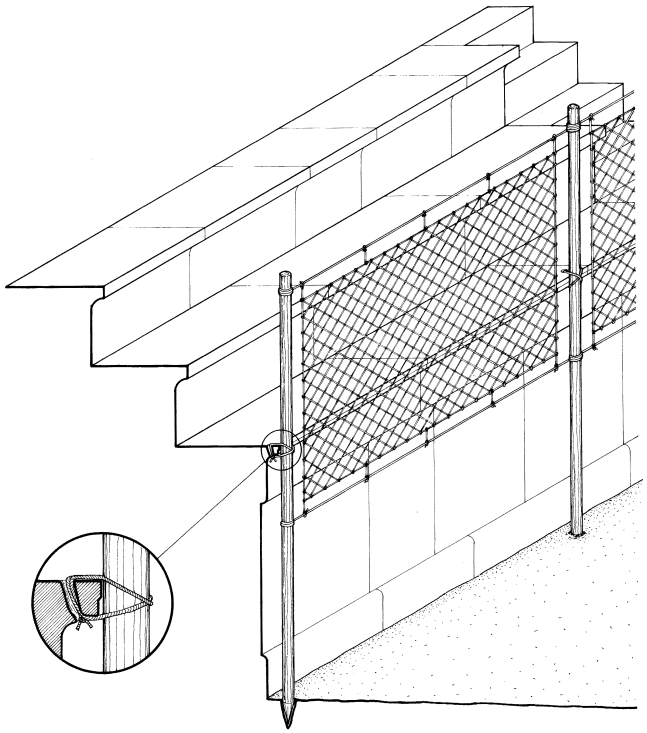


Fig. 28. Suggested reconstruction of a post-and-net system at the Aphrodisias stadium. Drawing by A. Leung. Source: Welch (1998b) p. 560, fig.12.

Fig. 29. An injured bull jumps over a 1.5-metre-high barrier and into the stands of a bullring, raising a panic among spectators. The bull had broken its horn against the wall in an earlier attempt to escape the arena. Since the bull's horn is living tissue, the injury caused the animal to become more dangerous and unpredictable, thereby enabling it to clear the high barrier. Plaza de toros in Tafalla, northern Spain. Photo credit: New York Post /Getty Images (Aug, 2010).

Fig. 30. Fragment of a relief panel depicting *damnatio ad bestias* with a harnessed bear. Found near the Hadrianic Baths in the western sector of the ancient city of Aphrodisias. 1st-2nd century CE. Source: Roueché (1993) p. 72, pl. 11, fig. 41.

Fig. 31. Floor mosaic depicting scenes of animal combats, gladiatorial fights, chariot races, dancing and mimes, and an execution involving bears and three *damnati*. Roman villa at Wadi Lebda, 3rd century CE. Lepcis Magna Mosaic Museum. Photo credit: Dunbabin (2016) p. 192, fig. 7.17a.

Fig. 32. Aerial view of the shortened, amphitheatrical arena at the southern end of Herod's Circus that was used for *venationes* in the late 2nd/early 3rd century CE. The 3-branch *hypogeum* at the centre was constructed during the same building phase as the two post-and-net instalments (see below, Fig. 33). Photo credit: Justin (Feb, 2019) The Urantia Book Fellowship.

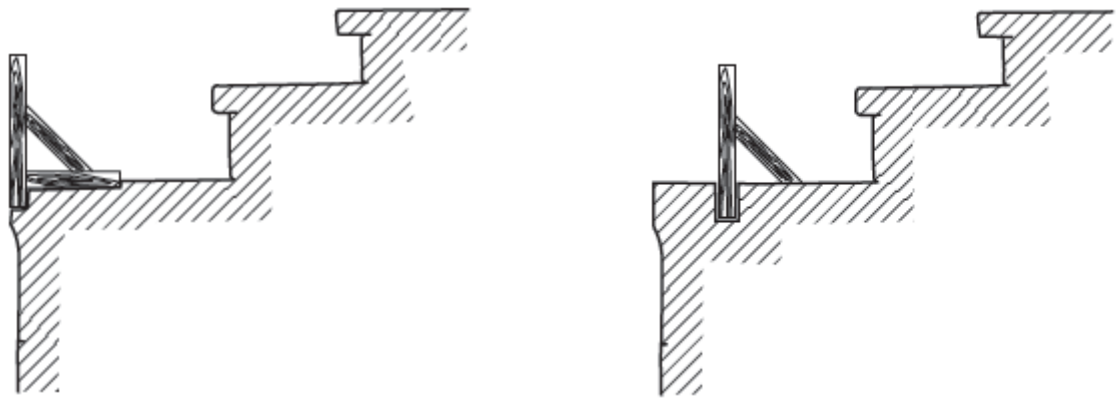


Fig. 33. Reconstruction of the placement of two different post-and-net barriers from the shortened arena at Herod's Circus. The barrier on the right was an improvement to the slightly earlier barrier on the left. Source: Porath (2013) p. 132, figs. 5.10, 5.11.

Fig. 34. A siamang gibbon swings between furnishings in a primate exhibit at Auckland Zoo, New Zealand. Gibbons specialise in swinging locomotion called brachiation, which involves using the forelimbs to swing from branch to branch. Photo credit: Author (Jan, 2023).

Fig. 35. Roman lamp depicting an entertainer (possibly a street artist) seated with a monkey and a small feline that climbs up a ladder, above which are two juggling rings. The entertainer holds a stick in his left hand which may have been used to guide or discipline the animals during a performance. Italy, ca. 30-70 CE. The British Museum, London, inv. 1814,0704.79. © The Trustees of the British Museum.

Fig. 36. Marble relief depicting a vegetable and poultry shop with two monkeys, possibly curiosities owned by the shop-owner. Via della Foce at Ostia, late 2nd century CE. Museo Ostiense, inv. 134. Photo credit: © Scala / Art Resource, NY.

Fig. 37. A trio of performing monkeys tethered by a rope to their trainer. This form of restraint continues to be used by some street performers in parts of Asia. Photo credit: Jason Lee/Reuters (Feb, 2016) The New York Times.

Fig. 38. Rhinoceros, zebra, and oryx exhibit at Brevard Zoo, Florida. Vertical wooden posts that can withstand impact from these species serve as the primary barrier. Photo credit: Author (April, 2023).

Fig. 39. A dry moat (approx. 1.7-1.8m deep) surrounds the elephant exhibit at Auckland Zoo, New Zealand. The 3-metre-deep *euripus* which Julius Caesar had dug around the perimeter of the arena of the Circus Maximus in Rome may have resembled this safety provision. Photo credit: Author (Jan, 2023).

Fig. 40. Zookeeper Lawrence White dangles a piece of meat above Scar, a 60-year-old crocodile, who lunges out of a pool at Butterfly Creek in New Zealand. With enough depth, large crocodiles can jump straight upwards to a height that reaches their hind legs. Smaller crocodiles are capable of getting more of their body out of water, depending on their weight. Photo credit: Jess Ayres (July, 2023).

Fig. 41. Fresco of a Nilotic scene depicting a battle between pygmies, crocodiles, and a hippopotamus. Pompeii, ca. 55-79 CE. Museo Archeologico Nazionale, Italy, inv. 113195. Photo credit: Author (May, 2022).

Fig. 42. Mosaic of a Nilotic scene from the House of the Faun, Pompeii, ca. 2nd -1st century BCE. Museo Archeologico Nazionale, Italy. Photo credit: Author (May, 2022).

Fig. 43. Confrontations between hippopotami and crocodiles are fairly common around watering holes in Africa and Egypt in modern times. Hippopotami have been sighted by zoologists exercising dominance by displacing crocodiles from their basking place. Photo credit: *Caters News.*

Fig. 44. Marble statue of a boy with African features (possibly from Tentyra, Egypt) balancing on a crocodile (with modern restorations). Lazio, Rome, 1st century BCE – 1st century CE. The British Museum, London, inv. 1805.0703.6. © The Trustees of the British Museum.

Fig. 45. The Colosseum's two-storey *hypogeum* was comprised of vaulted galleries, corridors, and chambers for housing performers, animals, and stage equipment. Photo credit: Author (May, 2022).

Fig. 46. A particularly narrow corridor inside the Colosseum's *hypogeum* contains a series of trapdoor openings, which facilitated the dramatic release of animals onto the arena floor. Photo credit: Author (May, 2022).

Fig. 47. Aerial view of the Puteoli amphitheatre looking down on the arena floor, made predominantly of concrete. Photo credit: Wojtek Rajpold (July, 2015) Wikimedia Commons.

Fig. 48. The central gallery inside the *hypogeum* of the Puteoli amphitheatre measured 90 metres long and 4.75 metres wide. In preparation for the shows, the wooden beams covering the gallery could be removed to allow caged animals and large stage machinery to move between the arena floor and subterranean passageways. Photo credit: Author (May, 2022).

Fig. 49. Aerial view of the Capua amphitheatre looking down on the arena floor, made predominantly of concrete. Photo credit: Stanley Goodspeed (Aug, 2005) Wikimedia Commons.

Fig. 50. The central gallery inside the *hypogeum* of the Capua amphitheatre. Photo credit: Author (May, 2022).

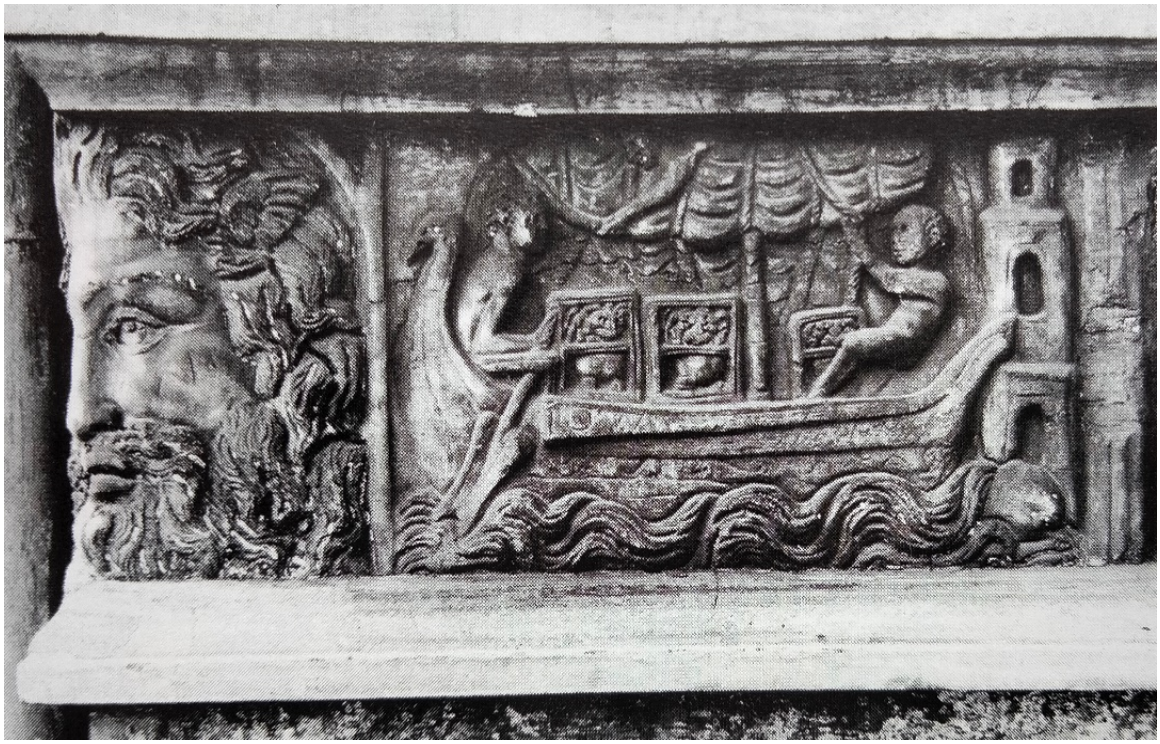


Fig. 51. Section of a sarcophagus relief showing the transportation of wild beasts on a ship. Three individually caged lions appear though the bars of cages. It was necessary to keep most animals, especially carnivores, in cages of their own to prevent escalated aggression between the occupants, which could result in injuries or even fatalities. Discovered in the Villa Medici, Rome, 270 CE. Source: Gabucci (2000) p. 67.

Fig. 52. Radial ducts in the vaulted chambers of the Capua *hypogeum* carried water and residue from the animals into a water channel. The amphitheatre was fed water by a nearby aqueduct called the *aqua Campana,* which supplied the requirements of the *hypogeum* and the provision of drinking water for spectators. Photo credit: Author (May, 2022).

Fig. 53. A water channel runs along the outer annular corridor of the Capua *hypogeum* for sanitation and to prevent flooding. Photo credit: Author (May, 2022).

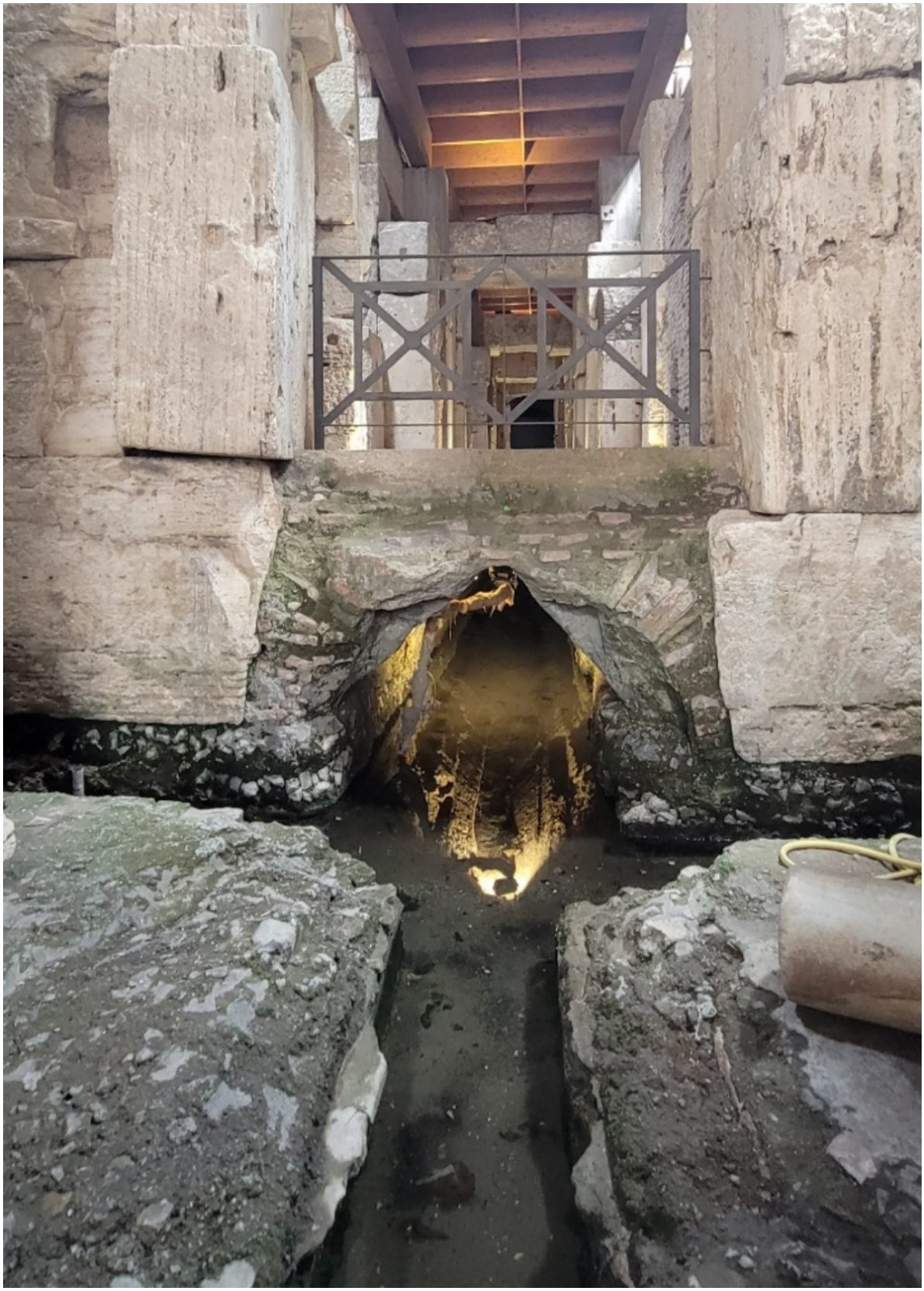


Fig. 54. A drainage system in the *hypogeum* of the Colosseum. There remains considerable debate among scholars about whether it was possible to flood the Colosseum for *naumachiae* (naval battles) and other aquatic spectacles. On these debates, see Coleman (1993) 59-60; Gabucci (2001) 234-40; Connolly (2003) 139-61, 185-206; Dodge (2014b) 571-72; Beste (2019); Taylor (2021) 274. Photo credit: Author (May, 2022).

Fig. 55. One of several large, vaulted rooms inside the Capua *hypogeum* that may have been used as a designated area for storing food, stage machinery and props. It is also possible that some of these rooms were used as a shrine. Photo credit: Author (May, 2022).

Fig. 56. Two levels of vaulted chambers inside the Colosseum's *hypogeum* were partially used for housing caged animals. Notice the small, square apertures in the upper-level chambers. It has been suggested that these openings may have been used for feeding the animals from a safe distance. Photo credit: Author (May, 2022).

Fig. 57. One of four stairways located on either side of the minor axis of the Capua amphitheatre, which led directly into the service corridor. Photo credit: Author (May, 2022).

Fig. 58. Stairs connect the lower and upper-level chambers with the service corridor in the Puteoli amphitheatre. Photo credit: Author (May, 2022).

Fig. 59. A narrow staircase leads from the service corridor down into the *hypogeum* of the Colosseum in Rome. Photo credit: Author (May, 2022).

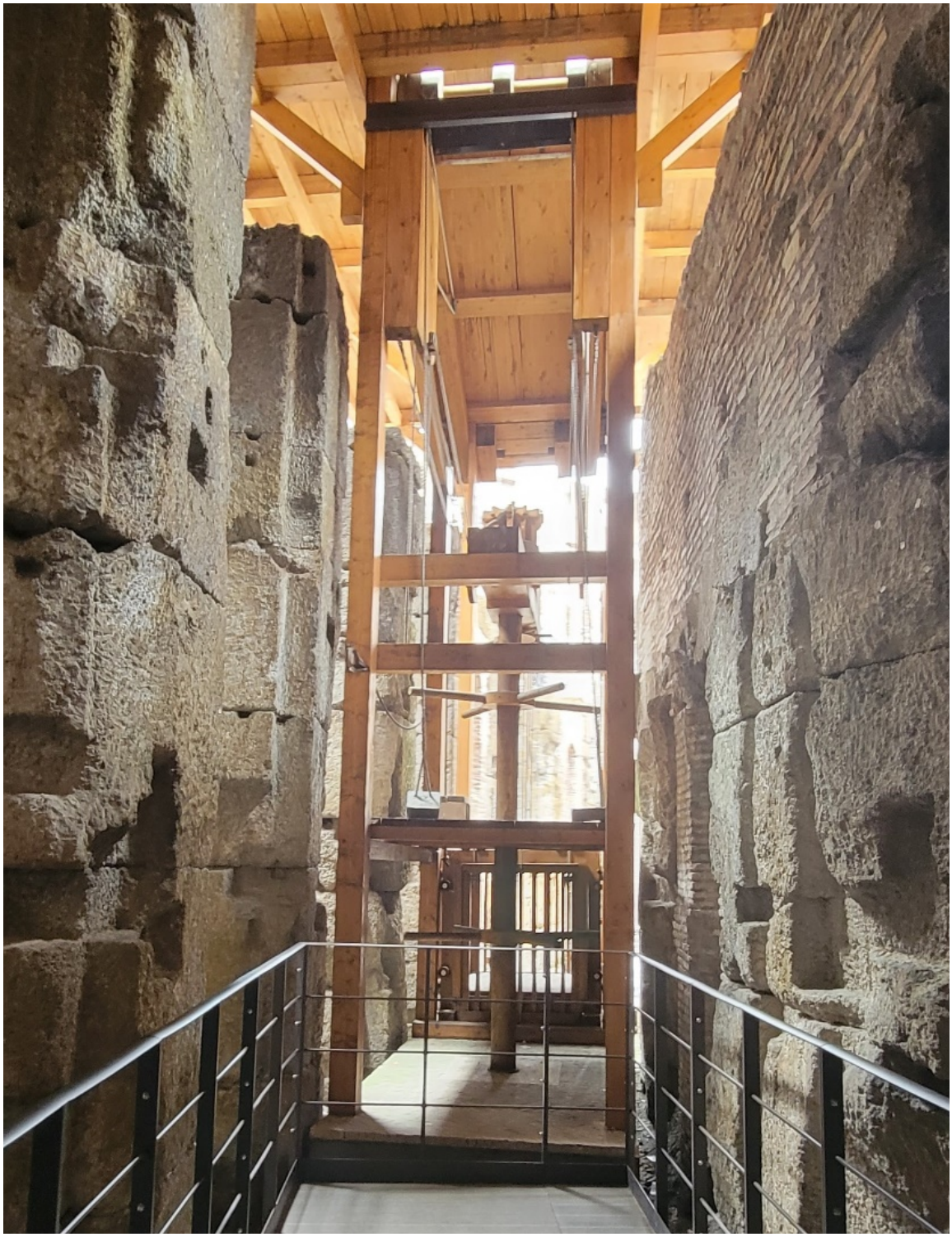


Fig. 60. Modern reconstruction of a cantilever system within the Colosseum's *hypogeum* that was used for hoisting animals into the arena through a series of trapdoors. Modern experiments demonstrated that the pulley system may have required eight arena attendants (four on each level) to operate. Photo credit: Author (May, 2022).

Fig. 61. The remains of grooves for a pulley system inside the Colosseum's *hypogeum*. Photo credit: Author (May, 2022).

Fig. 62. The annular corridor of the two-storey *hypogeum* in the Puteoli amphitheatre. Notice the trapdoors located above and adjacent to the vaulted chambers, where animals awaited their release. A total of 46 trapdoors of varying dimensions (1 x 1.3 metres and 1.25 x 1.90 metres) were built in a concentric pattern around the perimeter of the arena. Photo credit: Author (May, 2022).

Fig. 63. A linear corridor with trapdoor openings in the *hypogeum* of the Capua amphitheatre. Photo credit: Author (May, 2022).

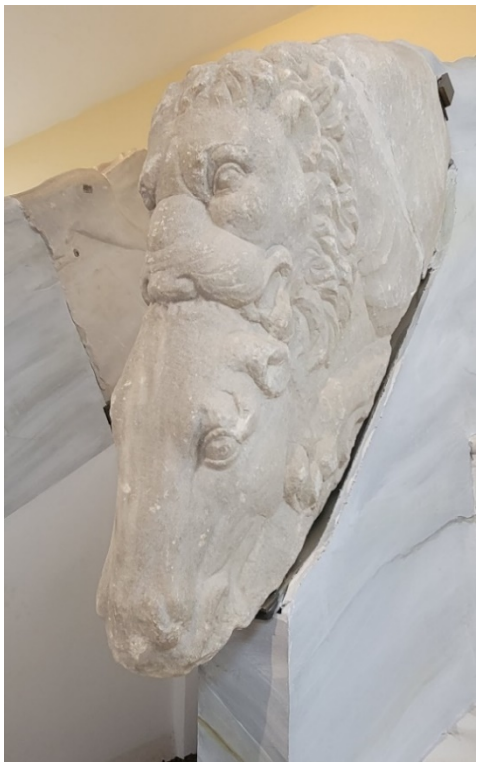
Fig. 64. One of six trapdoor openings for releasing especially large species into the Capua amphitheatre. Photo credit: Author (May, 2022).

Fig. 65. Ground view looking up at two trapdoors in the *hypogeum* of the Capua amphitheatre. One can get a sense of just how close these two openings are to each other, perhaps as close as 1 metre. These particular openings would have been sufficient for releasing small to medium-sized animals, including wild boars, dogs, some antelope and deer species, and leopards. From empirical observation, I could not see how large ungulates, especially cattle who can grow up to 2.5 metres in length, could fit through these smaller openings, in addition to adult bears and lions. The large trapdoor openings, seen above in Fig. 64, most likely accommodated these types of animals. Photo credit: Author (May, 2022).

(a)

Fig. 66. (a) Sculptured handrails of zoomorphic forms from marble balustrades that surrounded the entranceways into the *cavea* of the Capua amphitheatre. Preserved in the Museo dei Gladiatori, located adjacent to the amphitheatre. The majority of the species identified are of North African origin. These include, 29 large cats (9 of which are lions) (b, c, d, g), 15 members of the antelope family (g, h), and 1 elephant (e). In addition, 2 tigers, 5 cattle (b, c, d), 3 horses, and 1 wolf or bear (f), have also been identified in the reliefs. A total of 55 zoomorphic handrails survive, though it has been speculated that the *cavea* contained 160 (2 for each of the 80 *vomitoria*, as seen below). Photo credit: Author (May, 2022).

(b)



(c) Lion attacking prey (bull?)

(d) Lion attacking prey (bull?)

(e) Elephant

(f) Wolf or bear

(g) Antelope and lion

(h) Antelope

Fig. 67. Marble relief panel from the Capua amphitheatre depicting the Calydonian boar hunt, possibly staged as a hunt inside the amphitheatre. Museo dei Gladiatori, Capua. Photo credit: Author (May, 2022).

(a)

Fig. 68. (a) Wall painting depicting a leopard hunt from the Hunting Baths at Lepcis Magna, *Frigidarium* (room 17); (b) a *venator* helps his colleague dispatch a leopard, while in the background a leopard sinks its teeth and claws into the back of a *venator,* whose spear is shown lying on the sand behind him. Without the aid of his weapon, or another beast fighter, he probably stood little chance in escaping the leopard's grasp. Late 2nd/early 3rd century CE. Source: Sparreboom (2016) pp. 264-65, fig. 20A-B.

(b)

Fig. 69. Borghese mosaic depicting a leopard hunt. Via Casilina, Torrenova, Rome, 320-330 CE. Photo credit: © Scala/Ministero per i Beni e le Attività culturali / Art Resource, NY.

Fig. 70. Ivory diptych of an imperial priest, ca. 400 CE. Left panel: a *venator* strikes a bear with the *venabulum.* Another bear runs towards an unidentified object on the right. Right panel: a *venator* attempts to capture a bear using a lasso while two bears spar below. Musée du Louvre, Paris, inv. OA9062. Photo credit: © RMN-Grand Palais / Art Resource, NY.

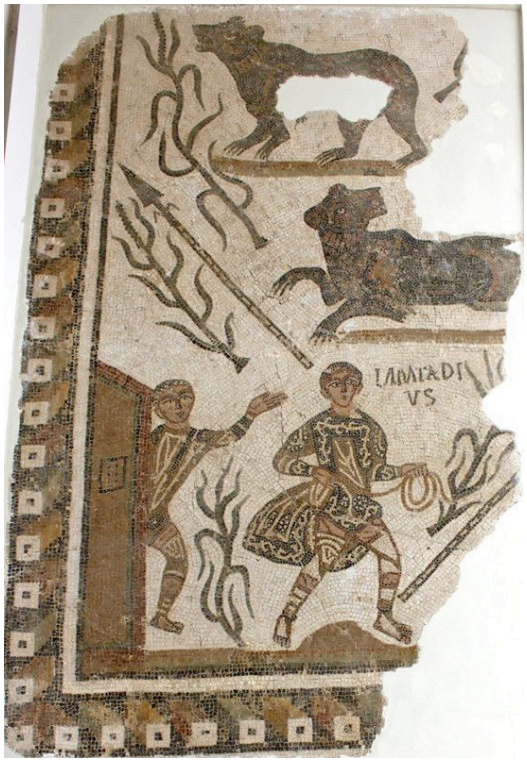


Fig. 71. Mosaic depicting a *venator* named Lampadius capturing bears with a lasso and spear. To the left, an arena assistant or beast fighter appears from a door or 'refuge'. Khanguet-el-Hadjadj (Zaghouan), Tunisia, late 4th/early 5th century CE. Photo credit: Sean Leatherbury/Manar al Athar.

Fig. 72. Oil painting by American artist James Walker of vaqueros (mounted livestock herders) lassoing a Californian grizzly bear. Due to their incredible size and weight, grizzlies often had to be secured by lassos strung around their neck and limbs. Vaqueros achieved this by throwing multiple lassos simultaneously over the bear, as illustrated above. Dated to 1877. Gilcrease Museum, Tulsa, OK, inv. 01.1479.

Fig. 73. A confrontation between two brown bears on Kurile Lake, Kamchatka, Russia. When threatened, a bear will often rise on its hind legs in an act of defence to make itself appear larger. In the wild, bears will confront their rivals in this manner, for they are well suited to close-quarters combat. Photo credit: Giuseppe D'Amico, Adobe Stock.

Fig. 74. Mosaic depicting *venatores* roping and wrestling with bulls, wild boars, and a leopard. Discovered in the *triclinium* of a Roman villa in Thysdrus, Tunisia, late 3rd century CE. Sousse Archaeological Museum. Photo credit: Zaher Kammoun.

(a)

Fig. 75. (a) Mosaic from the 'Maison des Autruches' in Hadrumetum depicting four *venatores* brandishing various types of weapons; (b) below the *venatores* are twenty herbivores depicted in a running motion; four of these are the ostriches that gave this house its name. The sickle-shaped sword held by the *venator* on the far right may have been used for decapitating ostriches. The same figure also wears an animal skin, which might have served as an olfactory stimulus to either cloak or enhance his scent. Mid-3rd century CE. Photo credit: Roberto Piperno.

(b)

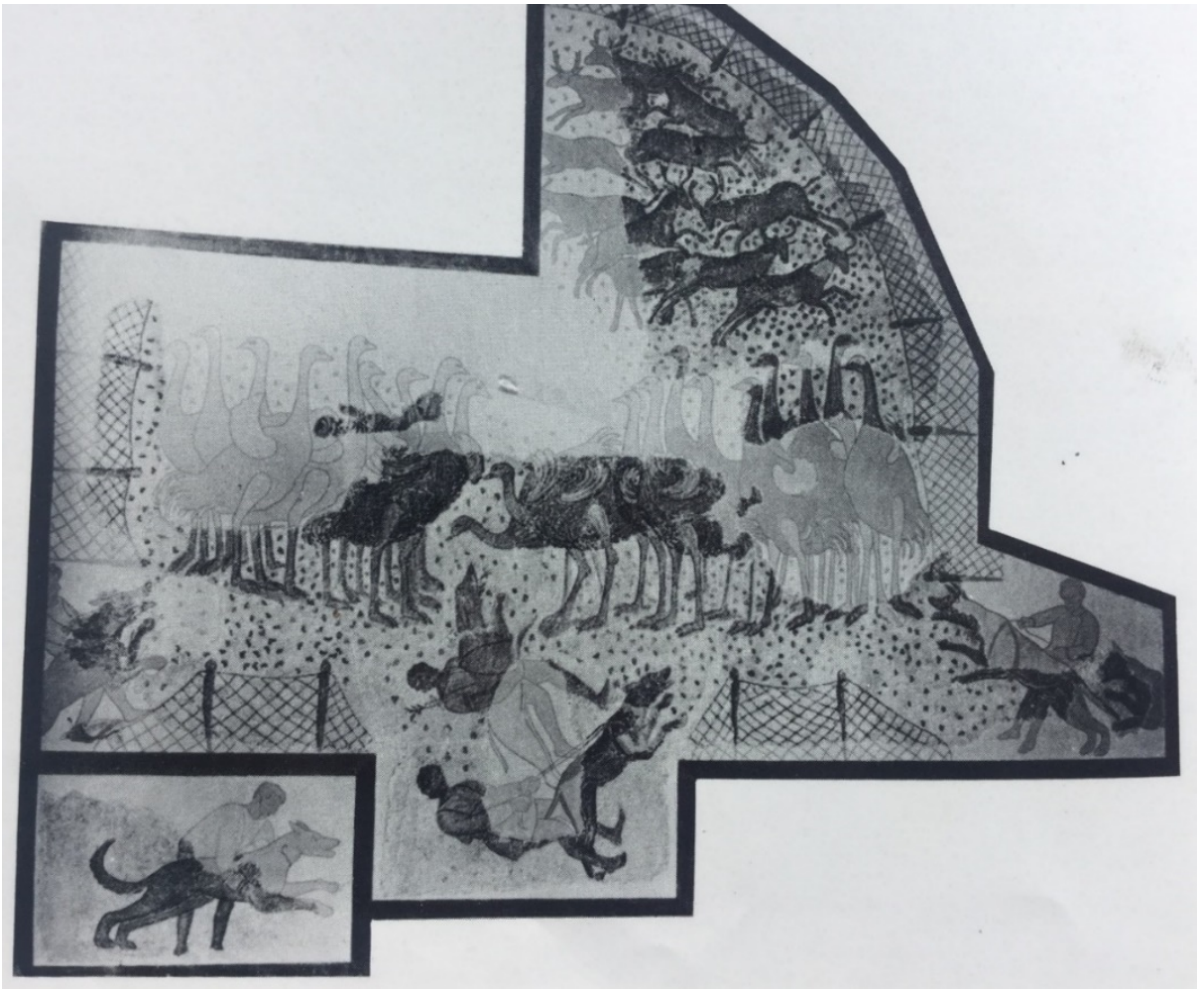


Fig. 76. Hunting mosaic depicting a large group of ostriches and deer (approximately twenty each in number) enclosed within a netted barrier. Handlers and tethered dogs can be seen entering from various openings. Le Kef, Tunisia, early 3rd century CE. Source: Dunbabin (1978) p. 69, pl. 22, fig. 54.

Fig. 77. Marble frieze slab depicting paired combats between bulls, bears, and wild boars in the arena. Sardis, 3rd-4th century CE. Archaeological and Ethnographic Museum, Manisa, inv. 4998. Source: Hanfmann and Ramage (1978) Cat. 147.

Fig. 78. Mosaic depicting Dionysus surrounded by bulls, bears, and wild boars in paired combats. Discovered in the House of Dionysus in Thysdrus, Tunisia, 4th century CE. Bardo National Museum, Tunis. Photo credit: Dea/Archivio J. Lange (May, 2015) Getty Images.

Fig. 79. Drawing by HM Stoops of a bear and bull fight. Fights between the Californian grizzly and Spanish bull were part of the entertainments offered in settlements towns in California during the 1840 Gold Rush. Source: "The Sport of Roping Grizzlies in California's Early Days" from *The San Francisco Call* published on January 15, 1911, pg. 14. Accessed via the Library of Congress.

Fig. 80. A giraffe uses its powerful legs and hooves to trample a pair of lions, who attempt to take down the animal at Kgalagadi Transfrontier Park in South Africa. Photo credit: Michael J Cohen (Nov, 2017).

Fig. 81. Detail of a floor mosaic depicting *damnatio ad bestias* with bears and leopards. Arena attendants or handlers assist the animals by pushing the *noxii* towards them. Discovered in the Sollertiana House in Thysdrus, late 3rd century CE. Museum of El Djem, Tunisia. Photo credit: © Gilles Mermet/Art Resource, NY.

Fig. 82. African *lagynos* (flask) depicting *damnatio ad bestias*. From the workshop of Navigius, ca. 400 CE. Hoisting *noxii* up on a stake forced the animals to climb or jump up to reach their quarry. Making the animals 'work' for their quarry created a more dynamic performance. Romisch-Germanisches Zentralmuseum in Mainz, Germany. Source: Cook (2012) p.78, fig. 3.

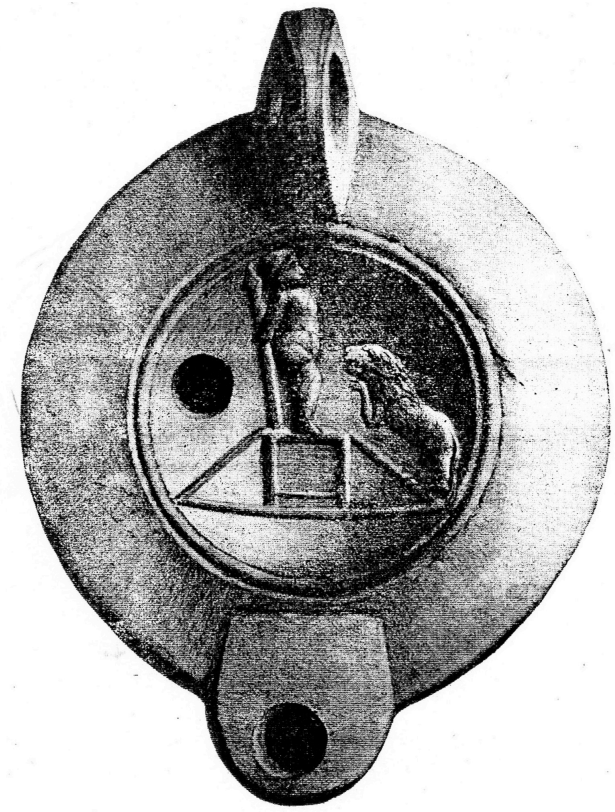


Fig. 83. Roman lamp depicting a lion lunging from a double ramp towards a *noxius* bound to a stake. North Africa, 1st-2nd century CE. Royal Athena Gallery, New York. Source: Cook (2012) p. 77, fig. 2.

Fig. 84. Fragment of a *terra sigillta* depicting *damnatio ad bestias*. A lion uses a ramp to attack a *noxius.* A beast fighter or attendant stands behind the stake. He appears to be holding a *mappa* or whip that might have been used for provoking the lion. Discovered at the La Graufesenque archaeological site near Millau in France, 2nd century CE. Source: Géraud (2012) pp. 28-31, fig. 8.

Fig. 85. A jaguar climbs a ‘feeding pole’ to obtain a carcass at Chester Zoo, England. This method of feeding enrichment aims to engage visitors and elicit natural hunting behaviours from captive animals. Source: Law and Kitchener (2020) p. 186, pl. 3.

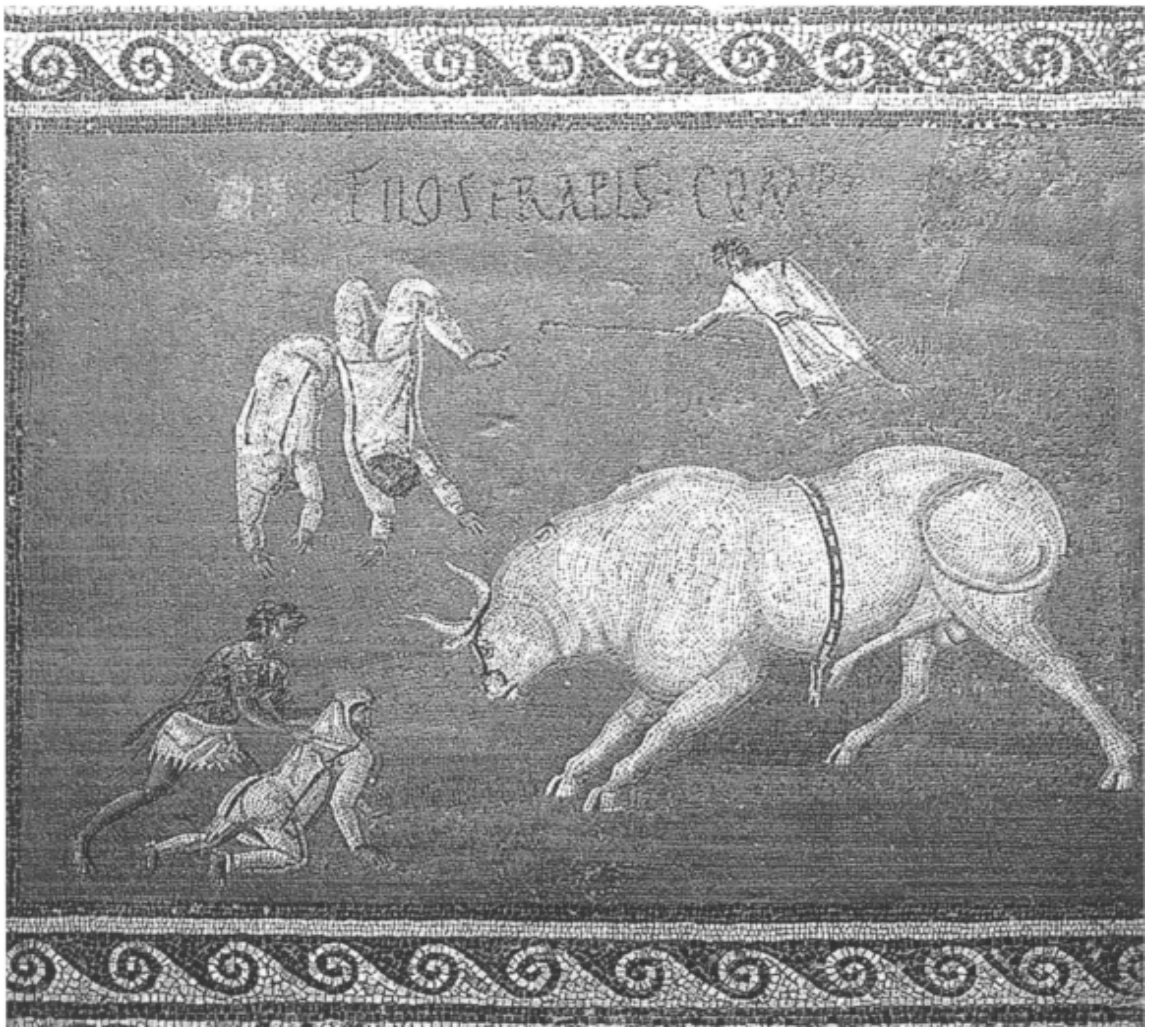


Fig. 86. Mosaic depicting two small figures being tossed by a huge white bull. A third figure is pushed towards the bull by a man wearing an animal skin. Above the scene, another figure points a hooked staff towards the two figures in the air. Inscription: *FILOSERAPIS COMP.* This scene may represent *damnatio ad bestias* or a trained feat. Discovered in the Villa du Taureau at Silin, Libya. Source: Carucci (2018) fig. 12.4.

Fig. 87. Roman terracotta sculpture depicting a naked criminal condemned *ad bestias* mounted to a bull. Discovered on the Necropolis in Kalaa Srira, Tunisia, 3rd/4th century CE. Musée du Louvre, Paris, inv. AO 6560. Source: Gabucci (2000) p. 78.

Fig. 88. Sarcophagus depicting the Triumph of Dionysus over India. On the left, Dionysus is shown riding in a chariot pulled by leopards. Preceding him is a procession of exotic animals, including elephants, lions, and a giraffe. Notice the bullhook held by the elephant rider at the centre, which might have been used to goad the animal. Excavated from the so-called Licinian tomb, via Piave, Rome, ca. 190 CE. The Walters Art Museum, inv. 23.31.

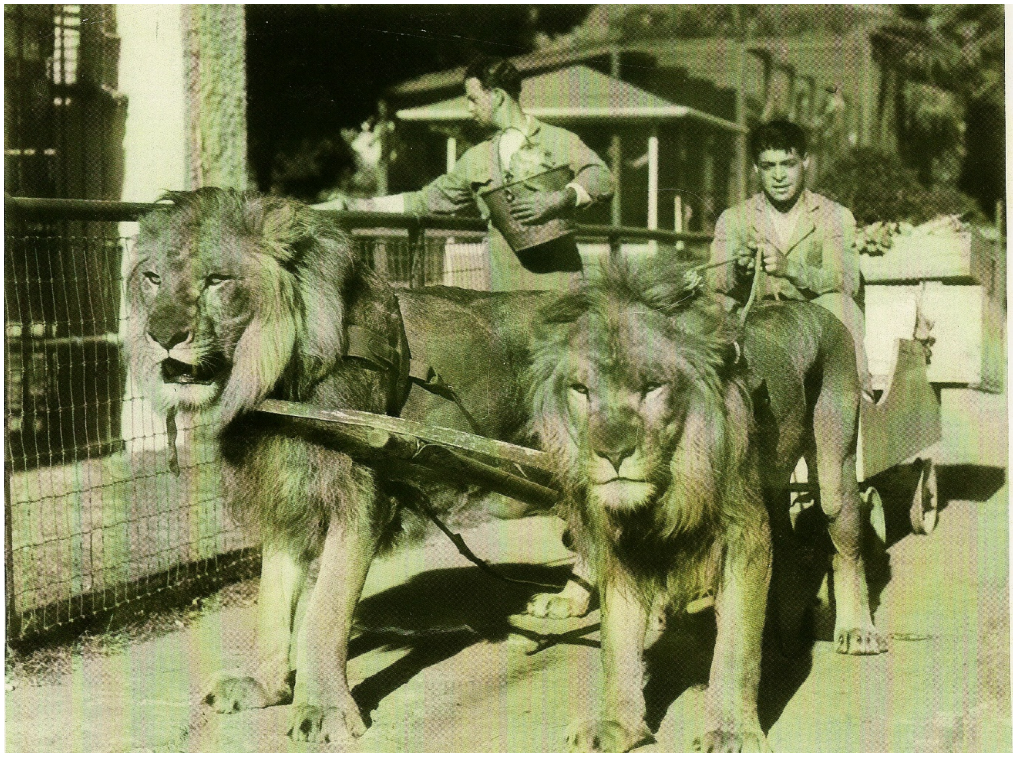


Fig. 89. A pair of adult lions named Tarzan (left) and King (right) pull a feeding cart carrying two trainers at either Goebel's Lion Farm or the Los Angeles Zoo, 1935. The two lions were reportedly trained by members of the California Zoological Society to pull feeding carts as part of an attraction for visitors. Source: The Circus Blog (August, 2011).

Fig. 90. A hippopotamus named Lotus, from the Al. G. Barnes Circus, pulls a cart carrying an unidentified man at its winter quarters in California, 1924. Source: Wretchedshekels (April, 2014).

Fig. 91. Radès mosaic from Tunisia depicting a catalogue of animals from the arena. Seven bears have been inscribed with names. This strongly suggests that the bears belonged to a professional troupe. Late 3rd century CE. Bardo National Museum, Tunis. Source: Gabucci (2001) p. 71.

Fig. 92. Mosaic from Korba (ancient Curubis), Tunisia, depicting a troupe of bears with names inscribed above them. Mid-4th century CE. Bardo National Museum, Tunis. Photo credit: Giorces (June, 2018) Mozaico.

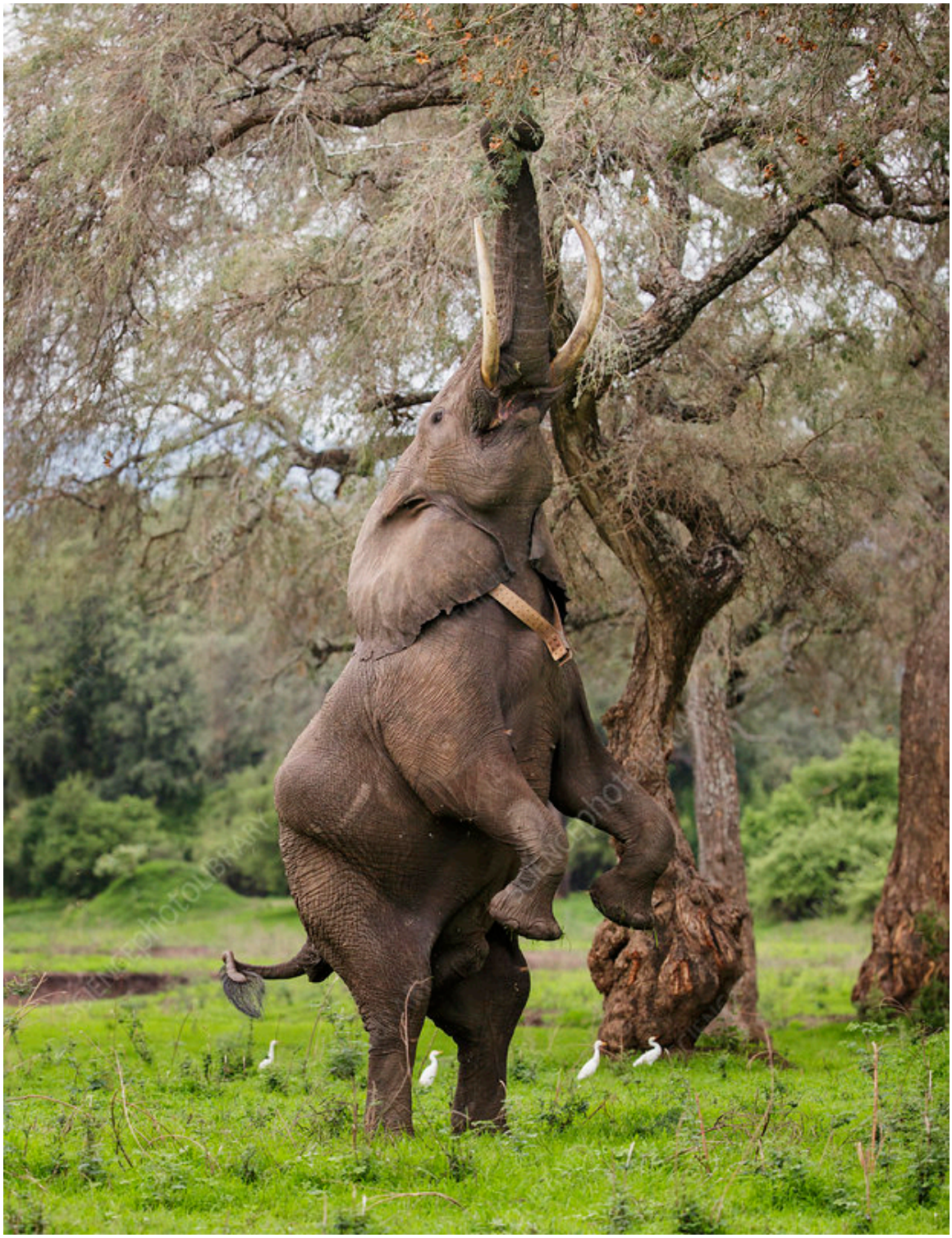


Fig. 93. A bull elephant stands on its hind legs to reach acacia pods in the Mana Pools National Park, Zimbabwe. Photo credit: Tony Heald / Nature Picture Library.

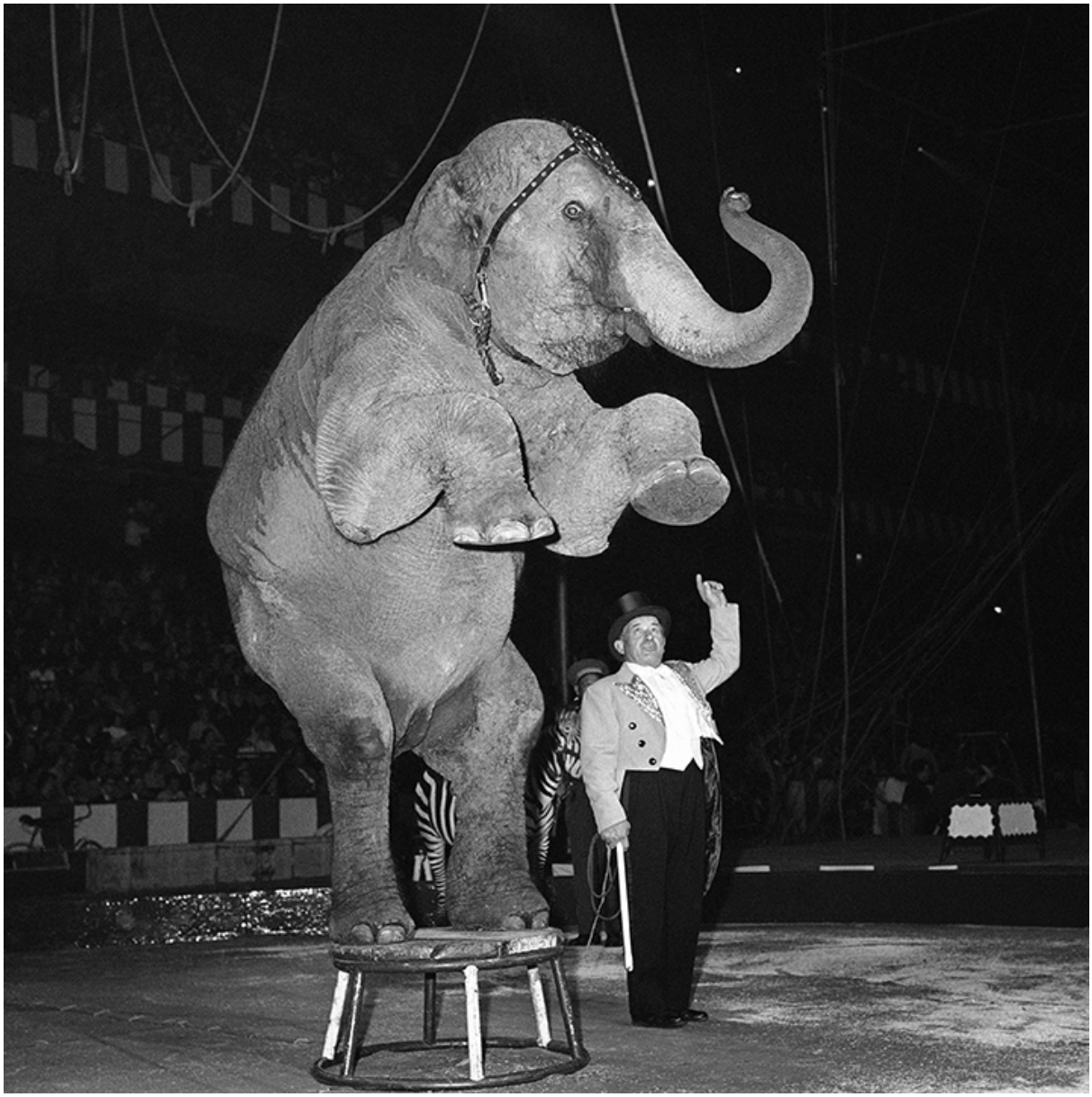


Fig. 94. A circus elephant demonstrates its balancing skills by standing on a stool next to its trainer, Edward Healy, during the opening of the Ringling Bros. and Barnum & Bailey Circus on March 30th, 1960. Madison Square Garden, New York. Source: Associated Press (March, 2015).

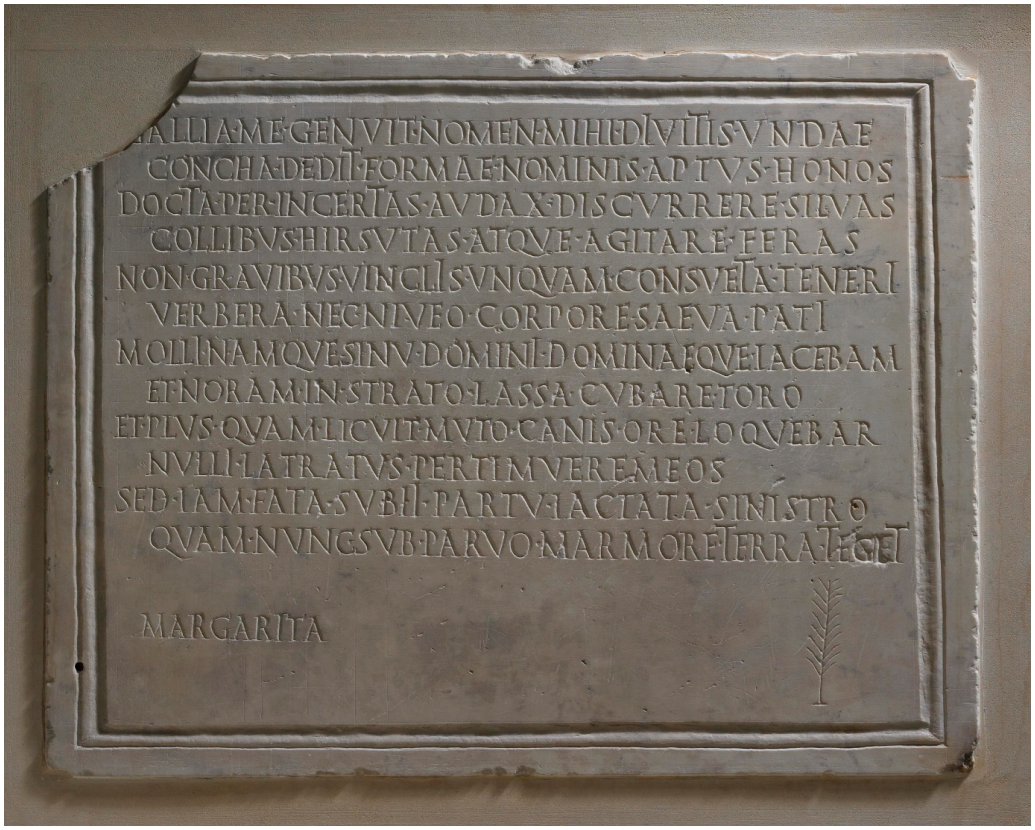


Fig. 95. Roman funerary epitaph commemorating a Roman-Gallic dog named Margarita ('Pearl'), who was beloved by its owners as a lapdog and hunting aid. 1st/2nd century CE. Provenance unknown. The British Museum, London, inv. 402376001. © The Trustees of the British Museum.

Fig. 96. Two tigers stand on their hind legs under the instruction of circus trainer Alexander Lacey of the Ringling Bros. and Barnum & Bailey Circus. This behaviour was prompted by Alexander raising a whip (shown in left hand) and short prod (right hand), which the tigers had learnt to associate with experiences of being struck. Photo credit: Michael S. Williamson, Getty Images.

Fig. 97. Terracotta Campana relief depicting a *quadriga* race. Notice how the charioteer employs a whip to spur on the horses as he approaches the turning posts. Late 1st century CE. The British Museum, London, inv. 1805,0703.337. © The Trustees of the British Museum.

Fig. 98. Mosaic depicting two *venatores* whipping a bear, who has fallen upon a third *venator.* Roman villa in Nennig, Germany, 3rd century CE. Photo credit: TimeTravelRome (April, 2021) Flckr.

Fig. 99. A circus bear balances unnaturally on its front paws under the instruction of its trainer James Hall, who holds a prod in his right hand, and a rope in his left hand, which is tethered to the bear. To elicit this performance, the trainer tapped the bear's hindfeet with the prod, thus prompting the bear to lift its feet to avoid being struck. Photo credit: © Animal Defenders International.

Fig. 100. A zebra touches its nose against a 'target pole' as part of training at Brevard Zoo, Florida. Photo credit: Ellen Dryer and Elliot Zirulnik, Brevard Zoo / AZA.

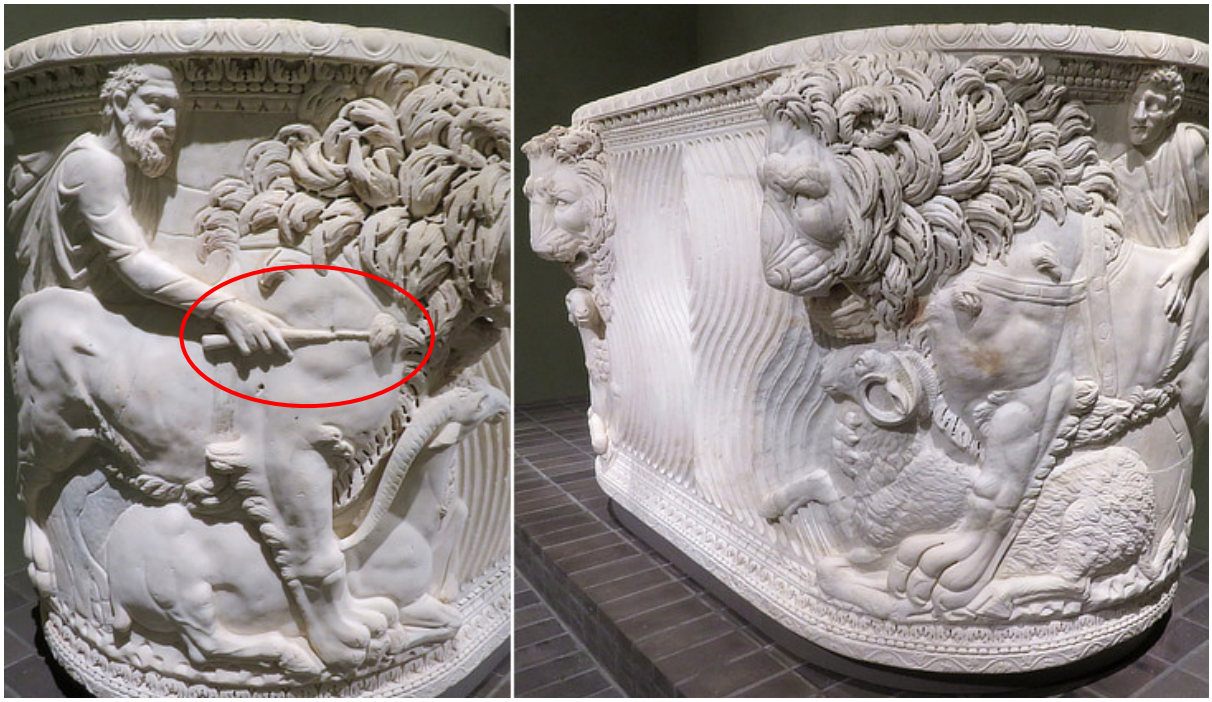


Fig. 101. Roman sarcophagus depicting two trainers with harnessed lions. The *magister* on the left holds a short tapering prod with a blunt circular end, which might have been used as a tactile or visual cue for instructing the lion during a performance. Torlonia Collection in Rome, 3rd century CE. Photo credit: Roberto Piperno (June, 2015).

Fig. 102. Roman sarcophagus depicting a youthful trainer with a harnessed lion. The trainer holds a hooked staff, which might have been used for thwarting potential attacks from the lion. ca. 220 CE. The Metropolitan Museum of Art, New York, inv. L.1993.47.4. Photo credit: Author (Jan, 2022).

Fig. 103. Roman sarcophagus depicting an elderly trainer with a lion. The trainer holds a double-pointed staff with one curved end, which might have been used for thwarting potential attacks from the lion. Late 3rd century CE. Vatican Museum, Vatican City. Photo credit: Tyler LaPenna (May, 2022).

Fig. 104. Section of a marble frieze depicting Cybele leading a harnessed lion with a double-pointed staff. Library Hall of the Castel Sant'Angelo, Rome. Photo credit: Tyler LaPenna (May, 2022).

Fig. 105. Ceremonial elephant goad or *aṅkuśa* made of iron and inlaid with gold and silver. Late 17th – early 18th century CE, Mughal Empire. The Metropolitan Museum of Art, New York, inv. 19992.378.

Fig. 106. A mahout prods an elephant's forehead with a bullhook. The bullhook is a tactile, pain-induced stimulus used for controlling captive elephants in the modern tourism and entertainment industries. Photo credit: Adobe Stock.

Fig. 107. Ceramic plate depicting a turreted war elephant with a calf in tow. The rider holds a hooked staff that shares similarities with the *aṅkuśa* and modern bullhook. Capena, Italy, early 3rd century BCE. Museo Nazionale Etrusco di Villa Giulia, Rome. Photo credit: © Scala / Art Resource, NY.

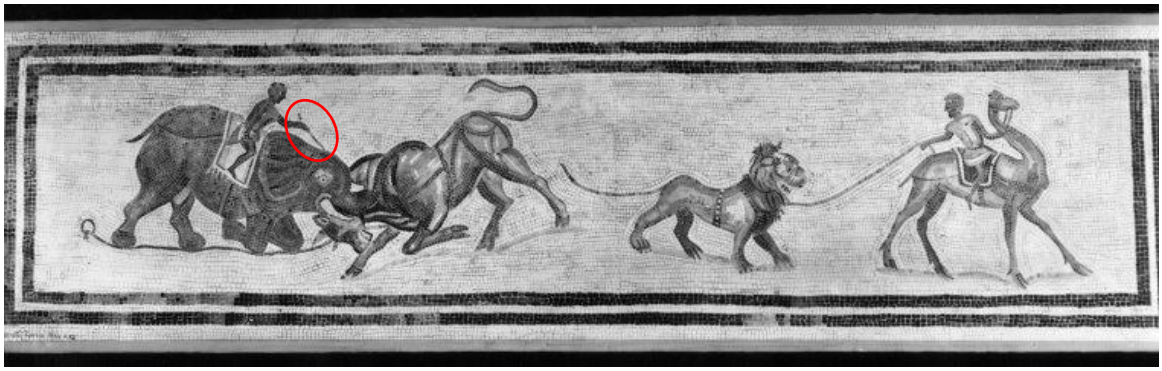


Fig. 108. Mosaic depicting a combat between a mounted elephant and a tethered bull (left). The rider of the elephant holds a goading implement. On the right, a tethered lion is paraded behind a mounted camel. Discovered on the Aventine in Rome, ca. 3rd century CE. © Alinari Archives / Art Resource, NY.

Fig. 109. Medallion of Gordian III depicting the Colosseum. Inside the Colosseum is a combat between a bull and a mounted elephant. The rider of the elephant appears to be holding a goad that might have been used for controlling the animals during the combat. ca. 238-244 CE. Cabinet des Médailles, Bibliothèque nationale de France, Paris. Photo credit: © DeA Picture Library / Art Resource, NY.

Fig. 110. Roman lamp depicting an elephant with a rider that holds a hooked staff. Puteoli, Italy, 50-90 CE. The British Museum, London, inv. 1856,1226.484. © The Trustees of the British Museum.

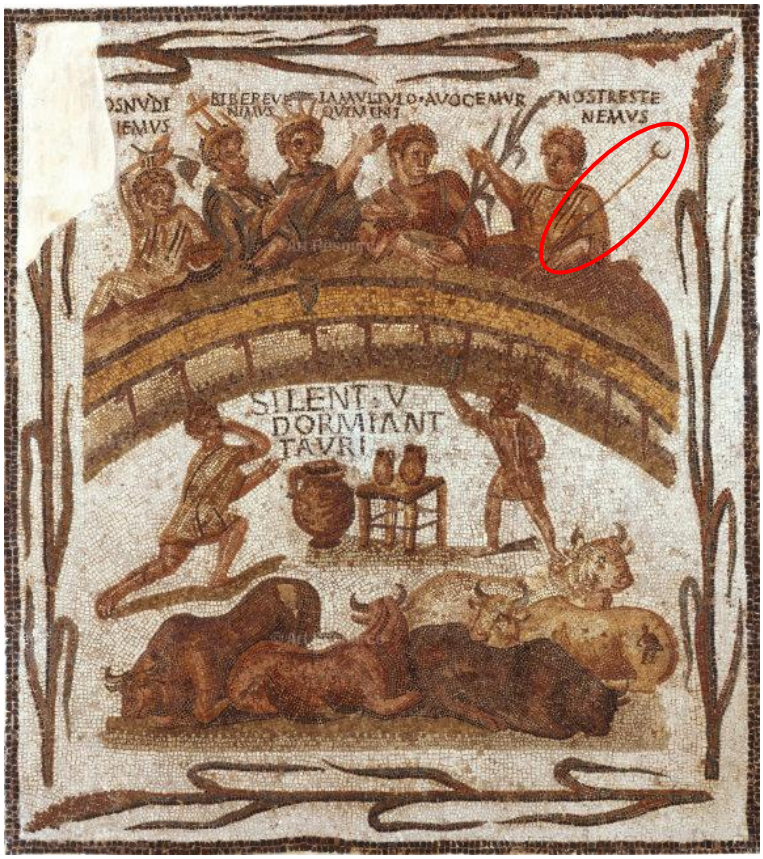


Fig. 111. Banquet mosaic from Thysdrus depicting five *sodalitates* of the amphitheatre and five sleeping bulls. First half of 3rd century CE. Bardo National Museum, Tunis. © Gilles Mermet / Art Resource, NY.

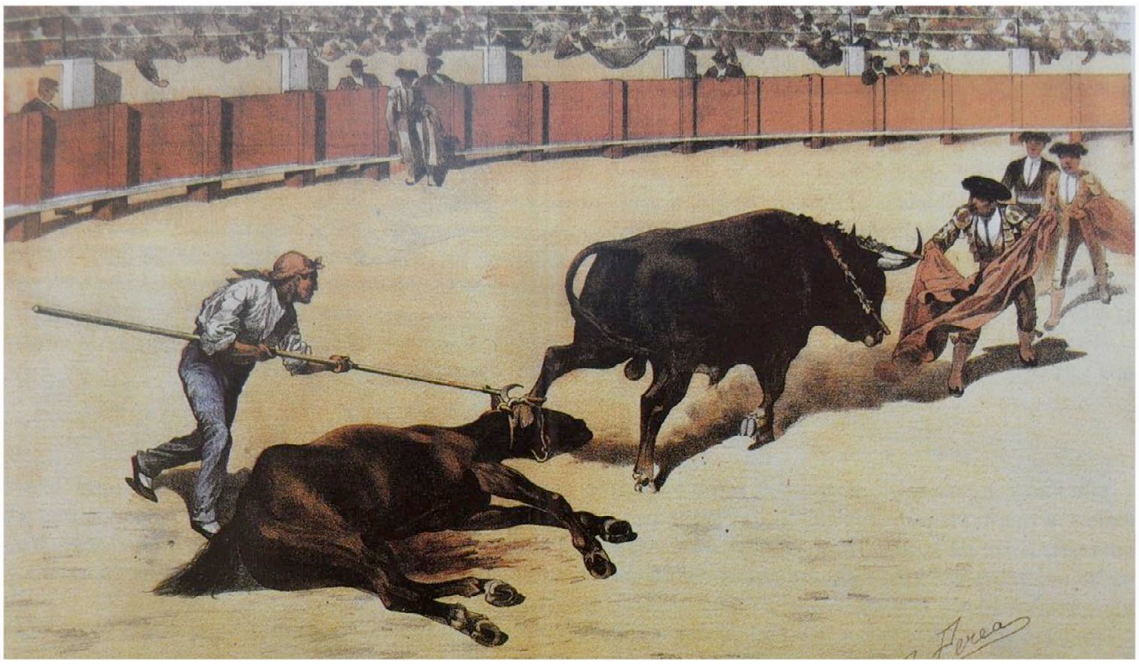


Fig. 112. Illustration by Perea published in *La Lidia* (25 October 1895) depicting a bullfight in Spain. The figure on the left employs the *desjarretadera* weapon to hamstring a bull. Source: Manas (2007) p. 8, fig. 5.

Fig. 113. A two-year-old bull named ‘52 Invizibull Fire’ demonstrates its bucking skills at the Buckers Unlimited Finals in Sterling, Colorado, 2017. The bull wears a flank strap that wraps around its torso. The tactile sensation of this stimulus is intended to elicit higher and straighter kicks. Source: Rice (2017).

(a)

Fig. 114. (a) Marble bas-relief depicting wild beast displays; (b) a rider holds onto the straps of a fitted harness that wraps around a zebu, who charges and bucks a man. The unfamiliar sensation of the harness and rider may have incited this behaviour. Germiyan Village, Malkara, Tekirdag (ancient Thracia), Turkey, 2nd-3rd century CE. Burdur Archaeological Museum. Photo credit: © Vanni Archive/ Art Resource, NY.

(b)

Fig. 115. Marble frieze depicting wild beast displays. Notice the fitted harness worn by the mounted zebu at the centre. To the left, a *salitor* performs a somersault over a bear. Discovered on the necropolis at Kibyra, late 2nd/early 3rd century CE. Burdur Archaeological Museum. Photo credit: Carole Raddato (April, 2013).

Fig. 116. Section of a mosaic depicting a man called Roupheinos riding a tethered bull, who attacks a bear. To the left of this interaction (not shown in the image), the same rider and bull attacks a boar. Discovered in a hall in the area of the gymnasium and Western Baths at Kos, late 2nd/early 3rd century CE. Source: Dunbabin (2016) pg. 197-98, fig. 7.21.

Fig. 117. Relief plaque depicting a lion hunt. Campana, Italy, 1st century BCE. Virginia Museum of Fine Arts, inv. 60.7.

Fig. 118. Marble relief depicting a *venatio* involving five heavily-armed *venatores* and three large carnivores (lion, mane-less lion, bear). Each animal is tethered with a decorated harness. A rope is shown attached to the bear's harness, which may suggest the animals were also bound to the arena floor. 1st century CE, Museo Torlonia. Source: Gabucci (2001) 68.

Fig. 119. Copper alloy vessel in the shape of a bear wearing a harness. It is possible that the artist drew inspiration from performing bears that were popular in the Late Antique games. Rome, ca. 200-400 CE. The Metropolitan Museum of Art, New York, inv. 66.18. Photo credit: Author (Jan, 2022).

Fig. 120. Bronze vessel in the shape of a bear wearing a harness. 3rd/4th century CE. Museum of Fine Arts in Boston, Massachusetts, inv. 62.1203.

Fig. 121. *Opus sectile* panel depicting a lion attacking an onager. The lion wears an elaborately decorated harness, which might have signalled the *editores* wealth. Porta Marina, Ostia, Italy, late 4th century CE. Photo credit: Mimmo Frassineti/AGF/Universal Images Group (Jan, 2023) Getty Images.

Fig. 122. Fragment of a Proconnesian marble relief from a sarcophagus depicting a harnessed lion holding a wild boar with its front paws. Ca. 200-250 CE. The British Museum, London, inv. 1849,1201.45. © The Trustees of the British Museum.

Fig. 123. A leopard walks across fallen tree logs and rocks that provide physical enrichment. Nanjing Hongshan Forest Zoo, China. Photo credit: Ma Ke (2020) ZooLex.

Fig. 124. A group of men warn elephants off with flaming torches in the remote village of Bishnupur in India. Photo credit: Cater News.

Fig. 125. Fishermen use bamboo sticks with sulphuric fire to attract fish on a traditional 'fire fishing' boat in New Taipei City, Taiwan. The light from the fire acts as a stimulus by driving the fish to the surface in large schools, making them easier to prey upon. Photo credit: Tyrone Siu (2019) Amusing Planet.

Fig. 126. French matador Sebastien Castella performs a muleta pass to a Domingo Hernandez fighting bull on the third day of the Beziers Feria, 13th August 2007 in Beziers, southern France. Contrary to popular belief, bulls are not irritated by the red colour of the muleta but its erratic movements. The red is preserved for tradition. Photo credit: Pascal Guyot (2007) Getty Images.

Fig. 127. South African rangers prepare to move a rhinoceros in Skukuza, South Africa, to a protection zone in the southern part of Kruger National Park. The rhinoceros was darted from a helicopter and subsequently blindfolded to subdue the animal as the rangers took blood samples. Source: The Columbian (Nov, 2014).

Fig. 128. Mosaic depicting an organist and horn player (*cornicen*). Roman villa in Nennig, Germany, 3rd century CE. Photo credit: Stiftung Saarländischer Kulturbesitz, Saarbrücken.

Fig. 129. Elephants clash in a battle re-enactment performed at the Surin Round-up Festival, held in November 2017 in the city of Surin in Isan, Thailand. Photo credit: urf / indivstock.

Fig. 130. Elephants dressed in ballerina costumes perform a dance in the 1942 Circus Polka staged by the Ringling Bros. and Barnum & Bailey Circus as part of *The Greatest Show on Earth* production. The dance was accompanied by music composed by Igor Stravinsky. Source: Plunket (2021).

Fig. 131. A bull displays Flehmen behaviour. This behaviour allows cattle to detect odorants from other members of their species. Photo credit: Heidi & Hans-Juergen Koch.

Fig. 132. Fragment of a bear hunt mosaic. A large piece of ham dangles in the doorway of an open crate as a lure to entice the bear into the trap. Hunting nets are used to confine the bears' flight path and force them towards the crate. Discovered on the Esquiline Hill in Rome, 4th century CE. Museo Centrale Montemartini, Rome. Photo credit: Luisa Ricciarini / Bridgeman Images.

Fig. 133. Mosaic depicting a hunt of wild beasts. Notice the figure kneeling on the crate on the top left corner, who prepares to shut the trapdoor where a live goat is placed to lure lions from their den. Dermech, Carthage, first half of 4th century CE. Musée national de Carthage. Source: Dunbabin (1978) pl. 13.

Fig. 134. Left: Leaf of consular ivory diptych of Areobindus. Elephant ivory. Constantinople, 506 CE. Musée national du Moyen Age, Thermes de Cluny, Paris, inv. CI 13135. Photo credit: © RMN-Grand Palais / Art Resource, NY.

Fig. 135. Right: Leaf of consular ivory diptych of Areobindus. Elephant ivory. Constantinople, 506 CE. State Hermitage Museum, St. Petersburg, Russia, inv. [omega] 12.

Fig. 136. Consular ivory diptych of Areobindus. Constantinople, 506 CE. Schweizerisches Landesmuseum, Zürich, inv. A-3564.

Fig. 137. Consular ivory diptych of Anastasius. Rome, 517 CE. Bibliothèque nationale de France, Monnaies, Médailles et Antiques, Paris, inv. 55 296bis. Photo credit: © Erich Lessing / Art Resource, NY.

Fig. 138. Modern reproduction of a leaf from the consular ivory diptych of Anastasius. Constantinople, 517 CE. Photo credit: Spurlock Museum of World Culture, University of Illinois Urbana-Champaign, inv. 1913.11.0002.

Fig. 139. Marble relief depicting two *salitores* with whips somersaulting over a pair of bears in the arena. Byzantium, ca. 500 CE. State Hermitage Museum, St. Petersburg, Russia, [omega] 224.

Fig. 140. A recortador jumps over a charging bull in the Placa de Bous bullring in Valencia, Spain. The technical form of the recortador closely resembles the form used by *salitores,* who somersaulted over animals in the Roman arena without the aid of a *contus*. Photo credit: StellarD (Oct, 2018). Wikimedia Commons.

Fig. 141. A *contorniate* from Rome, late 4th century CE. Obverse: Portrait of Caracalla wearing a cuirass. ANTONINVS – PIVS AVG. Reverse: A performer wearing a Phrygian cap uses a *cochlea* to interact with a big cat (possibly a leopard). Photo credit: Bertolami Fine Arts, Auction 19, Lot 678.

Fig. 142. Marble relief depicting a winged figure (possibly a performer dressed as Eros) balancing on a beam above a bear. Built into the Church of Panayia Trouloti at Pyrgi Thermis, Mytilene, Lesbos. Late 2nd/3rd century CE. Source: Karambanis (2020) p. 88, fig. 22, cat. no. 21.

Fig. 143. Fragment of a marble relief depicting two bears interacting with performers, who hide inside the *ericius.* Narbonne, France, 1st century BCE. Musée Narbo Via. Photo credit: Zunkir (June, 2021) Wikimedia Commons.

Fig. 144. A barrelman distracts a bull by waving a hat from the top of his barrel. Air Force Space Night at the Pikes Peak Rodeo, Colorado Springs, July 14th 2017. Photo credit: Tech Sgt. David Salanitri, U.S. Air Force (July, 2017) Wikimedia Commons.

Fig. 145. A frustrated bull named Bone Shaker prepares to toss a barrel with rodeo clown Ronald Burton inside at a rodeo show in San Bernardino, CA. Bullfighter Lelo Garcia entices the bull by rolling the barrel into its critical distance. Notice that the bull is wearing a flank strap around its torso. This was likely intended to encourage bucking behaviour. Photo credit: Kaus Photos.

Fig. 146. Cowboys from the Flying U Rodeo Company in California ride the Toro Totter while a bull charges beneath them. Source: Wrangler Network (Feb, 2022).

Fig. 147. Daredevil Johnny Knoxville falls victim to a bull while riding on the Toro Totter after his colleague on the other end dismounted the contraption. Notice the flank strap tied around the bull's torso. Source: *Jackass Number Two* (2006) Paramount Pictures.

Fig. 148. Left: Roman terracotta lamp depicting Cupid and an unidentifiable animal attached to a swivelling contraption, inspired by the arena games. Provenance unknown, mid-1st century CE. The J. Paul Getty Museum, Villa Collection, Malibu, California, inv. 83.AQ.377.546.

Fig. 149. Right: Roman terracotta lamp depicting Cupid and an unidentifiable animal attached to a swivelling contraption, inspired by the arena games. North African provenance, mid-1st century CE. The J. Paul Getty Museum, Villa Collection, Malibu, California, inv. 83.AQ.377.106.

Fig. 150. A group of rescue bears interact with a variety of exhibit furniture at Animal Asia's Vietnam Bear Rescue Centre. Photo credit: Animals Asia (Sept, 2015).

Fig. 151. Mosaic depicting hunting scenes amid various farming activities on a mixed-economy estate. House of Laberii in Oudhna, Tunisia, 2nd century CE. Bardo National Museum, Tunis. Photo credit: Gilles Mermet/ akg-images.

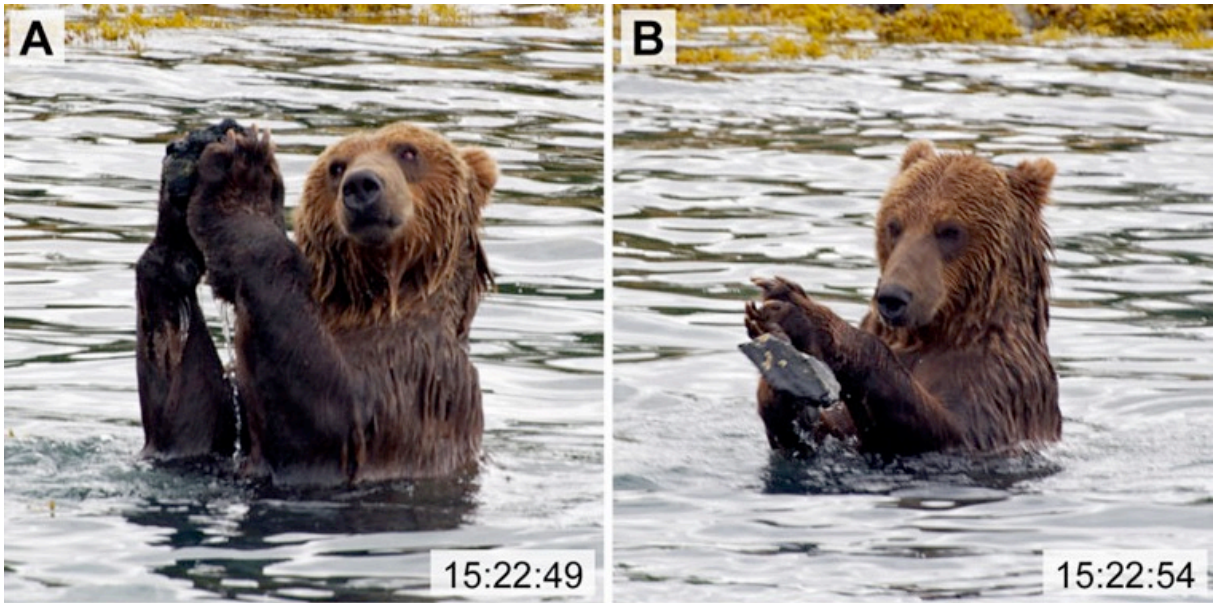


Fig. 152. A wild subadult brown bear manipulates a rock by repeatedly rubbing its neck and muzzle against it. This stone-rubbing behaviour has been classified by ethologists as 'tool-use', which demonstrates the bear's advanced motor skills and spatial cognition. Source: Deecke (2012) p. 728, fig. 1.

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