The captive brain: torture and the neuroscience of humane interrogation

S. O’Mara

From the Institute of Neuroscience, Trinity College, Dublin D02 PN40, Ireland. email: shane.omara@tcd.ie

Summary

Despite it being abhorrent and illegal, torture is sometimes employed for information gathering. However, the extreme stressors employed during torture force the brain away from the relatively narrow, adaptive range of function it operates within. Torture degrades signal-to-noise ratios of information yield and increases false positive discovery rates. As a discovery methodology, torture fails basic tests of veridical, reliable and replicable information discovery. Torture fails during interrogation because it is an assault on our core integrated, social, psychological and neural functioning. There is a need for a profound cultural shift regarding torture, recognizing that torture impairs, rather than facilitates, investigations and truth-finding. Rising to this challenge will increase operational effectiveness, eliminate prisoner abuse and torment, and aid veridical and actionable information gathering. Policy regarding prisoner and detainee interrogation need to be refocused as a behavioural and brain sciences problem, and not simply treated as a legal, ethical or philosophical problem. Getting the science, ethics and practice in line is a challenge, but it can and should be done.

The United Nations Convention Against Torture (UNCAT) defines torture1 as ‘… any act by which severe pain or suffering, whether physical or mental, is intentionally inflicted on a person for such purposes as obtaining from him, or a third person, information or a confession, punishing him for an act he or a third person has committed or is suspected of having committed, or intimidating or coercing him or a third person …’ (Article 1). Despite its illegality under international law, torture has been, and continues to be, a pervasive feature of human behaviour worldwide.2 Torture is employed to extract confessions, to force individuals or groups to recant beliefs, and to induce compliance with institutional authorities or political regimes. Torture is sometimes employed as an information-gathering tool, which I discuss here.3 Utilitarian arguments6 justify employing torture in the face of terrorist threat: using torture to gather information is morally permissible because that information can be used to ‘save lives’. The suffering of the few is outweighed by the needs of the many. How can a policy standoff between Kantians and Utilitarians be resolved, especially during a major policy formation dispute? Realpolitik suggests the standoff will be decided by the more powerful actors involved, unless the empirical evidence is overwhelmingly contrary to their preferred opinion. During the George W. Bush administration, horror at using torture was ostensibly in evidence, and euphemisms (such as ‘Enhanced Interrogation Techniques’) were employed instead, to give cover to the reality that techniques of torture were employed on detainees in the attempt to elicit information from them.7,8 The current US president has (rhetorically, at least) gone much further than this. During an election rally in Columbus, Ohio, President Trump said he would bring back waterboarding, stating ‘Believe me, it works, and you know

Received: 24 October 2017; Revised (in revised form): 7 December 2017

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QJM: An International Journal of Medicine, 2018, 73–78
doi: 10.1093/qjmed/hcx252
Advance Access Publication Date: 3 January 2018
Review
what, if it doesn’t work, they deserve it anyway for what they’re doing’. Trump’s words powerfully reflect two tendencies when thinking about torture. Torture can be used to easily and reliably extract veridical information that otherwise would have been withheld by a source. And if torture doesn’t work for information extraction, torture is a punishment for ‘what they’re doing’, the subject and object of which latter clause left unstated.

**Historical side-note on torture**

Media depictions of torture often involve the hero extracting vital information using torture from a source, the bomb being defused, and the city saved. Representations of torture as a confession-elicitation practice, however, are rare. Historically, torture has not been regarded as a reliable truth-discovering practice. Napoleon Bonaparte famously wrote that ‘[t]he barbarous custom of having men beaten who are suspected of having important secrets to reveal must be abolished. It has always been recognized that this way of interrogating men by putting them to torture produces nothing worthwhile’. The inquisitions famously used torture: females, for example, were tortured to force confessions of their being in league with supernatural, non-corporeal entities. Less widely appreciated, the Papal Inquisition into the Albigensian Heresy eschewed torture for information-gathering, preferring systematic and careful cross-referenced interviewing of an entire locale as more effective. Torture has commonly been employed during wartime. Hastings describes how, after agents of the Abwehr were captured, that MI5 spurned the use of torture, after some initial attempts to use it, in favour of ‘skilled questioning’.

**Caveats**

Torture is not a neuroscientific concept. It is a legal, moral and political concept. Here, we use neuroscientific concepts that map reasonably well to the practices and procedures used during torture. These are concepts such as stress, stressors, pain, anxiety, fear and deprivation (of food, liquid, sleep, social contact and sensory inputs). The analysis here is consequentialist, not Kantian. It examines the claim that imposing these extreme stressor states facilitates the retrieval of voluntarily withheld, veridical information by the source.

**Biomedical science and torture**

Self-evidently, we cannot conduct double-blind, randomized-controlled trials (RCTs), comparing information retrieval under torture, with non-torture methodologies. This point has been misunderstood and is worth considering in greater detail. An RCT methodology is an inductive scientific practice, where the experimenter is blinded to the treatment conditions to ensure that they do not contaminate the findings inadvertently (through harnessing the placebo effect, e.g.) or deliberately. Nor are RCTs necessarily solely appropriate for information discovery. An analogy is useful here. The past 30 years have seen a revolution in the treatment of individuals with cardiovascular disease (CVD). CVD investigators do not, prospectively, randomly assign individuals from the population at large to particular diets, exercise regimes and experimentally induced cardiac events, to test for survival rates and optimal treatment modes. Instead, investigators proceed deductively from models of cardiac function and use models of haemodynamics, vascular stability, cardiogenomics, etc., to make predictions about likely outcomes in individuals suffering CVD. This is experimental medicine, similar to a phase 0 clinical trial. RCTs for interventions may subsequently be conducted, if appropriate, but not necessarily. Similar logic applies to investigations of other compromised or stressed organ systems. RCTs are not a first, or only, recourse for investigations in biomedicine.

Assuming we can only approach torture scientifically using RCTs is a category error. Regarding brain function, we have a very powerful, carefully stated set of theories of great utility predicting likely outcomes of stressor states and how they interact with brain systems and subsystems. We can explore likely effects of stressor states employed during torture (in the same way we investigate cardiac events), subsequent treatments (which may be the subject of an RCT) and outcomes. In this way, we avoid the epistemic error of Bloche, amongst others who suggest a scientific understanding of torture is beyond reach. Knowledge evolves and accumulates from a wide variety of sources. In the case of torture, we can make predictions based on what is known from psychology and neuroscience of the effect of the imposition of these extreme stressor states.

**What is stress?**

One useful definition suggests that stress ‘... causes heightened excitability or arousal in the brain and body, a perception that present or future events will be very unpleasant, combined with a lack of controllability over these events’. A consensus model of the interaction between neurocognitive circuits and stressors is presented in Figure 1. Stress in the short-term is adaptive, readying organ systems for action and mitigating the likely consequences of the stressor. However, the stress response itself can and does become chronic and maladaptive,
resulting from repeatedly imposing severe stressor states. The chronic and elevated release of stress hormones, in particular cortisol, but also the catecholamines, has predictable, differentiable, discriminable and reliable effects on differing brain circuits and subcircuits, from the synapse all the way through to the integrated neuropsychiatric functioning of the individual.

Roozendaal et al. presented a generally accepted model of the effects of repeatedly imposing severe and chronic stress. Structural changes develop in interacting brain regions supporting cognitive and other functions. The hippocampal formation (which supports mnemonic function) becomes hypotrophic; the reduction in volume is in proportion to the severity and duration of the stress imposed. The amygdala (which supports fear, threat detection and anxiety), in contrast, becomes hyperresponsive and hypertrophic because of severe and chronic stress. Prefrontal cortex (which supports higher executive functions) becomes hyporesponsive in direct proportion to the chronicity and severity of the stressor state imposed. This model allows us to predict probable outcomes of the stressor states in Table 1, which tabulates predicted outcomes of imposing differing stressor states on neuropsychological function. The prediction of the torturer has to be that, at worst, imposing these stressors is neutral on the brain systems supporting the associated function (this is the best case scenario). Furthermore, torturers must hope that the effect of torture on motivation is positive, facilitating retrieval of veridical information. Ideally, torture should have no effect on the homeostatic or adaptive functions performed by the brain. However, to the best of our knowledge, we can safely predict that these stressor states negatively affect every aspect of integrated neuropsychological function. Imposing states of extreme cold, coupled with caloric deprivation, in addition to near-drowning through waterboarding is likely to have a profoundly deleterious effect on the functioning of all the brain systems listed in Table 1, for example. Model-based deductive reasoning is the only way we can proceed, and it obviates the need for an RCT, which would be, by definition, unethical, immoral, inhumane and illegal.

**Stress, synapses and memory**

At the synapse, severe, chronic and repeated stress blocks long-term potentiation (the key model of the plastic changes in the synapse to support learning and memory). Furthermore, severe, chronic and repeated stress facilitates long-term synaptic depression (the model for how memories are eliminated at synapses). In humans, chronic excretion of cortisol (as in hypercortisolaemia) causes atrophy of the human hippocampal formation and concomitant deficits in declarative memory. Such patients show deficits in recall for previously learned information, despite their motivation to recall. Experimental administration of the stress hormone cortisone impairs retrieval of declarative (autobiographical) memories in humans.

The effects of extreme stressors can be assayed in special populations, such as combat soldiers, in whom motivation to refuse the recall of information is irrelevant. In a specimen example, Morgan et al. examined elite soldiers exposed to 48 h of sleep deprivation (SD), heat, dehydration stress, food...
deprivation and under predator threat (simulated combat where live rounds of ammunition were used). All participants underwent a thorough neuropsychological investigation prior to participation and on the termination of the 48-h combat experience. Without exception, every aspect of psychological function assayed was degraded in these elite soldiers, including reaction times, vigilance, learning and memory, reasoning and mood states. Extreme stressors move the brain out of the narrow adaptive range within which it functions, with predictable consequences.

Waterboarding and respiratory function

The respiratory system in humans and other animals has been studied intensely for approximately 150 years. Great detail has been gathered about the peripheral and central control of respiratory function. Understanding respiratory function is a central concern for diving (especially under extreme conditions) and in health and biomedical interventional contexts. During waterboarding, an individual is ‘bound securely on an inclined bench...the individual’s feet are generally elevated, a cloth is placed over the forehead and eyes, water is ap-plied to the cloth in a controlled manner...air is now slightly restricted for 20–40 s due to...the cloth increasing carbon dioxide levels in the individual’s blood’, inducing the perception of drowning. This body position is the ‘Trendelenburg position’, which has been based on adverse outcomes (accumulated in non-RCT trials), discontinued as a surgical position. Filling of the nasal sinuses, oropharynx, and trachea with water during waterboarding is, of course, an extreme stressor. The person is brought repeatedly to the edge of death: maintaining a partial fraction of oxygen within the lungs may prevent imminent death, but the presence of fluid in the trachea hinders the inspiratory reflexes central to coughing clear the airways. We can conclude that waterboarding is perhaps the most extreme of the metabolic stressors envisaged in The Torture Memos, because the person is repeatedly semi-drowned and then revived. At the heart of waterboarding is dyspnoea, and the frantic search for air and especially oxygen. Dyspnoea triggers a stress response mediated by the amygdala and the anterior insula. Furthermore, elevations in blood CO2 (hypercapnia) activate acid-sensing receptors in the amygdala and brain regions associated with the processing of information about pain (in particular, periaqueductal grey).

The cognitive effects of oxygen deprivation are of especial interest for humans operating in environmental extremes, such as underwater submersion or the upper atmosphere. Turner et al. induced temporary experimental hypoxia in healthy adults to determine what cognitive processes are vulnerable to oxygen deprivation. Oxygen deprivation is a metabolic stressor; the torturer must predict that oxygen deprivation will be without effect on neurocognitive function. Furthermore, the torturer must hope that oxygen deprivation does not affect brain systems supporting life. Turner et al. concluded hypoxia causes severe cognitive deficits across all measured domains of cognitive function. These deficits are apparent in an overall neurocognitive index of neuropsychological function, with effects on composite memory, verbal visual memory, processing speed, executive function, reaction time and cognitive flexibility. Moreover, every aspect of mood and perceptual state is altered substantially by hypoxia: participants report feeling tired, and display loss of coordination, blurred vision, weakness and dizziness, irritability and restlessness. These are predictable outcomes, given what we know of neurocognitive function under conditions of respiratory stress.

Sleep deprivation

SD is a simple method of torture and confession elicitation in police stations and other custody situations, since time immemorial. Prolonged SD causes widespread changes in many organ systems; when sustained for sufficiently long periods of time, SD eventuates in death of experimental animals and humans. Individuals suffering from chronic insomnia have lowered hippocampal volumes on average and suffer deficits in declarative memory function. Many experimental studies, in volunteer students, psychiatric patients and elite populations (such as soldiers), confirm SD degrades memory and cognition, in direct proportion to the period of time since sleep deprivation was imposed. Loftus et al. have recently demonstrated that SD substantially increases the likelihood that college students falsely confess to damaging an experimental computer when sleep deprived.

Torture and the torturer

A less explored question is the effect of imposing torture by a torturer on a detainee. Functional brain imaging has disclosed a brain circuit activated when one person sees another person in distress or pain. This can be through the giving of mild electric shocks to the hand of another, or watching videos of another person subjected to surgical interventions, or accidents. Imposing extreme stressors on another human being, ostensibly for the purpose of gathering information from them, is in itself, stressful. Politicians imposing the policy do not themselves engage in torture: this is left to others. They do not endure the blood and filth of torture: the detritus and effluvia arising naturally from enforced nudity, adult diapers and prolonged stress positions. Politicians devising these policies distance themselves psychologically through a process of moral justification and moral disengagement: using worthwhile ends to justify inhumane means. Displacement and diffusion of responsibility, and denying the harmful effects of their actions, allow them to escape the consequence of their policies. However, testimony from ex-torturers demonstrates that a substantial fraction of those who have engaged in torture suffer psychiatric consequences for years afterward. Damien Corsetti, for example, has stated ‘the cries, the smells, the sounds, they are with me all the time. It is something I can’t take in. The cries of the prisoners calling for their relatives, their mother. I remember one who called for God, for Allah, all the time. I have those cries here inside my head’. The resulting burden on healthcare systems is considerable; post-traumatic stress disorder in this population is a considerable and disabling problem.

Does torture yield veridical information from memory?

The pro-torture case is typically made without comparison to alternative methods and is sometimes conflated with an express desire to punish (‘They deserve it for what they’re doing’). To be clear, the case here is not that torture uniformly does not work for information gathering. Rather, the case is this: torture substantially degrades signal-to-noise ratios of information yield and substantially increases false positive discovery rates.
As a discovery methodology, torture fails basic tests of veridical, reliable, and replicable information discovery. Experienced interrogators repudiate torture as useless for information gathering. They do not do so on the basis of having conducted RCTs. They proceed deductively, based on their own capacity to elicit information from individuals, knowing that our predisposition as humans is to engage in conversation with each other.39

The skills involved in interrogation have arisen in two distinct fashions. One is through apprenticeship, where knowledge of interrogation has accumulated through repeated practice in the field (an evolutionary practice). This is how many human information gathering practices evolved in medicine, clinical psychology and related fields. We can also compare outcomes of differing interrogation and interviewing methods for information discovery. These can be compared with the predictable outcomes of imposing severe stressors on neurocognitive systems. This is a theoretical, model-based, deductive way of proceeding, one that is well-founded and is supported by the intelligence community.40 The skills of a good interrogator (someone who can reliably elicit veridical information, often without the source being aware that they have disclosed this information) approximate the skills of a good clinician. Demographically, they tend to be older, culturally aware, practice active listening and are skilled at placing individuals at ease. They have excellent impulse control, high situational meta-awareness and are meta-cognitively aware.41 Alison and Alison42 provide an important history of the evolution of interrogation methods and an account of their analysis of successful and unsuccessful interrogations with suspected terrorists and criminals.

Humans are predisposed to engage in information sharing about themselves. Dunbar et al.44 showed that, ‘in the wild’, approximately 40% of what we say to others involves self-disclosure. Tamir and Mitchell45 showed that self-disclosure (as opposed to disclosing information about others), unexpectedly, activates reward circuits in the human brain. Self-reporting is a pervasive aspect of our interactions with other human beings. Individuals presenting with illness in a doctor’s surgery are one example; individuals crossing borders and being questioned by border control is another example. Self-reports might be elicited, or self-prompted. Regrettably, police forces often rely on techniques lacking empirical foundation, such as provocation and interviews with suspected terrorists and criminals.

The dynamics of verbal interaction during conversation are complex.56 Turn-taking during conversation happens rapidly, typically with an offset of about 200 ms. Subtle aspects of our physiology change mutually during conversation: for example, dyadic breathing synchronises unconsciously, allowing us to speak at the appropriate point during the conversation. Typically, interrogations are conceptualized as one-on-one. This may not be an optimal method for interrogations. Studies of transactive memory47 show that in dyadic pairs, such as intimate partners, that memory structures are held in common between individuals, with one person specializing in one aspect of the memory and the other in another.

Conclusions

Arguments favouring torture are self-defeating.3,48 Those who have been tortured develop substantial, sustained and usually non-remitting deficits all domains of neuropsychological function, from mood, to cognition, to memory and beyond. This is why the veridical and reliable intelligence yield from torture through the ages has been so paltry. Contrariwise, confession evidence derived from torture is voluminous and nonsensical, given the numbers of witches that torture has proved existed.49 Coercive interrogation causes severe, repeated, and prolonged stress, compromising brain structures supporting integrated neurocognitive function. Because these detrimental effects are not visible to the naked eye does not make them any less real. Interrogation is far too serious to be left to those who only know what they consume from mass media; torture is the first recourse of the amateur. Effective Interrogation is a research problem increasingly being solved by research programmes in the behavioural and brain sciences. Getting the science, the ethics and policy line in is a challenge, but it can and should be done.50

References

1. United Nations Convention against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment [Internet]. http://www.ohchr.org/EN/ProfessionalInterest/Pages/CAT.aspx (4 January 2018, date last accessed).


