

**Can you mold, handle or portray it? Iconicity and metaphor in depiction
strategies in co-speech gesture**

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Summary

The study explores iconicity and metaphor revealed in various gestural depiction strategies in co-speech representational gestures (Kendon, 2004; McNeill, 1992). The gesture examples have been sourced from three cultural-linguistic environments: Australia; Ireland; and Poland. It investigates whether it is possible to detect consistent patterns in referent depiction manifested as depiction strategies within each community and across communities. In line with the theory of inter-bodily co-enacting (Cuffari & Jensen, 2014), each community is viewed as an extended ecology (Steffensen, 2011), and human bodies are perceived to be co-evolving with their immediate environment, rather than as existing as isolated entities. This study is also rooted in the concept of affordances (Gibson, 1979) and how object features impact gesture production; namely, object characteristics are likely to affect the number of representational gestures and depiction strategy selection. Furthermore, in line with McNeill's (2005) perception of gestures as dimensions rather than separate categories, examples of fuzzy categories, showing features of representational and non-representational gestures simultaneously are also included in the analysis.

The thesis is composed of six chapters. Chapter 1 offers a brief introduction to the study, defining the major concepts and theories that lay the theoretical foundations of the project. It provides a definition of gesture and its example classifications, further narrowing the scope of the study to representational gestures while acknowledging the existence of fuzzy categories. It also gives an overview of various embodiment theories highlighting the relevance of the inter-bodily co-enacting concept (Steffensen, 2011) in which gesture is created by speakers directly affected by their immediate environment. Finally, the study's aims and research questions are briefly introduced followed by a general outline of the thesis.

Chapter 2 presents the relevant theoretical background. It reviews the literature on various models of gesture production and specifies the approach adopted in this study. The discussed models are the sketch model (De Ruiter, 2000), the lexical gesture process model (Krauss, Chen & Gottfexnum, 2000), the interface model (Kita & Özyürek, 2003), growth point theory (McNeill & Duncan, 2000) and gesture as simulated action (GSA) framework (Hostetter & Alibali, 2008). Next, it provides information on cognitive-semiotic modes as active ingredients of gestural sign creation. In this way, various theoretical and empirical perspectives of iconicity, metaphor, metonymy and different schemas are brought together and contextualized for the study's purposes. The final sections present various depiction strategy examples in the manual modality.

They also identify systematic tendencies in the use of these strategies in sign language, silent gesture and co-speech gesture.

Chapter 3 explains in detail the methodological design of the current study. First, its general aims are clarified. Second, the three research questions are re-stated. Research Question 1 investigates how different semantic features (spatiality, animatedness, manipulability and plurality) affect gesture production. Research Question 2 examines how different communities (Australia, Ireland and Poland) affect gesture production. Research Question 3 analyses the role of metaphor in depiction strategy creation. Third, the design of the study is outlined, including settings, participants, stimuli and collecting data procedure. Fourth, the steps to analyse the extracted data and calculating an interrater agreement are spelled out.

Chapter 4 discusses the findings in regard to Research Question 1 and Research Question 2. The results are organized according to the four semantic characteristics mentioned in Chapter 3: spatiality; animatedness; manipulability; and plurality. Universal and community-specific trends are also included for each characteristic. The principal findings are 1) each semantic characteristic favors a selection of a specific strategy: spatiality favors molding; animatedness favors portrayal; manipulability favors handling; and plurality favors molding and portrayal (with animate plural referents); 2) universal and community-specific trends have been detected regarding the selection of different referent images, strategies, articulators and form parameters; and 3) multiple and simultaneous constructions have been identified. Manipulability has generated the most multiple constructions. Simultaneity in gesture seems to be a universal feature, with specific tendencies for different groups of speakers.

Chapter 5 focuses on the results of Research Question 3 and centers around metaphor and its various functions in creating depiction strategies. The general conclusion is that representational gestures depicting physical items and entities are equipped with elements of metaphoricity. Metaphor seems to be employed to convey conceptual information that goes beyond the physical characteristics of the referents; for instance, it foregrounds various dimensions of concrete objects such as width or length. Abstract concepts such as amount can be represented via different geometrical configurations (e.g., a sphere or a circle). An underlying semantic core can give rise to metaphor (e.g., leaves used to represent AUTUMN that can be picked, manipulated and tactically explored as a pile). Similarly, an underlying physical action can give rise to a metaphorical extension (e.g., uncertainty presented via fluctuating movements resembling a fluctuating flame). Metaphor can also enrich iconic representation by adding the speaker's epistemic stance (KNOWING IS UP or NOT KNOWING IS DOWN (Lakoff & Johnson, 1980)) or neutralize a semantic meaning of a referent (Lapaire, 2016) (e.g., AMOUNT depictions).

Chapter 6 draws together the key findings identified in the study as well as final comments. The results are ordered according to the three research questions mentioned above. The final comments combine the broader implications of the project, its possible limitations and future research opportunities.

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Writing a PhD is like going on a long trip. Generally, you feel you are moving forward from one location to the other. Occasionally, you experience minor bumps on the road, and sometimes major roadworks can significantly slow you down. The key message is to keep going no matter what, as even major disasters can be overcome. If you are a solo driver, me included, it is good to have your support team located within reach. My team have been outstanding and if it had not been for them, my journey would have been much bumpier.

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At the human level, cognition is action – we think in order to act, and we act as part of our thinking (Johnson, 2007)

Cognition is something we do: we enact it, with the world's help, in our dynamic living activities. It is not something that happens inside us (Noë, 2009)

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List of Abbreviations and Sign Language Acronyms

General abbreviations

AB	away body
AC	away center
AP	Australian participants
center c	center center
c	counter (as in counter-balanced)
di	diagonal
extr	extreme
ELAN	EUDICO Linguistic Annotator
GP	Growth point
GSA	Gesture as simulated action
IP	Irish participants
l	left
L1	first language
L2	second or additional language
PP	Polish participants
PD	palm down
PL	palm lateral
PU	palm up
PV	palm vertical
peri	periphery
r	right
SLA	second language acquisition
TB	towards body
TC	towards center

Sign language acronyms

ASL	American Sign Language
BSL	British Sign Language
ISL	Irish Sign Language
JSL	Japanese Sign Language
SSL	Swedish Sign Language

Chapter 1: Introduction

The study sets out to investigate iconicity and metaphor as revealed in various depiction strategies in co-speech representational gesture sourced from three cultural-linguistic communities: Australia; Ireland; and Poland. It explores whether it is possible to detect consistent patterns in referent depiction within each community and across communities. The title of the thesis has been inspired by the work of Masson-Carro, Goudbeek, and Krahmer (2016)'s study, whose researchers investigate how object characteristics (e.g., objects that afford action and objects that do not) affect co-speech gesture production. This work extends their range of object characteristics (spatiality, animatedness, manipulability and plurality) and explores whether there is a connection between a specific characteristic and selecting a depiction strategy.¹

This introductory chapter presents a general framework of the thesis. Understanding the meaning of gesture and its multidimensional character is crucial for this study; hence, various attempts at defining and classifying gesture are presented first. Second, theories specifying a theoretical background for gesture creation are discussed. Third, a specific perspective on gesture, as adopted in this study, is developed. This includes a respecification the definition of gesture, an introduction to depiction strategies and an explanation of why iconicity and metaphor are the subject of this investigation. Fourth, certain elements of methodological design are briefly discussed to show how the project has evolved. Fifth, the significance of the study is explained followed by a brief overview of the thesis outline.

1.1. Gesture definitions

When we think of gesture, we normally conjure up an image of a person moving their hands as they speak. Silently scratching or fidgeting with a pen, for example, is not usually considered gestural. The same applies to affect displays or regulators, such as hair-patting, self-groomings or clothing adjustments (Kendon, 2004). The following definitions display different understandings of the phenomenon suggested by various researchers.

Kendon (2004, p. 8) states that gesture is a bodily action over which we “exercise at least some degree of voluntary control” and over what it “expresses.” Gesture is a visible action of any body part when it is used as an utterance or part of an utterance and has “*the features of manifest deliberate expressiveness*” (Kendon, 2004, pp. 13–14, italics in original). Those movements with “deliberate expressiveness” can be distinguished from other body movements through an analysis of

¹ Examples of various strategies and techniques of depiction are presented in the Literature Review (Section 2.3).

their form: “If an action is an excursion if it has well defined boundaries of onset and offset and if it has features which show that the movement is not made solely under the influence of gravity, then it is likely to be perceived as gestural” (Kendon, 2004, p. 14). Consequently, he includes in the “gesture” category actions like waving ““bye, bye,””pointings and pantomimes that people use in situations when speech is not possible. Head-wags or arm-wavings that occur along with speech are also recognized as gesture, while practical actions or emotional displays may take on gestural characteristics if their intention is to communicate. At the same time, actions might lose their gestural characteristics, becoming “incidental mannerisms” or “passing comfort movements” (Kendon, 2004, p. 10). Kendon’s understanding of gesture as a communicative behaviour is shared by Geneviève Calbris (2011), who also defines it as “meaningful body movement” (p. 3). Hence, critically speaking, our working definition of what constitutes a gesture is any visible motion undertaken by any body part with an intention to communicate.

In line with Kendon’s (1972, 1980) theory concerning *gesture units* and *gesture phrases*, his system assumes that gestures display a phrasal structure that can be decomposed. A gesture unit is the interval from the moment the articulators move from the resting position to the moment they move back to the same position of relaxation. It is the largest structure in Kendon’s hierarchy, which he calls “an entire excursion” (Kendon, 2004, p. 111). Each gesture unit also consists of gesture phrases such as rest position, preparation, stroke, hold and retraction (Kendon, 1972, 1980).

Gestures, McNeill (2007) notes, refer to daily occurrences spontaneously and regularly co-occurring with speech that are visible in movements of fingers, arms and hands. Kendon and McNeill’s definitions seem to share one aspect in common: they reject movements that are not related to speech. McNeill (2015, p. 4) defines gesture as the “intrinsic imagery of language.” Language cannot be separated from gesture because gesture orchestrates speech. Furthermore, by gesture McNeill very often refers to one specific gesture type on Kendon’s continuum only, viz, gesticulation (Figure 1.1).

Fig.1.1

Kendon’s continuum

Gesticulation → Speech-Framed Gestures → Emblems → Pantomime → Signs

Note: Adapted from McNeill (2006)

McNeill also disputes Kendon’s view that gestures are deliberate in the sense of occurring for a particular purpose, arguing that it is not a speaker’s intention to make a speech-orchestrating gesture but rather, to communicate.

Streeck (2009, pp. 5–6) perceives gestures as “a family of human practices.” These practices do not constitute a symbolic system or language component but are constantly developing by means of such qualities as improvised, heterogeneous, partly conventional, partly idiosyncratic, partly culture-specific and partly universal. When people gesture, they learn about the surrounding environment, which becomes meaningful and structured, and then share this experience with other speakers during the process of interaction. This is clearly visible in children, who produce gestures that they have observed, learn about various communicative actions by identifying their own gestures and those of other speakers, and subsequently reflect on both (Streeck, 2009).

Finally, Müller, Bressemer and Ladewig’s (2013) understanding of gesture is concordant with Kendon’s definition in two aspects, the first of which is the significance of gestural form. Indeed, they even go so far as to label their approach “a form-based view” (p. 707). A further notion they share with Kendon is that of “features of manifest deliberateness,” i.e., gestures are intentional. Their stance differs in their approach to gestural meaning, however. According to their understanding, gestural meaning is not only manifested as a visual action but also as a form of embodied conceptualization. In this respect, they follow Langacker (1991, p. 81) and his belief that “meaning resides in conceptualization.”

Overall, it has emerged that no universal definition can be used for all areas of gesture research since there are many factors influencing gesture production (e.g., the context, the purpose for which they have been used and their relationship with other channels of expression). In linguistics, just as key concepts or approaches to analysis are contested, the field of gesture is no different. The various systems presented below reflect this state of affairs. The idea of a communication instance crossing boundaries and still being classified as gesture is maintained in this study (e.g., examples co-occurring with speech and produced in pauses, examples of intentional and non-intentional communication). Table 1.1 summarizes the key characteristics of gesture.

Table 1.1

Key characteristics of gesture

Researcher	Gesture characteristics
Kendon (2004)	co-existing with speech, a body action that has the features of manifest body expressiveness
	has a phrasal structure that can be decomposed
McNeill (2007)	co-existing with speech, not deliberate but spontaneous visible movements of fingers, arms and hands whose

	intention is to communicate
	gesture often synonymous with gesticulation
Streeck (2009)	family of human practices
	improvised, heterogeneous, partly conventional, partly idiosyncratic, partly culture-specific and partly universal
Müller, Bressem and Ladewig (2013)	form-based view showing features of manifest body expressiveness
	a form of embodied conceptualization

1.2 Example classifications

It needs to be stressed that these examples do not present a complete list of all the classification systems identified in the literature, due to the limitations of the study. Nevertheless, a brief glimpse is offered at classifications that are relevant to the current project.

1.2.1 Efron's classification

One of the first pioneers of systematic gesture research was David Efron (1941/1972). In 1972, Efron's work was edited under the title *Gesture, Race and Culture*, which, with an introduction by Paul Ekman that classified gesture types, offers an in-depth study of the phenomenon. Efron specifically undertook to investigate the gestures of Southern Italian and Jewish immigrants in New York. In his comparative work, he discovered that gestures produced by the assimilating groups of immigrants became more and more similar to each other, losing their unique features, and more closely resembling American ones. They stood in contrast to the gestural behaviour of Jewish and Italian immigrants who did not undergo the process of Americanization, viz, the first generation of immigrants, who preserved their original gestural styles. Therefore, he demonstrated that it is culture that shapes gestural repertoires (Bohle, 2014; Kendon, 2004; Stam & Ishino, 2011).

Efron also laid the foundations for forthcoming classifications of gesture by introducing his categories of gesture. Efron (1941/1972) identified two categories: gestures that are produced with speech, which he called *logical-discursive gestures*, and gestures that can exist without speech, viz, *objective gestures*. The first category includes *batons*, which mark rhythm in a discourse and highlight

its important parts, and *ideographs*, which manifest the speaker's way of thinking. Ideographic gestures are abstract, which is why it is impossible to link them to actual objects or actions. The second category comprises three types: *deictics*, pointing gestures referring to a visibly present object; *physiographs*, which describe their referent; and *emblematic* or *symbolic gestures*, which carry a standardized meaning within a given community. Additionally, physiographs can be divided into *iconographic* gestures that represent the shape of an object or spatial relations and *kinetographic* gestures, which stand for a bodily action.

Efron's categories have received a mixed reception amongst contemporary scholars. However, it is undeniable that he is considered the first researcher to have investigated gestures in a systematic way (McNeill, 1992; Stam & McCafferty, 2008). Indeed, his division of gestures into categories that differentiate those produced with and without speech has been preserved (Kendon, 2004; McNeill, 1992, 2006). In pointing out that gesture patterns are modified by culture and not by racial or biological factors, his study has been vital for other gesture analysts following in his footsteps and investigating the gestures of different cultures (e.g., Kendon (2004)). On the other hand, his study reveals a number of shortcomings; for example, even though Efron acknowledges head movements as significant in the gesture repertoire of Jewish people in his sample, his scheme is developed mostly with respect to the movements of hands and arms (Bohle, 2014). Furthermore, his categories can be described as "implicit" since classifying gestures in a systematic way was not his priority (Bohle, 2014, p. 1454). Finally, his gesture study stems from drawings and interpretation of silent movies, which prevents a thorough analysis of the gesture and speech relationship (McNeill, 1992).

1.2.2 Kendon's continuum

It was not until the work of two prominent researchers, David McNeill and Adam Kendon, that gestures and speech began to be perceived as interconnected. In his paper entitled *Some relationships between body motion and speech*, Kendon (1972) indicated that gesture patterns are related to the patterns of co-occurring speech and, as speech is organized in hierarchical units, so too is gesture. Furthermore, Kendon (1988) recognized various gesture types, while McNeill (1992) arranged them along a continuum, which he subsequently named Kendon's continuum in the latter's honour. Kendon's continuum has been further developed into a system of separate continua depending on gesture's relationship to speech, linguistic properties, conventions and character of semiosis, with differentiated positions allocated to different gesture types (McNeill, 2000a). Kendon's continuum is presented and analysed below.

Fig.1.1

Kendon's continuum

Gesticulation → Speech-Framed Gestures → Emblems → Pantomime → Signs

Note: Adapted from McNeill (2006)

As one moves from left to right, the presence of speech becomes less obligatory. At the same time, the quality of gesture showing the properties of language increases. Gesticulations are synchronized with speech, whose presence is essential. They are idiosyncratic and do not possess language-like systematicity. Signs, on the other hand, are produced in the absence of speech but are characterized by similar-to-language features.

McNeill (1992) defines gesticulation as motion whose meaning directly relates to the accompanying speech. It is phonologically, semantically and pragmatically synchronic with speech and exists as an external manifestation of a speaker's thinking-for-speaking (Slobin, 1987). He also claims that 90% of this type of gesture is performed during speaking. These two modalities are co-expressive, which means they communicate the same idea simultaneously. The core of McNeill's theory on gestures inheres in his view that this synchronic communication in speech and gesture indicates that our mind performs the same activity in two ways, not as two separate activities. In contrast to sign languages, gesticulations are idiosyncratic, i.e., there is no standard way of producing spontaneous gestures, which is why they are very often called spontaneous gestures, the type to which McNeill devotes most of his time. He very often refers to gesticulations by means of the term "gestures," leaving out signs, emblems and pantomime (McNeill, Cassell, & McCullough, 1994, p. 224).

Speech-framed gestures, also referred to as *language-slotted gestures* or *speech-linked gestures* (McNeill, 2007, p. 5), behave differently than gesticulations. Rather than being co-expressive with speech, they are grammatically incorporated into a sentence in taking up a slot replacing a syntactic unit and becoming a sentence part. The following example of a speech-framed gesture comes from McNeill (2007, p. 2).

Sylvester went [gesture of an object flying out laterally], where the gesture fills in the sentence structure.

Their form is dependent on the context, and therefore they display fewer symbolic properties than emblems (Cienki, 2015). Ladewig (2014b) suggests that these gestures have a preference for a syntactic position at the end of the phrase.

Emblems are conventionalized culturally codified signs, examples of which include the thumbs-up, the 'OK sign' and others that are far less polite (McNeill, 2007, p. 5). Efron (1941/1972) labeled these symbolic or emblematic gestures, while Ekman and Friesen (1969) called them

emblems, and this term has become the most popular for this type of gesture. Kendon (1992) refers to this gesture type as quotable gestures since they display a stable relationship between form and meaning and can be quoted in their precise, accurate form, in the way a word or an expression can be reproduced. They can co-occur with speech and serve a complementary function or occur without speech as silent expressions. Emblems can be traced in various gesture dictionaries, where they are simply classified as gesture (French gestures, Arabic gestures, Mediterranean gestures) due to their standardized forms and stable meanings (Payrató, 2014).

Pantomime is a gesture or a series of gestures that is performed without speech, conveying a meaning and telling some sort of a story (McNeill, 2007, p. 5). It is also used when it is impossible to speak or to be heard if there is too much ambient noise or the distance between speakers is too big. As it is disconnected from speech, there is no co-expressiveness between these two modes of communication (McNeill, 2015). In contrast to gesticulations that are purely spontaneous and unintentional, pantomime is also performed for a particular purpose and contains re-enacting elements.

Sign languages (McNeill, 1992, p. 38) are fully developed linguistic systems with grammatical and morphological patterns, lexicons and social traditions that have evolved without the necessity of accompanying speech. It is even said that, for hearing signers, speaking and producing signs at the same time might lead to disruption of both (McNeill, 2005), while for deaf signers who use speech it might also be disruptive. This is because spoken and signed languages are two independent languages with two distinct grammars and cannot be co-produced effectively at one time.

1.2.3 The iconic-metaphoric-deictic-beat quartet

McNeill & Levy (1982) and McNeill (1992) introduced a classification scheme including four categories: *iconics*; *metaphorics*; *beats*; and *deixis*. McNeill (1992, p. 16) also mentions a fifth category, cohesive gestures, that links “thematically related but temporally separated parts of the discourse” that was subsequently replaced with his theory of catchment (McNeill, 2005, p. 19). The following overview comes from McNeill (1992).

Iconic gestures (McNeill, 1992, pp. 78-79) represent concrete objects and actions and are deeply anchored in our physical experience. They refer formally and structurally to a given object or an event by means of resemblance; for example, while telling a story that involves bending a tree, the speaker grasps and bends an imaginary tree at the same time. Iconics also expose a particular point of view adopted by the speaker, who can be either an actor using the active form of the sentence or adopting the passive form.

Metaphoric gestures (McNeill, 1992, p. 80) are similar to iconic variants in their representative function. They also present an image through their shape or movement, and therefore both are labeled representational gestures (McNeill, 1992). The difference lies in the idea

they represent, viz, an abstract concept in the case of metaphors. A good example is the gesture of empty palms, symbolizing having a problem, as if this problem was sitting in your hands. In fact, McNeill (1992) associates this kind of metaphoric gesture with the CONDUIT metaphoric model pioneered by Reddy (1979), which stipulates thinking/talking about ideas as physical items and will be discussed in Section 2.2.3.1 devoted to the conceptual metaphor theory.

Deictic gestures (McNeill, 1992, p. 80), also known as pointing gestures (Efron, 1941/1972; Kendon, 2004), are pointing movements of two types: concrete deixis, referring to real objects, directions or locations; for instance, pointing at the particular book while saying “your book is over there” ; and abstract deixis, referring to abstract space (e.g., a place the speaker has been before). By deictic gestures we typically understand an index finger pointing at something, but any extensible part of the body can be used, including movements of the head, elbow, foot and even protruding lips (Kendon & Versante, 2003). The selection of a particular body part for pointing might also be related to a difference in the gesture’s meaning; for instance, Calbris (1990) discovered that using the head for pointing might appear impolite in contrast to using the hand as a designating device. Production of this gesture type is largely influenced by cultural conventions. Some cultures offer a sophisticated system of pointing. In Naples, Italy, Kendon and Versante (2003) observed six different types of hand shapes. A pointing thumb, for instance, is used when a speaker does not consider the location or the identity of the object referred to as crucial in a given conversation; in contrast, a pointing thumb changes into a pointing index finger when the location of the object gains in importance. In conclusion, McNeill (2015) proposes a slightly modified continuum that he simply calls a gesture continuum and suggests moving pointing gestures right along a continuum to the emblem slot. In this way, points and emblems can exist on their own but can also co-exist with speech. In co-speech variants, gesticulation absorbs the emblem/point category and equips it with the orchestration ability, and points and emblems offer gesticulation their metapragmatic qualities.

Finally, beats (McNeill, 1992, p. 80), also referred to as batons in Efron (1941/1972), are quick movements of the hand(s), up and down or back and forth. Their main function is to pace the speaking process and add emphasis. They are not semantically connected with the accompanying speech, and, like other gesticulations, their use in discourse can be compared to being marked with a highlighter, i.e., they draw attention to what the speaker finds important and worth emphasizing.

To sum up, it has been shown that a single gesture might be classified in various ways in the presented classification systems, according to the literature. In this connection, Maricchiolo et al. (2014) offer an outline of different gesture classifications, presenting similarities and differences, with various criteria adopted by gesture researchers (see Table 1.2).

Table 1.2

Comparison of the main different gesture classifications with reference to the labels used for gesture's general categories

Gesture categories Taxonomy's authors and taxonomic criterion/a	Cultural gestures	Gestures with referent in discourse content	Gestures co-occurring with discourse structure	Discourse-independent gestures
Ekman, Friesen (1969) – <i>Use</i> – <i>Origin</i> – <i>Coding</i>	emblems	illustrators	–	adaptors
Argyle (1975)	conventional and ritual gestures	illustrators	illustrators	gestures indicating speaker's personality
McNeill (1985, 1992) <i>Discourse collocation</i>	–	propositional (iconic, metaphoric, deictic)	non-propositional (<i>beats</i> , cohesive)	–
Kendon (1995) <i>Discourse link type</i>	conventional	substantive	pragmatic	–
Bavelas et al. (1992) <i>Verbal gesture destination</i>	–	topic and interactive	–	–
Krauss, Chen, and Chawla (1996) <i>Level of lexicalization</i>	symbolic	lexical movements	motor movements	adaptor
Maricchiolo, Gnisci, and Bonaiuto (2012) <i>Linkage to speech</i>	emblematic	ideational (iconic, metaphoric, deictic)	cohesive and rhythmic (with many sub-categories)	adaptors (person-, object-, self-adaptors)

Note: Adapted from Maricchiolo et al. (2014, p. 1465)

Bohle (2014) claims that one reason for this diversity is the impossibility of defining mutually exclusive gesture categories. Kendon (2004) also acknowledges that creating a single system is not feasible since gestures exist as dimensions, which appears to be corroborated by McNeill's (2000a) separate continua, with different signs swapping places along the continuum. The view that gestures should be approached as dimensions is advocated by McNeill (2006), who states that iconicity, metaphoricity and deixis frequently blend in the same gesture. For instance, beats are very often combined with pointing gestures, and many iconic gestures are also simultaneously deictic. A multidimensional approach to gesture has been adopted in this study. The gesture analysis and results sections (Chapter 4 and Chapter 5) will describe in greater detail examples of realizations combining multiple dimensions.

1.2.4 Recurrent gestures and various functions of gesture

McNeill's gesture classification (1992) clearly stipulates that gestures are spontaneous and idiosyncratic creations that do not display language-like properties. This atomistic point of view is challenged by numerous qualitative studies implying that it is possible to observe steady parameters in form and function among gestures (Calbris, 1990; Kendon, 2004; Ladewig, 2011; Müller et al., 2013). In this way, a singular spontaneous gesture created on the spur of the moment is differentiated from a recurrent gesture which is "used repeatedly in different contexts and its formational and semantic core remains stable across different contexts and speakers" (Ladewig, 2014a, p. 1605).

Recurrent gestures occupy a particular spot on the continuum. Cienki (2015, p. 508) places them between speech-linked gestures and gesticulations. According to his understanding, the revised 'right side' of Kendon's continuum would be presented like this:

emblems – speech-linked gestures – recurrent gestures – spontaneous gesticulation

For Parrill (2008) certain examples of recurrent gestures, for instance, the representatives of the Palm Up Open Hand, belong to the category of metaphorics. Other researchers, however, claim that allocating recurrent gestures to one position on the continuum can prove to be challenging due to a diversified degree of their conventionalisation (Kendon, 1995; Ladewig, 2011, 2014c). To illustrate it, Ladewig (2014c) offers an outline of studies in which recurrent gestures in their referential function show the lowest level of conventionalisation, as in Brookes (2001) or Ladewig (2011), as well as those studies with the examples that are said to be most conventionalised and fall into the category of emblems, e.g., Kendon (1995) or Neumann (2004). On some occasions, a particular gesture can be classified as an emblem and a recurrent gesture. A ring gesture "is an example for an emblem and a recurrent gesture, depending on its contexts-of-use and on its specific formational characteristics" (Bressem & Müller, 2014a, p. 1576).

While reviewing literature on recurrent gestures, these creations are very often labeled *pragmatic gestures* (Ladewig, 2014c). Ladewig (2014c, p. 1560) offers a convincing line of argumentation against using these expressions interchangeably. First, gestures are multifunctional and reducing recurrent gestures to only one function, a pragmatic one, is clearly narrowing their potential. They can, for instance, perform a referential role in a communicative act. Second, using the name recurrent gestures reflects the true nature of "their conventional character" (Ladewig, 2014c p. 1559). In a similar vein, Kendon (2004) defines various functions of gesture. Gestures fulfilling a *referential* role either "provide a *representation* of an aspect of the content of an utterance" (Kendon, 2004, p. 160) or "contribute to the propositional content of the utterance by *pointing* to the object of the reference (Kendon, 2004, p. 160). Kendon's pragmatic functions are defined as "the

functions gestures have as they contribute to or constitute the acts or moves accomplished by utterances” (Kendon, 2004, p. 225). These gestures operate in “any of the ways in which gestures may relate to features of an utterance’s meaning that are not a part of its referential meaning or propositional content” (Kendon, 2004, p. 158). Kendon (2004, pp. 158-159) also distinguishes three types of such functions: *performative* (presenting what kind of a ‘move’ or a speech act a speaker is involved in; e.g., rejecting, denying or asking a question), *modal* (acting on a certain unit of verbal discourse and revealing how this unit is meant to be interpreted; e.g., the OHP family gestures operating on a verbal component in a way similar to negative particles) and *parsing* (distinguishing certain structural features in spoken discourse; e.g., making something specific with the R-family gestures).

1.3 Embodiment theories forming the study’s theoretical foundations

Before the theory of embodiment was proposed, language “was seen through the Chomskyan metaphor: A sentence is a string of meaningless abstract symbols; a language is a set of such strings; and a grammar is an algorithmic method of generating such sets of strings, independent of meaning or communication or any aspect of embodiment” (Lakoff, 2012, p. 774). However, several lines of evidence suggest that human linguistic and cognitive abilities are affected by the body and its interactions with the immediate world. The embodied cognition approach refers to an array of theories stipulating that cognitive and linguistic processes are, in fact, grounded in the human body’s interactions with the surrounding environment, examples of which include Gibbs (2006), who defines embodiment as “understanding the role of an agent’s own body in its everyday, situated cognition” (p. 1). In other words, our thoughts and actions are rooted in our bodily experience. Likewise, the theory of the embodied mind (Johnson, 1992, p. 346) states that “meaning and value are grounded in the nature of our bodies and brains, and in our physical, social and cultural environments.” As a result, our linguistic and cognitive abilities are molded by our organisms and interactions with the surrounding environment (Mittelberg, 2013). Finally, Lakoff (2012) presents an overview of a neural theory for thought and language (NTTL), whose main principles are (1) our brains are used for thinking and thought is physical, distributed by neural circuitry; (2) thought is meaningful thanks to the neural circuits’ connection to the body, which determines the quality of embodied experience; and (3) language and abstract ideas are embodied in this fashion.

The embodiment theory has been explored in the research on gesture. It has been assumed that gesture production serves as compelling evidence for the belief that language and cognition are embodied. This is exemplified in the work undertaken by Hostetter & Alibali (2008) and their GSA framework, which will be discussed in Section 2.1.5. Alibali & Nathan (2012) take a step forward and argue that embodied knowledge is presented differently by various gesture types, namely (1) pointing gestures illustrate the fact that cognition is rooted in the physical world; (2) representational

gestures (iconics and metaphorics) illustrate action and perception mental simulations; and (3) some metaphoric gestures communicate bodily-anchored conceptual metaphors. To elaborate, people make pointing gestures to refer to entities that are physically present or to evoke non-present entities by making use of the physical space around them. They may, for instance, come up with locations for particular things or people within their gesture space called “placeholders” and refer to these things/people by pointing to the locations. In this way, pointing gestures ground speaking and/or thinking processes in the immediately existing environment. Similarly, representational gestures created from perception and action simulations, as in Hostetter & Alibali (2008), show that our cognition is rooted in our body. Body-based conceptual metaphors are conveyed in metaphoric gestures. This is in line with Lakoff and Johnson’s view (1980), who revealed that conceptual metaphors influence the way we perceive and understand the world, which is demonstrated through the ubiquity of conceptual metaphors in everyday language.

Mittelberg (2013, p. 755) proposes the term *exbodiment*, which means externalizing mental imagery, knowledge structures and bodily practices. During this process, as in the case of embodiment, the body serves as a channel through which abstraction and concretization processes operate. In this way, virtual physical entities are sketched or manipulated in the air to represent image-schematic patterns, geometric representations, or abstract ideas pertaining to emotions, mental states or other concepts. Gesture in the exbodiment process is a vehicle for externalizing these “cognitively entrenched patterns of experience” (Mittelberg, 2013, p. 756).

Finally, the theory of *inter-bodily co-enacting* (Cuffari & Jensen, 2014) has had a profound impact on shaping this work. Accordingly, each community is viewed as an extended ecology (Steffensen, 2011) constructed by “the inter-relation between bodies and environmental structures” (Cuffari & Jensen, 2014, p. 2020).

The ecology is not an outer frame that just surrounds or contains the individual agents, and it cannot be captured in the simple outer-inner dichotomy. Rather, the ecology emerges from the active sense-making of agents employing the physical materials and socio-cultural resources of the environment [...] (Cuffari & Jensen, 2014, p. 2021)

To put it another way, human bodies do not exist as isolated entities but co-evolve with their immediate environment. Similarly, an ecological view of cognition is shared by Jensen (2018). Following the concept of *affordances* (Gibson, 1979), viz, action possibilities offered directly by the environment, he states that making sense of the world is accomplished by actively exploring it in face-to-face interaction through “the immediate inter-bodily dynamics and possibilities for impulsive action and thought enabled by the interactive environment in the here-and-now capable of transforming the world around us into the world between us” (Jensen, 2018, p. 1).

1.3.1 Other theories contributing to the study

The rationale for this investigation is also indirectly grounded in cross-cultural gesture analyses as socio-cultural factors bear great relevance to the theory of inter-bodily co-enacting. For instance, the rationale agrees with Kendon's (2007) notion of *communication economy*. Sourced from Hymes (1974), this is defined by Kendon as a "system of interrelated communicative modalities which are balanced in relation to one another in different ways according to the various communicative circumstances typical in the culture" (Kendon, 2007, p. 5). Put differently, depending on a given culture, gesture plays a significant or more minor role in a communication process.

This study is also in line with Kita's (2009, p. 8) view that gestural variation results from *cognitive diversity* and diversified *gestural pragmatics* across cultures. Cognitive diversity relates to the fact that culture-specific cognition affects gestural patterns. This can be exemplified by varieties in gestural representation of temporal or spatial information existing in different cultural environments. Gestural pragmatics refers to cultural discrepancies in the following aspects: politeness of gesture use; gestures regulating conversation; the use of gesture space; and finally gesture rate.² The researcher illustrates each aspect with particular examples; for instance, the left-hand taboo in Ghana exemplifying the aspect of politeness (Kita & Essegbey, 2001); differences in head-nods regulating conversation for Japanese and American English speakers (Maynard, 1993); variations in gesture space between Mediterranean people and northern Europeans (Müller, 1998b); and varying gesture rates in Taiwanese and American mothers (Goldin-Meadow & Saltzman, 2000).

1.4 The study's perspective on gesture

There is a growing body of evidence suggesting that, in regard to communicating a message, an examination of gesture is of the essence. Goldin-Meadow (2016) recognizes the significance of this assertion and concedes that communication is most successful when two codes are simultaneously at work: a discrete and segmented code (speech) and an analogue and mimetic code (gesture). Kendon (2016) also postulates that "gesturing must be considered as much a part of languaging as speaking is" (p. 6x). The viewpoints represented by the two researchers differ substantially in their understanding of 'gesture.' Goldin-Meadow and Brentari (2017) advocate a much narrower gesture definition proposing a 'cataclysmic break' (Singleton, Goldin-Meadow, & McNeill, 1995) between gesture and sign. Their definition includes only spontaneous gesticulation (McNeill, 1992), excluding other forms undergoing the process of stabilization (Müller, 2017). Kendon's understanding of

² The politeness of gesture use aspect entails the gestures we produce towards an addressee. For instance, certain gestures should be avoided in amicable situations (e.g., the extended middle finger). Gestures can also regulate conversation by eliciting responses, foreground/background information or manage turn-taking. The use of gesture space aspect shows gestural differences in the position, size and plane; for instance, certain examples can take up more space than others. Finally, differences in gesture rates have been documented across cultures in ways attributed to culture-specific philosophies.

gesture is much broader. He refers to gesture as “utterance visible action” (Kendon, 2013, p. 7). In other words, any visible bodily action that serves a communicative role in an utterance is perceived as gesture. A vast range of ‘utterance visible actions’ are included in his definition (e.g., recurrent gestures, emblematic gestures and examples undergoing conventionalization, featuring gestural and sign-like qualities) (Kendon 2004, 2014) and continuity between gesture and sign is preserved. Subsequently, Kendon (2014, p. 4) decides to focus his attention on hand movements only: “And although visible bodily actions in the torso, head and face can and do play roles in what is said in an utterance, here I shall concentrate upon the way hand actions interact with what is spoken in the production of content.” In a similar vein, Müller (2018, p. 16) supports the conception of a process rather than a break in the evolution from gesture to sign: “a dynamic, continuous and ongoing process of historical change, where no cataclysmic break is involved, and no sudden rupture transforms gesture into sign from one moment to another.” This study also follows Kendon’s (2004, 2014) stand and investigates gesture across a wide spectrum. Even though the prime analysis has been narrowed down to the examples of representational gestures (Kendon, 2004; McNeill, 1992), non-representational examples (e.g., beats, presenting or pointing gestures) are also included if they show a mix of representational and non-representational features.

Such gestures use various techniques to represent entities, objects or actions, which Müller (1998a) refers to as modes of representation.³ These techniques are defined as depiction strategies in this work. Müller (2014b) suggests that the production of gestures is comparable to the creation of art images, as both processes employ visual thinking. Visual thinking also implies much more than the artist’s perception of the world; it also involves medium selection, e.g., whether a given piece is intended to be a sketch or an oil painting. Drawing a sketch, for example, entails the creation of a world using lines, whereas painting an oil requires working with paints of different colors and textures. Thus, the creation of an image of the same scenery from the same perspective can mean developing different products. Gestures use similar modes of representation as they are “conceptualizations of perceived and conceived experiences that merge visual and manual ways of thinking through and in movement” (Müller, 2014b, p. 1689). In this way, a given object might be represented by the way it moves, molding its shape, drawing its outline or part of it, its articulators embodying the thing, or placing it at a specifying location in gesture space. The selection of a particular technique, as in Müller (1998a), is not random, and the literature investigating iconic patterns in sign language and gesture presented in Section 2.3.2 corroborates this statement.

Finally, cognitive-semiotic modes, such as iconicity, metaphor and metonymy, are perceived as active ingredients of gestural sign creation and are responsible for motivating gestural meaning (Mittelberg, 2013). This thesis predominantly focuses on the involvement of the two major cognitive

³ See Section 2.3 for a detailed overview of depiction technique examples.

semiotic modes, viz, iconicity and metaphor, in the selection and creation of depiction strategies. Despite the fact that other ingredients of sign creation (e.g., metonymy or image schemas) will be acknowledged in this project, the aforementioned two modes will undergo a thorough analysis as they are the principal focus of this study.⁴ Iconicity has been suggested as playing a vital part in gestural sign formation (Mittelberg, 2014), whereas metaphor is crucial for motivating gestures as signs (Cienki & Müller, 2014). An investigation of iconicity and metaphor as the two major forces driving sign creation is not uncommon in the literature (see Brennan (1990) and Taub (2001)). The next sections focus on three elements of methodological design, stimuli, participants and research questions, to show how the project has evolved over time.

1.5 Pictures as a preferential means of eliciting gesture in this project

A picture description task was adopted to elicit gestures in this project. As in the case of cartoon description, it enables the examination of gesture patterns across various groups, such as speakers of different languages and from different cultural backgrounds (Mittelberg & Evola, 2014). A cartoon was an initial choice; however, this was abandoned, as pictures have been shown to elicit a greater number of gestures and required less demonstration time. Subsequently, a data collection task, which was a memory task, was introduced.⁵

The fact that stimuli presented in a visual form boost gesture production has been well documented in the literature. Hostetter and Alibali (2008) suggest that the global and synthetic gesture properties bear a resemblance to the global and synthetic properties of physical or mental images. Put differently, images communicate meaning in a similar fashion to gestures, expressing it globally. Synthetic properties of images and gestures are illustrated with their capacity for combining individual meanings (e.g., climbing the ladder depicted in one picture or one gesture). This isomorphism is shown in image-gesture co-existence (i.e., gestures are frequently produced when speakers convey messages invoking images). Similarly, Hostetter and Skirving (2011) reported increased representational gestures when speakers were exposed to a visual input modality. Examples of other studies using images are Masson-Carro et al. (2016) and van Nispen et al. (2017).

1.6 Participant selection

The participants were native speakers of English living in Australia, native speakers of English living in Ireland and native speakers of Polish living in Poland. They were females and males between eighteen and sixty-five years old. An adult population was selected as a substantial period of time for gestures is needed to develop language-specific differences (Özyürek et al., 2008). They were sourced with the help of two primary schools in Dublin, Trinity College Dublin, the University of

⁴ For a detailed overview of the major cognitive-semiotic principles, see Section 2.2.

⁵ A full list of stimuli is presented in Appendix I.

Warmia and Mazury in Olsztyn, Poland, and universities in Sydney, Melbourne, Adelaide, Perth, Canberra and Brisbane. All the participants were self-selecting and included school and college staff, college students and students' parents, some of whom agreed to participate in the study on the recommendation of their friends who had been recorded. As a result, a wide and well-balanced range of occupations and professions was represented in the sample across the three environments. It is also important to remember that the intention was to investigate the community's impact on a given population and not gesture types in a given profession. The final subject pool (n=87) is further divided into three communities in Chapter 3 (Section 3.2.2).

1.7 Research questions selection

The research questions to be addressed in this study are:

1. How do different semantic characteristics affect iconicity in depiction strategy selection and creation?
2. How do different communities affect iconicity in depiction strategy selection and creation?
3. What is the role of metaphor in creating depiction strategies?

Chapter 3 will discuss these questions in detail as well as signpost the relevant sections in the Literature Review.

1.8 Potential project implications

This work takes its place within the rapidly growing field of gesture studies. In setting out to analyse iconicity and metaphor in depiction strategies, it aims to contribute to an extension of our knowledge of these two cognitive-semiotic principles as well as of depiction strategies themselves. The Literature Review sections describe systematic tendencies in the selection of an iconic strategy across various semantic characteristics. Since these examples mainly relate to sign language and silent gesture, further research is needed in the field of co-speech gesture. Since gesture does not exist in isolation, moreover, it does not simply copy the gesturer's inner or outer world but cooperates in encoding and organizing experience via the processes of association and creation (Mittelberg, 2014). Furthermore, several investigations already presented in the Literature Review show cross-cultural and cross-community differences in the selection of iconic strategy (Section 2.3.3) and the cultural impact on the cognitive semiotic principles (Section 2.2.5). Therefore, this study will also shed light on how these processes are conducted across various communities and add to the growing body of cross-cultural cognition research.

This study is also designed to investigate the role of metaphor in depiction strategy creation. The Literature Review sections on metaphor show its crucial importance in gestural sign creation. Section 2.2.3.1 presents the conceptual metaphor theory (Lakoff & Johnson, 1980) specifying

the foundations of meaning creation, while Section 2.2.3 offers a diverse examination of metaphor as centered around its main types and functions in the manual modality. In these ways, this research attempts to add more insight into metaphor's involvement in creating gestures.

This project also seeks to obtain more data on gesture and speech production that will contribute to verifying the recognized frameworks. A considerable amount of the literature reviewed in the section devoted to the gesture-speech production models does not offer clear-cut answers to questions about the connection between gesture and speech or gesture production. This study attempts to address these research gaps. First, it aims to verify the gesture-as-simulated-action framework (GSA) (Hostetter & Alibali, 2008) and the notion that representational gestures arise from simulated action and perception. Whether embodied simulations emerge as gestures is contingent on three factors: the strength of the simulated action; the speaker's threshold; and the current engagement in the process of speaking. As more motor activity engages in these simulations, the prospect of the simulation resulting in an overt gesture increases (Hostetter, 2014). In addition, motor simulations are at full strength when the concepts that are spoken about are related to physical movement, with manipulability being a significant predictor of gesture production (Hostetter, 2014). It remains to be seen whether certain participants or communities exhibit a lower gesture threshold and what factors would impact it. Furthermore, an analysis will be made of whether stimuli presenting action-related referents, especially those that can be manipulated, generate more gestures than the others (e.g., referents relating to spatiality or plurality). Finally, the role of linguistic factors (Kita & Özyürek, 2003) in gesture production will be accounted for.

1.9 Thesis outline

The overall structure of the thesis takes the form of six chapters, beginning with Chapter 1, which offers a brief introduction to the study (see above).

Chapter 2 presents the relevant theoretical background that will be used as a reference source in further stages of this work. It reviews various models of gesture production and specifies the approach adopted in this study. It explores cognitive-semiotic modes as active ingredients of gestural sign creation and also discusses various depiction strategies/techniques in the manual modality, before showing systematic trends in their use.

Chapter 3 explains in detail the methodological design of the current study. First, its general aims are clarified. Second, the three research questions are introduced. Research questions 1 and 2 are centered around factors affecting depiction strategies, viz, the semantic and community impact. The semantic factors involve the various object characteristics (spatiality, animatedness, manipulability and plurality) that affect gesture production, while the community factors involve the specific community impact on gesture production, in which a community is viewed as an extended ecology (Steffensen, 2011) in line with the theory of inter-bodily co-enacting (Cuffari & Jensen, 2014)

presented in Chapter 1. Research question 3 investigates the role of metaphor in depiction strategy creation. Third, the design of the study is outlined. Fourth, the steps to analyse the extracted data are spelled out.

Chapter 4 presents the results applicable to Question 1 and 2 and the impact of semantic and community constraints on depiction strategies realized in gesture. As we will see, the findings can be considered with respect to three kinds of realizations, viz, what I call “single,” “multiple” and “simultaneous” realizations.

Chapter 5 focuses on the results applicable to Question 3 and centers around metaphor and its various functions in creating depiction strategies. The presented examples are arranged around the specific abstract concept they represent, such as size, amount, knowing/not knowing and autumn. Further examples evolve around a particular action they employ as their source domain to convey their meaning in the target domain, such as PHYSICAL QUIVERING IS EMITTING LIGHT and PHYSICAL FLUCTUATION IS MENTAL FLUCTUATION (Brennan, 1990), as in absorbing and emitting actions. This chapter also documents other metaphor functions, such as foregrounding various abstract dimensions, enriching the iconic representation with the gesturer’s epistemic stance or attitude, neutralizing semantic meaning and overriding the iconic arrangement of the stimulus.

Chapter 6 offers a summary of the main results, in addition to final comments. The results are ordered according to the three research questions. The final comments include the broader implications of the project, its possible limitations and its prospective replication opportunities.

Chapter 2: Literature Review

In this chapter, this study will be placed in the context of current manual modality research and the key terms and theories essential to comprehend the chief goals and principles driving the project will be outlined. The chapter comprises three main parts. It opens with a comprehensive overview of gesture production models (Section 2.1) followed by gestural sign creation ingredients in the form of cognitive-semiotic principles (Section 2.2). The last part presents an outline of the depiction strategy types identified in sign and gesture, their systematic patterns and multiple and simultaneous constructions (Section 2.3).

2.1 Review of gesture-speech production models

It is widely known that all speakers, including some congenitally blind speakers who have never seen anyone gesturing, produce gesture (Iverson & Goldin-Meadow, 1998). The reason for this seems to be the fact that language and gesture are related. Sweetser (2007), for instance, claims that co-linguistic gesture is neurally co-produced with language. Indeed, this close connection is supported by a considerable number of studies in cognitive neuroscience (e.g., Özyürek et al., 2007). Some researchers imply that gesture has a special role to play in language production, namely, gestures co-occurring with speech may assist in producing that speech (Kita, 2000). The bone of contention is how exactly speech and gesture are generated: whether they are part of one system or are produced by two processes closely cooperating with each other but independent to some extent. In the sections below, various gesture-speech production frameworks are discussed. Including these models in the Literature Review discussion is extremely relevant to this study, a general aim of which is to provide a deeper insight into the nature of gesture and speech creation.

2.1.1 The sketch model

De Ruiter (2000) devised his *sketch model* on the basis of Levelt's (1989) model, consisting of three modules: the conceptualizer; the formulator; and the articulator. The modular style (Levelt, 1989) suggests that an utterance is created gradually in a linear pattern. This entails completing separate modules in sequential stages. De Ruiter's modification involved adding a sequence of stages for gesture production that correspond to those advocated for speech. According to this model, speech and gesture develop in parallel but without any cooperation; these are two separate processes

coming close only at the initial conceptualization. The conceptualizer, through access to working memory, can reach both: the knowledge of generating preverbal messages; and imagistic information for creating gesture. Any information that is difficult to encode as a preverbal message is encrypted in a sketch. Subsequently, the sketch is forwarded to a gesture planner, whose task is to change it into a motor program, to allocate an appropriate body part for gesture production and to send the motor program to the motor control module. At the same time, the preverbal message is sent to the formulator. Finally, the motor program is realized as an overt gesture by the motor control, and speech is produced by the articulator. Galati & Brennan (2014, p. 437) remark that, as the speech-gesture synchrony is achieved at the conceptualizer only, at lower levels speech and gesture develop *ballistically* as they do not interact with each other.

2.1.2 The lexical gesture process model

Krauss et al. (2000) propose the *lexical gesture process model*. This model, as with De Ruiter's (2000), previously discussed approach, is derived from Levelt's model and also stipulates that the linguistic component does not influence gesture production. Gestures occur ahead of speech and facilitate lexical retrieval. In the process called "cross modal priming" (p. 13), gestures increase the words' activation and consequently facilitate their retrieval from memory. The model also specifies different gesture origins. They are not created from visuospatial imagery but from relevant spatial representations accessed from working memory and changed into a motor plan. In this way, the whole stage equivalent to a sketch generator is omitted. As regards the gesture-speech relationship, these are two different systems that can work together at two times. The first opportunity arises at the formulator's stage, during which gesture plays a significant role in assisting the progress of speech production. The second time occurs when the auditory monitor lets the motor planner know to terminate gesture; hearing a particular word being pronounced is a direct signal for gesture termination. To provide evidence for the model, the authors tested it when lexical access was more challenging (describing objects from memory) and found that the gesture frequency increased and restricting gestures reduced the speech rate (Morsella & Krauss, 2004). With respect to the model's evaluation by other researchers, it can be argued that the lexical gesture process model focuses on a speaker-oriented lexical retrieval and does not mention any communicative function (De Ruiter, 2000; Galati & Brennan, 2014). Nonetheless, its authors admit that lexical retrieval is not the sole role of co-speech gestures, since they are capable of serving multiple functions (Morsella & Krauss, 2004; 2005).

2.1.3 The interface model

Kita et al., (2007) state that in the two previously discussed models, gestures occur before speech and with no access to the linguistic component. As a result, the way a given idea is conveyed in gesture is not affected by the way the same idea is reflected in speech. In contrast, Kita & Özyürek (2003) suggest that during the process of speaking, “speakers coordinate linguistic and gestural representations in an online and interactive fashion” (p. 1233) and propose the *interface model*. The interface model has its origins in the *information packaging hypothesis* (Kita, 2000). In accordance with this hypothesis, spatio-motoric thinking that determines representational gestures supports speaking by supplying a specific manner of arranging information. Thus, gestures take part in the conceptual planning of a message. They accommodate splitting mental images into smaller parts that would be appropriate for verbalization and reduce cognitive load. Instead of attempting to convey the complicated image all at once, speakers utilize representational gestures that help to divide it into several images that can be easily conveyed in speech. As in the case of the sketch model, no coordination between speech and gesture at the lowest modules is suggested (Galati & Brennan, 2014).

Analogously to Morsella & Krauss (2004), who claim that gesture is multifunctional, Hostetter, Alibali & Kita (2007) do not negate the validity of the previously discussed models; however, they state that the information packaging hypothesis proves to offer pretty powerful evidence for its existence. Furthermore, Alibali, Kita & Young (2000) propose that gesture’s function definitely reaches beyond lexical retrieval, and, concordantly with the information packaging hypothesis, it might participate in other cognitive operations (e.g., message conceptualization). The study of Kita & Özyürek (2003) on information coordination between speech and gesture in various languages also lends support for the interface model. The gestural representations of manner and trajectory across languages show variation and similarity in line with the linguistic encoding patterns of manner and trajectory in these languages. A further example of a study supporting the information packaging hypothesis and the interface model is that of Mol & Kita (2012)

2.1.4 Growth point theory

Gestures created by *growth points* (GP) (McNeill & Duncan, 2000, p. 4) are co-expressive and synchronized with speech. Being co-expressive means that “gesture and speech cover the same idea unit” (McNeill, 2013, p. 4), in contrast with gesture mismatches in which gesture and speech convey two different meanings. These two semiotic modes might express the same idea; however, each of them undertakes a different aspect, and it is only after analysing speech and gesture together that the meaning becomes understandable (McNeill & Duncan, 2000). This also explains their non-redundancy (McNeill, 2013). Moreover, gestures in growth point theory are idiosyncratic (McNeill &

Duncan, 2000). This, in a nutshell, means they do not comply with the standards of well-formedness. Completely determined by carrying meaning, they are always created locally during the moment of speaking. This non-compliance with form creation rules and on-the-spur-of-the-moment production differentiates this type of gestures from emblems. These gestures are also global and synthetic (McNeill, 1992; McNeill, 2013; McNeill & Duncan, 2000). They are global, as their meaning is derived from their form, whereby they are undividable into separate elements; gesture's components, such as trajectory, orientation and movement, do not take on their own meanings, and the meaning of the whole gesture does not consist of several components. Finally, the growth point (GP) gestures are synthetic and not analytic; "their meanings are synthesized into one symbolic form" (McNeill, 2013, p. 5) and cannot be investigated according to e.g., syntactic rules that can be used to analyse language.

In his analysis of the sketch model and growth point theory, De Ruiter (2000) notes that "gestures and speech are part of the same communicative intention and are planned by the same process" (p. 306). He continues to observe, however, that growth point theory does not offer any explanation as to how growth points turn to gesture and speech. Without a proper theoretical basis, it is not possible to determine whether speech/gesture data support or contradict the theory. Galati & Brennan (2014) further propose that McNeill's theory does not specify how multiple constraints influence gesture production. By "multiple constraints" they mean factors affecting gesture production, such as neural or cognitive factors, or characteristics of a particular communicative situation.

2.1.5 Gesture as simulated action (GSA) framework

Hostetter and Alibali's gesture-as-simulated-action framework (GSA) (2008) provides an explanation of how representational gestures (iconic, metaphoric and deictic in McNeill (1992)) originate from an embodied cognitive system. Further research is needed to explore if this theory could also be applied to non-representational gestures (Hostetter, 2014). The theory stems from the concept of language embodiment. The authors make reference to Lakoff's (1987) concept that meaning is embodied and words are not merely abstract symbols but are related to their referents through the referents' physical or functional attributes. Thus, creating meaning entails simulating those actions. As a result, "gestures emerge from the perceptual and motor simulations that underlie embodied language and mental imagery" (Hostetter & Alibali, 2008, p. 502).

The reciprocal influence of perception and action is the focal point of the framework: perception decides potential action, and action regulates how an object or entity is perceived. There are three requirements that must be fulfilled for a simulated action to become a gesture: (1) The action stimulation must be strong enough to expand from pre-motor to motor areas and overcome

the gesture threshold, understood as “the level of activation beyond which a speaker cannot inhibit the expression of simulated actions as gestures” (Hostetter & Alibali, 2008, p. 503); (2) The height of the gesture threshold must be low enough for gesture to overcome it. This condition is related to a number of factors; for instance, the state of neural connectivity, whereby, if the connections are strong enough, a little activation is needed or, if the connections are weak, a larger activation is required. The height of the gesture threshold might also be related to a given communicative context, which speakers may bring down if they believe gesturing could facilitate their interlocutor’s understanding or increase if gesturing is not appropriate for a particular situation; and (3) The motor system must be engaged for the activity of speaking. When a given idea is to be carried across in speech, the premotor area is activated for both: activating the articulatory tract and simulating the sensorimotor part of the idea. The authors compare the activation of the motor system for speaking to the process of opening a gate: once the gate is open, premotor simulation, which is subsequently realized in gesture, squeezes in as well.

Overall, the authors of the GSA framework state that even though the model has its origin in many assumptions of the previously discussed models, its uniqueness lies in predicting a different source of gesture (i.e., gesture arising from embodied simulations). Furthermore, it proposes a more dynamic approach to gesture production, listing various interacting constraints that could potentially change instantly during the speaking process.

2.2 Cognitive-semiotic principles as ingredients of gestural sign

The section offers a short overview of cognitive-semiotic principles perceived as active ingredients in the gesture creation process. For Mittelberg (2013), cognitive-semiotic principles, such as iconicity, metaphor and metonymy, cooperate with one another to motivate and build multimodal messages. Drawing on the works of Peirce (1955, 1960) on similarity (iconicity) with the three subtypes of iconicity (image, diagram, metaphor), contiguity (indexicality) and conventionality/ habit (symbolicity), accompanied by Jakobson’s concepts of metaphor and metonymy (1956, 1960), image schemata (Lakoff & Johnson, 1980) and recent works in the cognitive semantics field, she claims that these principles could be responsible for motivating meaning and can be seen in gestures coordinated with spoken discourse. Furthermore, it needs to be re-stated that there are no separate categories of iconic or metaphoric gestures as such, but one needs to determine which cognitive-semiotic principle, amongst others interacting in a particular gestural sign, decides the sign’s local function (Mittelberg & Evola, 2014). What follows is an account of the main cognitive-semiotic modes and their examples realized in gesture.

2.2.1 Iconicity

Iconicity can be defined as the relationship between a sign and an object which is conveyed in the similarity of the sign's form to the object (Peirce, 1960). Furthermore, it is not only a case of the likeness between meaning and form but a complex process requiring conceptual effort necessary for items' mapping and schematization (Taub, 2001). Accordingly, Taub's definition of linguistic iconicity involves "the existence of structure-preserving mapping between mental models of linguistic form and meaning" (Taub, 2001, p. 39). In the subsequent sections, the theoretical foundations of iconicity, along with iconic manifestations in gesture, are presented.

2.2.1.1 Peircean semiotics as a point of departure

Peirce (1955, 1960) introduced three semiotic relationships between a sign carrier and the object it stands for: similarity (iconicity); contiguity (indexicality); and conventionality or habit (symbolicity). Predominantly, three of them contribute to sign creation. Signs are normally composed of properties of more than one relation (Ahlner & Zlatev, 2010); for instance, iconicity interacting with indexicality, as in Mittelberg & Evola (2014). Parrill & Sweetser (2004), taking up the Peircean understanding of similarity and applying it to gesture, claim that creating meaning in gesture or sign language entails iconic mapping. This mapping is understood in terms of correspondences between one item and another. Similarity is the key semiotic process underlying the mapping concept. We participate in this process when we visualize a particular hand configuration and arrive at the conclusion that the hand stands for the thing mentioned in the concomitant discourse. Taub's (2001) remark concerning the observer's role seems to be especially relevant here: similarity does not exist without an observer who draws a comparison between two entities. Thus, resemblance is not an impartial truth but an output of our cognitive abilities. When we compare two items for similarity, we undertake to establish "structure-preserving correspondences between our mental models of the two entities" (Taub, 2001, p. 36) and determine pertinent parts and various associations between the parts for each entity. Having analysed the entity structure, we seek an analogous structure in a different entity. The more correspondences we discover, the more alike we think the two entities are. As an example, the author gives ASL TREE, in which its form mirrors the appearance of a prototypical tree (see Fig. 2.1). In this way, the sign is entirely iconic with its form resembling its meaning.

Fig 2.1

The sign tree



Note: Adapted from Kaneko and Sutton-Spence (2016)

2.2.1.2 Peirce's triadic model of the sign

Peirce's triadic model of the sign offers a logical explanation of how a sign is created. The following elaboration has been sourced from Mittelberg (2008) unless stated otherwise. The model comprises a representamen: the material form a sign assumes (e.g., gestures or words); an object to which the sign refers; and an interpretant (the impression a sign arouses in its receiver's mind). Since signs indicate objects or entities external to them, a mind is required to interpret their meaning; in other words, meaning emerges as interpretants in the mind of the sign receiver. Without the mind, there is no similarity or other semiotic relations and no meaning (Mittelberg, 2014). A representamen has what is called the ground. This exhibits the denoting features of the sign vehicle, rendering other features irrelevant in a particular context. A good example is the pronunciation of a word, in which a specific mix of phonemes generates its meaning; nevertheless, the individually distinctive voice qualities of the person who utters it are an important factor in its meaning creation. It is vital that the representamen is related to the object only to some extent; otherwise, the object and the representamen would be identical and unable to be separated (Ahlner & Zlatev, 2010). The interpretant brings about other signs driving the semiotic process forward, as a result of which an endless sign circulation and distribution is ensured.

2.2.1.3 Immediate and dynamic objects

Each sign has two different types of object: immediate and dynamic (Peirce, 1960). Kockelman (2005) offers their extensive analysis. According to his interpretation, the dynamic object is "the object that determines the existence of the sign," whereas the immediate object is "the object represented by the sign" (p. 246). In other words, immediate objects arise because of the signs that stand for them, and dynamic objects are independent of the signs that represent them. On some occasions, both signs overlap. This is evident in the case of the interjection "ouch" or a face manifesting pain that might be perceived both as caused/determined by pain (as their dynamic objects) and as standing for

pain (their immediate objects). Furthermore, the connection between dynamic objects and the signs of the dynamic objects has an (iconic) indexical background, whereas the relationship between immediate objects and their signs is mainly (indexical) symbolic. Any third relation can be symbolic, indexical and iconic: a sign is partly determined by having a dynamic object and partly representing by having an immediate object. Nevertheless, a typical relation is more often symbolic and representing, rather than (iconic) indexical and determining.

In a similar vein, Mittelberg (2014) distinguishes between Peircean dynamic and immediate objects when analysing gestures. First, she stresses the fact that different objects are used in two different processes: gesture creation and interpretation. When a gestural sign is created, similarity links the sign carrier to the dynamic object. Conversely, during an interpretation activity, the similarity relation refers to the immediate object. She justifies this statement by explaining that dynamic objects are independent of any signs representing them. In contrast, during a multimodal communicative activity, the addressee has access to the immediate object only, and this is portrayed by the sign. Even if the addressee has seen/encountered the dynamic object before, all the aspects that are made prominent by this particular gesture are materialized first. Thus, misunderstanding instances may occur if the gap between the two is too big. A gesture might also not thoroughly reflect the dynamic object as it occurs in the real world; it could, for instance, reveal the way a given person brings back a certain memory or perceives an abstract category. In support of this concept, Mittelberg (2014) enlists conceptual structures such as image schemas (Johnson, 1987) and metaphors (Lakoff & Johnson, 1980) that motivate some gestures.

2.2.1.4 Various types of iconicity in gesture

Following Peirce's (1960) division of *icons* into *images*, *diagrams* and *metaphors*, Mittelberg (2014) gives a detailed overview of three types of in gesture: image iconicity; diagrammatic iconicity; and metaphor iconicity. In image iconicity icons, the body mirrors a specific body position or kinetic action, as exemplified in the gesture of an index finger representing a person's action of climbing the stairs. Amongst other examples, the researcher cites Bouvet (2001), in which a little boy impersonates a helicopter by revolving his arms and the example taken from Müller (1998b), which presents a flat hand standing for a piece of paper. Furthermore, "[d]iagrams show relations of the parts of object by analogous relations in their own parts" (e.g., territories and buildings) (Hiraga, 1994, p. 7). Different parts of the body, such as arms or hands, iconically stand for an object or an action. Hence, gestural diagrams bring to light the inner structure of a gestalt by emphasizing how its elements are linked to one another. Mittelberg (2014) provides an example of such a diagram, taken from Mittelberg & Waugh (2009), in which a professor of linguistics demonstrates the principles of noun morphology. While illustrating this with the word "teach-and-er", both his palms are positioned upwards with curled fingers. When uttering "teach," his left hand is brought up, which is followed by

his pronouncing “up” and lifting his right hand. It is worth mentioning that, apart from a diagram, metaphor contributes to the constitution of this sign, whereby a linguistic element is treated as a physical object. Finally, metaphor iconicity entails incorporeal lines, planes and volumes sketched in gesture space that might generate a representation of a person, an object or an idea. As an instance of a metaphor icon, Mittelberg (2014) describes a situation in which a professor of linguistics uses the phrase “the main verb” while simultaneously modeling a form of a small container with his palm. The iconic ground of this gestural sign manifests the particular prototypical structural features of a small container, such as a bowl; however, it does not directly indicate the main verb. It is thanks to the help of metaphor that this expression is treated like a physical item. It is in line with the conceptual metaphor in which CATEGORIES ARE CONTAINERS (Lakoff & Johnson, 1980). Metaphor icons like the one presented here are monomodal metaphors; they manifest their metaphoricity on their own, independently of speech. Accordingly, they may be contrasted with multimodal metaphors that can be expressed in gestural image icons of metaphoric linguistic expressions.

Collectively, these works outline the critical role of iconicity for sign creation and interpretation, whereby a sign is created on the basis of corresponding mappings between the mental models and linguistic forms (Taub, 2001). These mappings are not accidental; they preserve the part/whole structure of each domain and form. In this way, the form parts stand for the corresponding referent parts. This cognitive-semiotic mode also plays a crucial role in interpretation acts. That is to say, a given sign is interpreted as an immediate object, and gaps are revealed if the interpretation reveals a substantial difference between immediate and dynamic objects.

2.2.2 Metonymy

Metonymy can be defined as “a mapping of a cognitive domain, the source, onto another domain, the target,” with source and target being in the same functional domain (Barcelona, 2002, p. 246). In other words, metonymy “allows us to use one entity to stand for another” (Lakoff & Johnson, 1980, p. 36). Like metaphor, metonymy relates to two entities; however, the latter is based on a contiguity relationship between two phenomena within a single domain, whereas metaphor involves similarity between two different domains of experience (Gibbs & Ferreira, 2015).

The theoretical ground for metonymy stems from the works of two scholars, Charles Sanders Peirce and Roman Jakobson. Peirce’s understanding of similarity and contiguity were subsequently developed in Jakobson’s work (1956) on metaphor and metonymy as two different principles necessary for conceptualization processes. This in turn led Jakobson to take a closer look at contiguity and to differentiate between its two aspects: the exterior aspect (metonymy proper); and the interior aspect (synecdoche) (Jakobson & Pomorska, 1983). Wojciechowska & Juszczak (2014) stress that it was thanks to Lakoff and Johnson’s (1980) *Metaphors We Live By* that metonymy began

to be perceived as a category distinguishable from metaphor. Since then, though various scholars have contributed to the cognitive-linguistic understanding of metonymy (Barcelona, 2002; Lakoff & Turner, 1989; Mittelberg, 2006), metaphor has managed to maintain its dominance in the cognitive linguistics field (Mittelberg & Waugh, 2014; Wojciechowska & Juszczak, 2014). (See, however, Mittelberg & Waugh (2009), who show that that metonymy is essential for accessing metaphor.) In the following sections, two types of metonymy are presented, internal and external metonymy, with their gestural examples.

2.2.2.1 Internal metonymy

Internal metonymy, also known as synecdoche, is based on a contiguity relation in which a part stands for another part, a part for the whole or a whole for the part (Mittelberg & Waugh, 2014, p. 1750). The word “internal” implies that the inner structure of an object, organism or event is decomposed into parts or phases, one of which is used to stand up for the complete structure. In this way, significant features of an object, idea or action are highlighted with the use of gesture, manifesting their parts, shapes and dimensions, or any aspect a speaker might wish to emphasize. Gestures representing internal metonymy have ICON as their base term, as iconicity interacts with metonymy in their creation. Following Peirce’s (1960) classification of icons into image icons, diagrammatic icons and metaphor icons, Mittelberg & Waugh (2014) present their typology, stressing that these modes are not fixed categories but rather “interacting dynamic processes of profiling relevant features by making them stand out within complex semiotic gestalts” (p. 1751).

BODY POSTURE/BODY ACTION IMAGE ICON. In this mode, a body (part) represents a body (part) and (re)enacted bodily action represents bodily action of the same sort. This can be exemplified by body positions imitating body positions (e.g., leaning), body actions impersonating bodily actions (grasping, dancing) and hand actions portraying hand actions (waving).

BODY-/HAND-AS-OBJECT IMAGE ICON. Gestures of this type reveal the gesturer’s body or a body part representing something else, such as an object or an idea of something. Accordingly, hands can be transformed into objects, tools or people. The authors quote a number of studies from the literature to illustrate this process; for example, a flat, palm-vertical hand becomes a blade cutting an imagined fruit (Grandhi, Joue & Mittelberg, 2011), a cupped hand stands for a recipient (Mittelberg, 2008) or a flat, palm-open hand embodies a sheet of paper (Müller, 1998b).

ABSTRACT ACTION/PROCESS IMAGE ICON. These gestures foreground the action itself, whereas the items or individuals involved in it are backgrounded. They metonymically extract the core of an underlying process, such as iteration, continuation or merging.

LINE/FIGURE/PLANE/VOLUME IMAGE ICON. The gestures create lines, planes or volumes; for instance, outlining a belt as a traverse line (Calbris, 1990).

DIAGRAMMATIC ICON. These are “abstract and schematic representations that bring out the internal structure of a gestalt by highlighting the boundaries between its parts or how the elements are connected” (Mittelberg & Waugh, 2014, p. 1754).

METAPHOR ICON. The modes of internal metonymy discussed above might cooperate with metaphoric processes. These ICONS are independent of speech and demonstrate metaphorical understanding on their own. Accordingly, they can be contrasted with IMAGE ICON gestures that are used with metaphoric linguistic expressions.

2.2.2.2 External metonymy

External metonymy, on the other hand, comprises an array of outer contiguity relations, such as contact, containment, manipulation and exploration, as in “The White House remained silent,” in which “The White House” implies the American president or his spokesperson (Mittelberg & Waugh, 2014, 1754). During interaction processes, gesturers’ hands bring into being containers, surfaces or points that might represent the ideas or items being talked about. In this way, this type of metonymy not only determines sensory-motor interaction with the physical and social environment but also sustains the connection between our inner and outer self (e.g., the mind, the brain and the organs). Our hands form external contiguity relations with various items, tools or surfaces, and these relations might be accentuated, initiated or eradicated with the help of metonymic modes. The following typology comes from Mittelberg and Waugh (2014). Since indexicality is a dominant mode here, INDEX has been selected as the base term for the external metonymy principles.

AWAY FROM BODY INDEX (POINTING). These are pointing gestures originating from the relation between the pointing fingertip or palm and a target that can be concrete or abstract.

PLACING INDEX. This mode involves inventing placeholders that might help to initiate a new discourse component or assist with anaphoric reference. The placing movement is produced with one or both palms, generally with the palm down or away from the body. On some occasions, an index finger may be pointing into the space in front of the speaker, implying a point or location that represents something else (Mittelberg, 2006).

INTERACTIVE DISCOURSE INDEX (POINTING AT INTERLOCUTORS; DISCOURSE CONTENTS; COMMON GROUND). The metonymic processes here include a diversity of interactive pointing techniques. The pointing is directed towards others who are taking part in a communication process, audience, conversation contents or common ground. As an example, Mittelberg & Waugh (2014) cite Bavelas et al (1995), in whose study the authors depict general citing gestures that are made to cite an earlier addressee’s contributions to a conversation, typically made with a loose palm up. Joint knowledge or mutual experiences can be emphasized in this manner as well.

BODY PART INDEX. These gestures acquire their meaning from coming into contact with or approaching a certain body part, e.g., the head or an organ, such as the heart. By way of illustration,

the authors present a bimanual body part index pointing at the gesturer's temples, co-existing with utterance of the word "knowledge." Two cupped palms, creating a container fastened to the head, reveal external contiguous relations, first between the hands and the head, and subsequently between the head and its interior. This type of contiguity is also quite widespread in sign production in various sign languages.⁶

HAND-OBJECT INDEX (SUPPORT, CONTAINER). Gesture creation of this index entails open cupped or closed palms coming in contact with imaginary objects they support, hold or handle. The palm-up open hand, holding discourse content as if it were an object, exemplifies this metonymic principle (Müller, 2004).

HAND-TOOL INDEX (WITH/OUT IMPLIED OBJECT). This category can be distinguished from the previously discussed one by drawing attention to the fact that these gestures reflect handling a tool and performing a certain action with its use; a hand is holding a tool necessary for a particular undertaking. Hence, it can also be differentiated from **HAND-AS-TOOL ICON** in which the hand becomes an iconic representation. This can be illustrated with the slicing an apple gestures taken from Mittelberg & Waugh (2014) in which one hand pretends to be holding a chopping knife (**HAND-TOOL INDEX**) while the other imitates holding an apple (**HAND-OBJECT INDEX**). The two indices together also constitute one **BODY ACTION IMAGE ICON**.

DOUBLE HAND-OBJECT INDEX (ENCLOSING; GROUPING; SCULPTING). Gestures from this group serve indexical roles similar to those introduced above. However, the use of two palms or two fingers yields more iconic data about the shape and dimensions of the item they are grasping or the gesture space they are encompassing. In support of this, Mittelberg & Waugh (2014) present the example of a **DOUBLE HAND-OBJECT INDEX** to represent a subcategory. In the example, the speaker discusses main verbs and auxiliaries and, while saying that verbs like "have" and "will" must all belong to some subcategory, produces a bimanual gesture as if holding an object. In this way, the gesture incorporates an iconic mode via internal metonymy (**BODY ACTION IMAGE ICON**: the act of holding something) and an indexical mode through external metonymy (the relation between the hands and the adjoining imaginary object). Gestural representations of these indices might often be observed enclosing or grouping imaginary objects in space.

HAND-SURFACE INDEX (TOUCH; EXPLORATION). On some occasions, the hands are engaged in touching or moving across various surfaces to investigate their texture or to detect physical characteristics, such as bumpiness or smoothness.

HAND-TRACE INDEX (IMPACT; EFFECT; WITH/OUT RESULTING ICON). Hand movement patterns do not stand for anything but themselves and do not create iconic signs. In such cases, the highlight is to exert a sort of impact, like producing traces in the air. The indexical contiguity is

⁶ See Brennan (1990).

manifested by the relationship between the tangible articulators, e.g., hands and lines traced in gestural space. This can also be a preliminary stage of LINE IMAGE ICON creation.

MODAL INDEX (EPISTEMIC STANCE; ATTITUDE). Palm-up open hand versions indicating empty hands might serve as an instance of this indexicality type. Indeed, various kinds of expressive motion and facial expressions disclose the speaker's attitude or epistemic stance towards their words or the words of their interlocutor, such as doubt, uncertainty or obviousness. In this way, the indices described above might enrich a gestural depiction with modal functions.

EMOTIONAL/MENTAL STATE INDEX. Finally, various types of expressive motion can be prompted by emotional or mental states. Despite the fact they are similar to vocalizations, indicating, for example, surprise or impatience, gestural indices are integrated in the physical body. They emanate from inside of the body icons and refer back inwards to inform about the gesturer's disposition. Iconic and indexical metonymic relations in conjunction may, for instance, create a combined bodily representation, revealing a speaker's surprise or emotional disturbance related to something they are discussing.

Overall, Section 2.2.2 has introduced numerous studies that provide important insights into understanding metonymy, its theoretical background, metonymic relations and their significance in gestural sign creation. What particularly stands out in this review is analysis of the phenomenon from the embodied perspective, in which context metonymies "are pervasive embodied processes of association and signification, rooted in entrenched multi-sensory experiences of perceiving, interpreting and communicating" (Mittelberg & Waugh, 2014, p. 1749). Even though metonymy is not the subject of this investigation per se, its involvement cannot be ignored and, together with iconicity and metaphor, is regarded as a crucial ingredient in creating gestures. On this basis, the embodied approach to metonymy is adopted in this study.

2.2.3 Metaphor

A further indispensable component of gestural sign creation and its meaning is metaphor (Cienki & Müller, 2014). Lakoff and Johnson argue that "the essence of metaphor is understanding and experiencing one kind of thing in terms of another" (Lakoff & Johnson, 1980, p. 5). Conceptual metaphor (Lakoff & Johnson, 1980) is a point of departure for analysing metaphor and gesture in this study. Subsequently, other approaches to metaphor adopted by various scholars are also discussed.

2.2.3.1 The conceptual metaphor theory

The *conceptual metaphor* theory stems from the approach advocated by Lakoff and Johnson (1980) and their aforementioned work *Metaphors We Live By*. They propose that our conceptual system is determined by an array of conceptual metaphors that are conveyed in speech and gesture (Lakoff &

Johnson, 1980, pp. 3-4). This concept of metaphor can be defined as a mapping from the source domain to a target domain: TARGET-DOMAIN is SOURCE-DOMAIN or TARGET-DOMAIN as SOURCE-DOMAIN, with the mapping formulated by means of corresponding links between the two domains or “understanding one conceptual domain in terms of another conceptual domain” (Kövecses, 2010, p. 4). One such example is the TIME IS SPACE metaphor, in which the target domain – time being here conceptualized with regard to the source domain – is space. Others include talking about fights as wars, love as a journey, theories as buildings and organizations as plants. In short, concrete experience serves as scaffolding for denoting abstract ideas. Müller (2008b, p. 219) speculates that Lakoff and Johnson’s “primarily conceptual rather than linguistic” perception of metaphor has changed the way it is perceived by present linguists and psychologists, stating that “Lakoff and Johnson took metaphor out of the drawers of rhetoric and literary criticism where it resided for millennia, cultivated and criticized as an ornament and a delusion, and put it back into the mundane world of everyday people’s language and minds” (p. 220).

Regarding its affiliation with gesture, conceptual metaphor can be conveyed by speech and gesture at the same time, or it can be expressed through gesture only in the absence of co-existing speech (Cienki, 2008). As an example, the author presents the concept of truth and the metaphor TRUTH IS STRAIGHT with a chopping movement of the hand placed vertically and briefly maintained in this position. Occasionally, there might be discrepancies in expressing a metaphor through words and gestures. Cienki (2008, pp. 14–15) offers an example in which two conceptual metaphors conveying moral beliefs have the same target domain but vary in source domains expressed in speech and gesture:

So in speech we have a “color” metaphor, such that the stark difference between two kinds of moral behavior is likened to the visual difference between black and white. But in gesture we see a spatial metaphor, whereby the vertical hand shows the distinction between the moral categories of right and wrong as if it were a clear division separating two distinct spaces.

The researcher concludes that this concept is consonant with the fact, that gestures, in contrast to sign languages, do not have the ability to convey colors symbolically. As a result, the concept of what is right or wrong can be expressed spatio-motorically.

A sub-type of the conceptual metaphor is the *conduit metaphor*. It was first mentioned in Reddy (1979) but also discussed in Lakoff and Johnson (1980). Its two main characteristics are thinking or speaking about ideas as if they were objects and communication as transferring ideas with the help of a container. As an example, McNeill (1992) provides the conduit metaphor from his study in which an open hand metaphorically holds the concept of the “next scene” (p. 156). Other examples include IDEAS/CONCEPTS are OBJECTS, WORDS/SENTENCES are CONTAINERS and

COMMUNICATION is SENDING and RECEIVING (Alibali & Nathan, 2012). As the conduit metaphor is very often reflected through gesture, conduit gestures demonstrate discourse ideas as objects on the open palm (Cienki & Müller, 2014). These gestures present, show, give or take these objects, metonymically relating to holding them on an open hand. Metaphoric processes are manifested not only in treating abstract ideas as objects but also in their pragmatic function of performing a speech act to communicate a particular idea. In this role metaphor does not serve as a reference but motivates gestural meaning.

2.2.3.2 Orientational, ontological and structural metaphors

Lakoff and Johnson (1980) have proposed several metaphor types: *orientational*; *ontological*; and *structural*. This division is not rigid, as the authors admit that metaphors can overlap by displaying *shared entitlements* (Lakoff & Johnson, 1980, p. 93), as in the case of JOURNEY and CONTAINER metaphors. Szwedek (2000), for instance, proposes organizing these metaphor types into an inferential chain: ontological → structural → orientational.

The *orientational metaphor* “does not structure one concept in terms of another but instead organizes a whole system of concepts with respect to one another” (Lakoff & Johnson, 1980, p. 14). Consequently, “most of them have to do with spatial orientation: up-down, in-out, front-back, on-off, deep-shallow, central-peripheral” (Lakoff & Johnson, 1980, p. 14). Brennan (1990, p. 112) refers to them as the POSITIONAL set of metaphors, “where relative position in space reflects the relative status or relationship of individuals, groups and objects.” Prior studies have noted differences in spatial depictions of such mental concepts across various cultural environments. For instance, Wilcox (2000) reported that, in American culture, happiness is conceptualized as HAPPY IS UP, with ASL signs executed with an upward movement in American culture. Contrastingly, in Japanese Sign Language (JSL), happiness is believed to have a more soothing impact on the body, as is reflected in their signs incorporating a gentle sweeping downward or outward movement.

Ontological metaphors constitute a further type. Lakoff and Johnson (1980) define this grouping of metaphors in the following way:

Just as the basic experiences of human spatial orientations give rise to orientational metaphors, so our experiences with physical objects (especially our own bodies) provide the basis for an extraordinarily wide variety of ontological metaphors, that is, ways of viewing events, activities, emotions, ideas, etc., as entities and substances. (Lakoff & Johnson, 1980, p. 26)

The authors claim that these metaphors constitute the most basic tools for grasping our experience. Indeed, they are so natural and omnipresent in our thoughts that we do not think of them as metaphorical. THE MIND IS AN ENTITY is one of the most prevailing ontological metaphors

in American culture, in which the mind is seen as a physical object: it can be on or off, be broken or work efficiently, have internal parts. Another ubiquitous example is the grouping of container metaphors, whereby physical beings (e.g., humans or objects like rocks or land areas) are containers of various sizes bounded by the surface. Various sorts of containers are distinguished; for instance, the tub is a CONTAINER OBJECT, whereas water is a CONTAINER SUBSTANCE. In addition, as the authors argue, “[e]vents and actions are conceptualized metaphorically as objects, activities as substances, states as containers” (Lakoff & Johnson, 1980, p. 31).

Structural metaphors are a metaphor type that “involves structuring one kind of thing or experience in terms of another kind, but the same natural dimensions of experience are used in both (e.g., parts, stages, purposes, etc.)” (Lakoff & Johnson, 1980, p. 178). LOVE IS A JOURNEY, THE MIND IS A MACHINE, IDEAS ARE FOOD, MIND IS A CONTAINER are examples of structural metaphors. These creations are based on metaphorically induced similarity. For instance, in the IDEAS ARE FOOD metaphor, food and ideas can be digested or swallowed. They consist of ontological metaphors as sub-components and are the most metaphorically elaborate out of the three types:

Structural metaphors allow us to do much more than just orient concepts, refer to them, quantify them, etc., as we do with simple orientational and onto-logical metaphors; they allow us, in addition, to use one highly structured and clearly delineated concept to structure another. (Lakoff & Johnson, 1980, p. 61)

2.2.3.3 Expected and unexpected metaphors

McNeill (2008) identified expected and unexpected metaphors. The first type is created by cultural standards, whose counterpart is likely to be developed in speech. As expected metaphors take their origins from notions or concepts typical for a given culture, their gestural manifestations are conventional as well: since they are expected, their form and content can be roughly foreseen. They are also “conventionalized as metaphors but not as gesture forms” (McNeill, 2008, p. 12), which means that a cultural metaphor itself manifests a recurring relation of form and meaning, and it is the role of this metaphor to impose this quality on the relevant metaphoric gesture. It is also possible for some expected metaphoric gestures to be converted into gestural morphemes in the process of grammaticalization (by a morpheme, McNeill understands “a recurring form-meaning pair maintained by a linguistic culture” (p. 11)). However, it must be stated that metaphorics do not display the standards of form observed in morphemic gestures.

Unexpected metaphors display quite different traits: “this metaphoric content is fleeting, one-off, and created afresh and instantaneously, as one speaks” (McNeill, 2008, p. 157). In other words, to notice these metaphors, language must be observed from a dynamic perspective, which is, for instance, revealed in unexpected metaphors’ context dependence. Next, metaphoric gestures of this type are highly spontaneous; however, they are not random creations. They play a part in

creating discourse by linking a main idea/growth point with the rest of the discourse. In this way, they assist in maintaining coherence within the discourse and regulate speech production. Moreover, both kinds of metaphor, expected and unexpected, supply the imagery that, along with the linguistic part, constitutes growth points. Whereas, in the case of expected metaphoric gestures, the imagery is already there, furnished by culture, in the case of unexpected metaphors, when an image cannot be provided by cultural conventions, it is up to an individual to create it. Finally, McNeill (2008) draws attention to the fact that these metaphors do not arise from iconicity. It is metaphoricity that is in charge, of which iconicity constitutes a vital ingredient. The final product is an unexpected metaphor when the speaking individual “sees the image as something else” (p. 158).

2.2.3.4 Metaphors dead and alive, sleeping and waking

In her book *Metaphors Dead and Alive, Sleeping and Waking: A Dynamic View*, Cornelia Müller (2008a) challenges the traditional dichotomous view of metaphor as dead or alive and offers a less rigid and more dynamic view of metaphoricity. Her understanding of metaphor diverges from its traditional definition of the verbal metaphor: “metaphoricity is not merely a property of a linguistic item but the cognitive achievement of a speaker/writer or listener/reader” (p. 2). Put differently, metaphors are a cognitive act of a particular person that might be active for one person at a specific time and inactive for another. Her dynamic understanding of metaphors implies that dead metaphors are, in fact, not dead – they might be activated during a language use, which is why metaphors must be recognized as either sleeping (manifesting no or little activation) or waking (manifesting a great deal of activation). Following Lakoff and Johnson’s (1999) claim that metaphors emerge in different modalities, she argues that not only can metaphors manifest themselves in different modalities but they can also combine into multimodal metaphors, such as verbo-gestural or verbo-pictorial.

The activation of metaphoricity is further elaborated in the study of Müller & Tag (2010), who propose that if metaphoricity is foregrounded, it is also activated. An example of foregrounding would be verbally developing a metaphoric expression. Various degrees of metaphor activation and its unfolding in time can be detected by observing speakers in conversation. It is both an individual and interactive phenomenon as it involves cognitive, affective (experiential) and interactive aspects, with attention playing a major part. When a speaker interactively foregrounds certain information, they address it to their interlocutor. As this information is the focus of the speaker’s attention, it is also being cognitively processed at the same time. Assuming that their interlocutor is of the same opinion and considers it worth spending a while with, the process applies to them as well. The affective side of the activation is revealed by the “felt” experiences of the participants. In other words, foregrounding metaphoricity involves our embodied experience of a particular metaphor.

By contrast, the metaphor is waking when it is manifested in more than one modality (e.g., in speech and in gesture). Spontaneous gestures that go together with speech (McNeill, 1992) are thought to be involved in the process of the source domain activation. An impromptu multimodal metaphor created at a specific moment with the help of words and hand gestures is an example of activated metaphoricity. Conversely, the same metaphor used verbally without gestural manifestation or any sort of accentuation by verbal elaborations is regarded as sleeping and the activation is minimal if any. All things considered, Müller & Tag's micro-analysis of metaphors complements Müller's study (2008a) on sleeping and waking metaphors and expands it further by equipping it with the metaphor activation methodology, emphasizing the role of attention in the process of waking a metaphor.

This section has presented metaphor from various perspectives. McNeill (2008), differentiating between expected and unexpected metaphors, preserves the traditional view of metaphor as static and dynamic. Conceptual metaphors, including conduit metaphors, would belong to his category of expected metaphors. He does not exclude, however, the possibility that some metaphors can be "awakened", to use Müller's terminology, if "an expected metaphor performed in an unexpected way" (McNeill, 2008, p. 10) when some innovative alternation is applied which does not agree with the metaphor's conventional use. It must also be stressed that metaphoric gestures are not restricted only to the conduit metaphor. As Cienki (2008) notes, conduit gestures are only one category amongst other metaphoric gestures, and there is still a great deal to explore in the various types of metaphors, as well as their forms and contexts of use. In a similar vein, Cienki & Müller (2014) argue that it is unfortunate that the conduit gesture has been treated as a prototype of metaphors, while Quinn (2008) mentions an array of as yet unclassified gestural spaces falling beyond the space occupied by the conduit metaphor; for instance, gestural spaces related to marriage, in addition to marriage conceived as a container or relation. My study attempts to go beyond the conduit metaphor and identify other types and functions of metaphor.

Thus far, the Literature Review has discussed iconicity, metonymy and metaphor, viewed as cognitive-semiotic processes actively participating in gesture creation. Iconicity has been suggested to take a major part in gestural sign formation and interpretation of communicative acts (Mittelberg, 2014). To create the relationship between a sign and an object, iconicity interacts with metonymy to profile specific features of an object applying inner or outer contiguity relations (Mittelberg & Waugh, 2014). Therefore, metonymy has been seen as an inherent component of gesture (Mittelberg & Waugh, 2014). Together with metonymy, metaphor has been reported as a significant ingredient motivating gestural meaning (Cienki & Müller, 2014) and is used all the time in daily speech acts (Taub, 2001). The question remains if metaphor is always iconic and iconicity always metaphoric. Section 2.2.1.1 presented an example of a prototypical tree in the form of ASL TREE which is said to be purely iconic (Taub, 2001, p. 21). Cienki and Müller (2014) suggest that in gestures

like emblems (Efron, 1941/1972) iconicity might not be obvious any more due to their conventionalized symbolic character, however, metaphor, determining the relation between gestural form and the idea the gesture symbolically represents, can still be detected. On some occasions, the line between iconicity and metaphor is not that definite. Wilcox (2000), for instance, states that Brennan's (1990) interpretation of metaphor made unclear the distinction between iconicity and metaphor and some of her examples are "iconic not necessarily metaphoric", as in the spreading action of hands in SUN or LIGHT contrasted with MAGIC. (Wilcox, 2000, pp. 52-53). Furthermore, Taub (2001) quotes numerous ASL metaphorical signs that are created with a metaphorical mapping and an iconic mapping suggesting that ASL metaphorical signs are both iconic and metaphorical. There are, however, signs that share an iconic mapping but not a metaphorical mapping or they can share a metaphorical mapping but not an iconic mapping (for specific examples see Taub (2001, p. 113).

2.2.4 Image schemas and mimetic schemas as examples of conceptual structures

We have seen that it has been suggested that meaning arises in our mind as a result of our body interacting with the world. During these interactions, we move, exercise and experience force (Naghizadeh & Afshar, 2016). Embodied experience is regarded as a fundamental basis not only for the constitution of meaning but also for the structuring of language (Cienki, 2013). Indeed, in order to think and speak, we need some sort of underlying foundation in the form of mental representations. Zlatev (2014) claims that image schemas and mimetic schemas provide this foundation for language evolution and development. Despite the fact that these two structures are very closely connected with language and gesture, however, they display different properties and therefore are presented separately.

2.2.4.1 Image schemas

Image schemas are amongst the principal conceptual pillars in cognitive linguistics (Grady, 2005). Their notion came into existence with two publications by Johnson (1987) and Lakoff (1987). The image schema can be briefly defined as "a recurring, dynamic pattern of our perceptual interactions and motor programs that gives coherence and structure to our experience" (Johnson, 1987, p. xiv). Since the time of these seminal publications, various attempts have been made to characterize what image schemas are and to define their main characteristics. For instance, Hampe (2005, italics in original), presents an overview of image schemas sourced from the abovementioned publications of Johnson and Lakoff. According to her interpretation, image schemas are

- (1) *directly meaningful* (embodied) *preconceptual structures*, originating from bodily movements in space, perceptual interactions and object manipulation;
- (2) highly *schematic*, grasping the structural *contours* of sensory-motor experience, incorporating information from various modalities;
- (3) *continuous* and *analogue* patterns *beneath* consciousness, existing prior to and independent of other concepts; and
- (4) *internally structured* (composed of a small number of related parts) and *flexible* (undergoing transformations) *gestalts*.

Despite the exemplary effort to define and categorize image schemas presented above, they have not yielded a definitive definition. Being aware of major discrepancies in the definitions, Zlatev (2014) compiled their main qualities, along with the contradictory views of various researchers. One of the most striking issues concerns the notion of consciousness: Can image schemas be accessed consciously (Gibbs, 2005), or do they belong to cognitive unconsciousness (Lakoff & Johnson, 1999)? Next, are image schemas universal, as is commonly hypothesized, or perhaps culture-specific (Kimmel, 2005), representational (Mandler, 2005) or non-representational (Lakoff & Johnson, 1999)? These are only a few examples from Zlatev's work, all of which point to the conclusion that defining image schemas remains a controversial issue.

The image schema list has never been a closed inventory, and scholars have added new schemas over the years. The list below comes from Johnson (1987, p. 126), presented in the order listed by the author:

CONTAINER; BALANCE; COMPULSION; BLOCKAGE; COUNTERFORCE; RESTRAINT REMOVAL; ENABLEMENT; ATTRACTION; MASS-COUNT; PATH; LINK; CENTER-PERIPHERY; CYCLE; NEAR-FAR; SCALE; PART-WHOLE; MERGING; SPLITTING; FULL-EMPTY; MATCHING; SUPERIMPOSITION; ITERATION; CONTACT; PROCESS; SURFACE; OBJECT; COLLECTION.

Amongst these schemas, Johnson (1987, pp. 42–48) also distinguishes force image schemas (COMPULSION; BLOCKAGE; COUNTERFORCE; RESTRAINT REMOVAL; ENABLEMENT; ATTRACTION). These schemas refer to an experience of encountering some sort of obstacle and using force to control or overcome it.⁷

A considerable amount of literature has been published on image schemas in relation to gesture. It has commonly been assumed that these structures contribute to gestural conceptualization processes on both sides: the gesture producer's and the addressee's (Mittelberg 2014). They are also said to be a starting point for metonymic inferences (Mittelberg & Waugh, 2014)

⁷ For further additions, see, for instance, Cienki (1997), Hampe (2005) and Mittelberg (2010).

and source domains for metaphors (Cienki, 2013; Forceville, 2017). In fact, many image schemas presented by Lakoff and Johnson (1980) are reflected in conceptual metaphors; for instance, HAPPINESS is UP and SADNESS is DOWN. The exemplary studies include Cienki (2005), who presented gestural realizations of image schemas, such as CONTAINER, CYCLE and PATH. PATH, for instance, can be seen in an outstretched forearm and hand or in a hand tracing a path, while SURFACE can be shown with a flat open and tense hand, held in position or with the sweeping movement of a flat hand, as if it is tracing a surface.

One point Cienki (2013) makes in his study deserves special attention: the image-schematic origin of gesture offers some support for McNeill and Duncan's (2000) growth point, its unpacking and Slobin's thinking-for-speaking concept McNeill and Duncan (2000) follow. Gestures arising from structures provided by the schemas require less conscious effort and attention than using more sophisticated spatial images. This is compliant with McNeill's definition (1992, p. 72) of spontaneous gestures as "unwitting accompaniments of speech." As for McNeill's perception of idiosyncrasy in gesticulation, Cienki (2005, p. 438) argues that gestures may be idiosyncratic in their execution; however, "image schemas might provide common skeletal structures which underlie individuals' seemingly idiosyncratic gestures." Further investigation is needed to see if these patterns are shared across cultures.

In another major work, Mittelberg (2010) compiled a list of image schemas with corresponding gestural representations on the basis of the data recorded during university linguistics courses. Gestures in her study are treated as partial manifestations of actions and objects metaphorically alluding to abstract notions such as grammatical concepts. One example is the image schema of OBJECT and corresponding gestural patterns of Palm Up Open Hand (PUOH): "puoh – tray" (hand as flat surface, supporting imaginary objects); "puoh – cup" (hand with curled fingers, forming a receptacle); "puoh – box" ("c" represents palm facing center of gesture space); and "fist" (closed fist). A further example is CYCLE, with its gestural variants: "circle – bh" (one full cycle with both hands); "wrist rotation"; and "rotation lateral" (both hands form circles recurrently rotating around one another). In fact, the CYCLE image schema seems to provide the skeletal structure for other types of the cyclic gesture found in the literature; e.g., the cyclic gesture in German speakers (Ladewig, 2011) or the variant co-existing with the progressive aspect in English (Harrison, 2009a). Finally, Bressemer (2008) analysed image schematic manifestations in recurrent gestures amongst German speakers, concluding that image schemas can be detected in four gestural parameters: handshape; orientation; movement; and position. These can be observed in one form feature (e.g., PATH or ITERATION in movement) or as image schematic patterns of two co-occurring form features (e.g., BLOCKAGE realized with a flat hand positioned downward). Image schemas can also form clusters. A significant example would be the schema cluster of SPACE comprising the four form features: a flat hand co-existing with the palm positioned sideward (VERTICAL ORIENTATION); and a

straight movement down (PATH, VERTICAL ORIENTATION, STRAIGHT, UP-DOWN), placed in the lower gesture space (CENTER-PERIPHERY).

Regarding other sources that have contributed to the stimuli development, Antas (2013) analyses a broad range of image schematic gestural realizations in the Polish language, including DIFFERENT IS APART, UNCERTAINTY IS WAVERING and WHOLE/ALL IS A SPHERE. These examples are relevant to this study, as image schemas structure the source domain for conceptual metaphors (Gibbs, 2005), and examples of metaphorical extensions alluding to DIFFERENT or UNCERTAINTY have been found in the preliminary screening of the data. Antas (2013) distinguishes between different/contrasting ideas or concepts (*przeciwstawność*) and ideas opposing each other (*przeciwieństwo*). Different or contrasting ideas are presented at two different locations. The locations are positioned on two different sides of the body or on an up-down axis. Two notions opposing each other are displayed with two MOVEMENTS along diverging PATHS. Uncertainty and the process of choosing one alternative over the other, thus making a decision, are illustrated with the examples of body WAVERING. The instances of WAVERING hands involve wavering movements of one hand or two PUOH hands wavering inward and outward, to the left and right side, alternately. Finally, the concept of all/whole can be conveyed with the help of a SPHERE. Antas (2013) emphasizes the fact that when speakers talk about a set that is complete, they simultaneously produce a gesture depicting a sphere or an arch.

2.2.4.2 Mimetic schemas

Zlatev (2005, p. 313) defines mimetic schemas as “dynamic, concrete and preverbal representations, involving the body image, which are available to consciousness, and pre-reflectively shared in a community.” His schema theory stems from the notion of bodily mimesis and is subsequently elaborated in various publications, such as Zlatev (2005), Zlatev (2007a), Zlatev (2007b), Zlatev, Persson & Gärdenfors (2005) and Zlatev (2014). Action concepts featuring daily activities and events like EAT, SIT, KISS, HIT, PUT IN, TAKE OUT, RUN, CRAWL, FLY and FALL are classic examples of mimetic schemas (Zlatev, 2005, p. 317). According to Zlatev (2005) mimetic schemas are:

- (1) bodily: most often entailing the sense of proprioception even though the action is produced through simulation rather than enactment;
- (2) representational: activating a given schema, in real life or by imagining it, is distinguished from an object or action to which the schema is parallel;
- (3) dynamic: involving motion;
- (4) accessible to consciousness: not always referring to focal consciousness but perceptible as forms of marginal consciousness (Gurwitsch, 1964);
- (5) specific: created by drawing an inference from a specific bodily act;
- (6) pre-reflectively shared: as they originate from imitating culturally noticeable actions and objects, they are shared amongst the community members.

Despite the fact that mimetic schemas are still quite a novel idea, several studies in gesture research implicitly encourage further investigation in this direction, in particular works referring to gestures deriving from manual actions (Cienki, 2013). Mimetic schemas can also be connected with various gestural depiction techniques, such as Müller's (1998a, 2014b) acting mode of representation or Streeck's (2009) handling and mimesis (Cienki, 2013). Zlatev (2014) develops a more explicit approach towards mimetic schemas and their gestural realizations, positing that mimetic schemas, not image schemas, ground iconic gestures in development. Admittedly, bodily mimesis plays a significant part in the development of all gestures; however, only iconic gestures arise as mimetic schemas. This is especially relevant for those iconic gestures in which children enact a specific practical action. As mimetic schemas become intertwined with speech during interaction, iconic gestures cannot be treated as direct realizations of mimetic schemas but rather as "complex orchestrations of visible and audible communicative actions" (p. 22).

Overall, it has been shown that both image schemas and mimetic schemas provide some sort of pattern for gesture creation. Cienki's (2013) synopsis of image schemas and mimetic schemas in gesture seems to be particularly relevant to conclude the discussion on both schema types. He suggests that the patterns supplied by the schemas can be used as source domains for metaphors; however, the target domains of the implied metaphors seem to differ for image schemas and mimetic schemas respectively. That is to say, gestures arising from image schemas incorporate more general concepts, such as process or behavior, whereas those emerging from mimetic schemas relate to more specific notions, like negation or dismissiveness. The following sections will attempt to explore the cultural impact on a number of cognitive-semiotic principles.

2.2.5 Cultural impact on cognitive-semiotic principles

This section will discuss the cultural impact on the cognitive-semiotic principles presented above. Understanding how certain cultural environments affect these modes is crucial for this thesis as it has contributed to formulating research question 2, which investigates the community impact on representational gesture production. Subsequently, various modes affected by a cultural environment will be presented, followed by an example of favoring one principle over others in a specific cultural context.

2.2.5.1 Impact on image schemas

Although image schemas are most often assumed to be universal (Zlatev, 2014), they should not be perceived as pure abstractions functioning in cultureless contexts. An indirect reference to culture impacting image schemas can be found in Johnson's (2005, pp. 27–31) declaration about "putting

flesh on image-schematic skeletons.” What he wishes to emphasize is the fact that image schemas are “recurring patterns of organism-environment interactions” relying on “how our brains work, what our physiology is like, and the kinds of environments we inhabit” (Johnson, 2005, p. 31). If image schemas are patterns of our bodies interacting with a given environment, it could be hypothesized that culture developed in this environment determines these patterns.

Kimmel (2005) offers even more support for image schemata’s cultural reliance, whose socio-cultural approach advocates approaching these structures as compound image schemas and situated image schemas. The first of these types refers to an investigation of how several primitive schemas group into compounds determined by a specific context (e.g., any complex posture reveals simultaneous presence of compound images schemas – a STRAIGHT spine, arms in BALANCE, a chest as a CONTAINER). These compounds are stored and evoked as complex image-schematic gestalts. The other approach proposes looking at schemas as situated image schemas whose acquisition and use is influenced by the aspects of cultural (or natural) environments. As a result, situation-adaptive subvariants of generic image schemas emerge. By binding compound and situated schemas with socio-cultural contexts, Kimmel (2005, p. 288) attempts to return “qualitative flesh and blood to our image-schematic skeletons.”

2.2.5.2 Impact on mimetic schemas

Regarding mimetic schemas and instances of mimetic patterns, it has already been argued that the former originate from an imitation of culture-specific practical actions (Zlatev, 2005, 2007a, 2007b, 2014) and emerge as iconic gestures (Zlatev, 2014). A further convincing illustration is Calbris’s (1990) study, who claims that mimetic gestures are bound by convention as they reflect certain cultural practices. In other words, the way the features of a reference object are selected and converted, to be subsequently represented in gesture, is culture-related. In her book *Elements of Meaning in Gesture*, Calbris (2011) discusses the relationship between our everyday experience and forms of gestural expression, providing examples of how gesture can represent our physical reality in different ways and referring to “our knowledge of physico-cultural interactions” (p. 11). This physico-cultural knowledge is necessary for creating gestural representation, as it provides us with the capability to find links of contiguity or similarity and to make inferences about the physical world. Depending on the above-mentioned knowledge, miming entails a process of abstraction that determines which salient feature of an action, object or person is selected for their representation and how it is going to be performed, e.g., a movement type or body part selection. In other words, one distinctive feature evokes the whole entity; e.g., describing an animal according to the way it moves. Furthermore, a given movement might represent not only a particular action in progress but also its result, such as encircling something or a circular form emphasizing the result. Finally, through variations in quality movement (speed, strength or size) and integrating gesture’s physical elements

in different ways, we can create different meanings. Overall, it is the link of contiguity or resemblance between our experience and a salient gesture feature that decides on the conveying of a specific meaning.

2.2.5.3 Impact on iconicity

The existence of culture-reliant iconic patterns in gesture has been documented in the literature. For instance, Mittelberg (2014) acknowledges the fact that even though iconic gestures are spontaneous creations, conventionality or habit exert influence upon gestural repertoires disguised as movement patterns, action schemas or socio-culturally molded behaviours. She also mentions prototypes (Rosch, 1977), which serve as cultural models in both sign creation and interpretation. According to Rosch (2011, p. 99), “people form and use an idea and/or image of the category that represents the category to them, and which is more like (or more easily generates) the good than the poorer examples of the category.” A very good example is the “bird” prototype. This representation frequently acts as a reference point used by people when they are engaged in activities pertaining to this category; for instance, determining if a particular item is a member of the category. Regarding the prototypical examples in cross-cultural gesture analysis, Fricke (2014) points out that a given gesture can be object-related and depict the very object of reference or interpretant-related and portray a prototype. By way of illustration, the prototype of the German word “Tor”, meaning “entrance to the building,” is arc-shaped, not rectangular (Fricke, 2012). In fact, it is the speaker’s decision to select between these two alternatives.

2.2.5.4 Impact on metaphor

Cultural communities affecting metaphor can be illustrated by manifestations of conceptual metaphor across various cultural contexts. When a conceptual metaphor functions at a very general level, it might be almost universal (Kövecses, 2004). Kövecses, 2004) exemplifies this with THE ANGRY PERSON IS A PRESSURIZED CONTAINER. At this stage, the metaphor serves as a generic schema and does not indicate much (i.e., what sort of container is used or what substance is inside, be it liquid or objects). This generic schema becomes much more specific when it becomes utilized by a particular environment. Everyone has access to bodily experience that allows them to create universal metaphors; however, this universal bodily foundation is not exploited in the same fashion or to the same degree in various languages/cultures. In other words, different peoples might respond differently to various aspects of their functioning body in relation to the target domain of the conceptual metaphor. For instance, in English, the ANGER IS HEAT metaphor is prevalent, whereas in Chinese the anger metaphor relies on pressure. Furthermore, the substance exerting pressure on the container is “gas” in Chinese and “fluid” in English, which clearly indicates that the speakers residing in these two cultures engage different aspects of their physiology for anger conceptualization. On

some occasions, conceptual metaphors differ in the source domains that some languages and cultures utilize to conceptualize target domains (Kövecses, 2004). This is exemplified by the conceptualization of life itself, which can be differently conceived as STRUGGLE/WAR, JOURNEY or POSSESSION by Americans and Hungarians and further perceived as A STRING that can be cut or broken among some Thai speakers.

Other works that point to the cultural impact on metaphor include Alibali & Nathan (2012), Núñez & Sweetser (2006) and Forceville (2017). Alibali & Nathan (2012) claim that even though conceptual metaphors take their origins from common human experience, such as everyday actions or bodily experiences, they are also motivated by social and cultural factors. Núñez & Sweetser (2006) focus on the particular example of the conceptual metaphor of time. The linguistic and gestural data they collected indicate that an everyday concept such as time, which is universally grounded in our bodily experience, can be molded in a particular fashion and subsequently produce cultural variability: the Aymara spatial construals of time.

2.3 Depiction strategies as a means of representing mental images

Iconicity can be seen in various depiction strategies implemented by gesture. In fact, if all the strategies or modes of representations were implemented to depict the same object, each of them would point to a different type of iconic ground and consequently foreground different object features (Mittelberg, 2014). Consequently, different modalities display various capabilities for generating certain ground types: they may describe or abstract some qualities more easily and adequately than others. Hwang et al. (2017) propose that these iconic strategies show the potential to create patterns, in which different strategies seem to depict different categories of related entities. They refer to the phenomenon as patterned iconicity. Patterned iconicity is “made up of iconic strategies grouped together to form distinct patterns that are consistently used by gesturers and signers” (Hwang et al., 2017, p. 557). In the section that follows, examples of such recurrent patterns are presented in various depiction strategy typologies. First, arguments for including studies on depiction techniques in sign language and silent gesture are given, followed by example depiction strategy classifications in sign language, silent gesture and co-speech gesture.

2.3.1 Sign language and silent gesture research

The rationale for including the research on representation strategies in signed language and silent gesture stems from two arguments. First, all iconic manual depictions to some degree employ similar techniques to portray visual features of a given physical referent (Ortega & Özyürek, 2019a). Since numerous studies have attempted to unravel iconic patterns in signed language and silent gesture, Ortega & Özyürek, (2019a)’s findings could have significant implications for detecting existing

patterning in co-speech gesture. Second, much of the current literature shows a link between signed language and gesture. For instance, in Ortega, Schiefner and Özyürek (2019), the researchers state that (silent) gestures display systematic forms across participants for some concepts and share a varied proportion of overlap in form with signs for the same concepts. These iconic gestures are referred to as “manual cognates” that assist in the first exposure to a signed language. It is also speculated that corresponding forms in sign and gesture could be accounted for by the fact that signers and gesturers have access to the same conceptual substrate that is embedded in their interactions with the world. The theory of iconic silent gestures as “manual cognates” was also demonstrated in Ortega, Özyürek and Peeters (2019), whose findings show that hearing non-signers lean on their gestural knowledge at their first exposure to signs. It remains to be seen if further similarities are detected among various manual systems of communication.

2.3.2 Depiction techniques in sign language, silent and co-speech gesture

Thus far, several studies have explored recurring patterns used to create iconic strategies for depiction. In regard to sign language and silent gesture, different categories have been proposed. Padden et al. (2013), for instance, enumerate handling (the hand is shaped as if grasping an invisible tool or moves as if it was using the tool), instrument (the hand depicts features of an object employing a tool-related movement simultaneously), object (the hand depicts the shape and dimensions of an object with no action), tracing (the hand outlines the object’s shape or dimensions), touch (the hand touches or comes close to the area of the body where the item is normally located) and body part (holding up a body part where an object is normally located, e.g. gloves). A further notable classification is presented by Hwang et al. (2017), whose authors include MANIPULATION (the body stands for the body of a human agent and an arm stands for the arm of a human agent that manipulates the referent) that can in turn be split into HANDLING (the hand shows how a tool is manipulated) and INSTRUMENT (the hand profiles the shape of the tool). They also add the OBJECT strategy (the hand depicts the size and shape of the body with no representation of human action) and PERSONIFICATION (the hand depicts the size and shape of non-human animate entity specific parts via mapping the body of a non-human entity onto the human body).

Regarding examples of depiction techniques in gesture, Kendon (2004) delineates modeling, enactment and depiction, Sowa (2006) proposes his computational model for the representation and processing of shape, and Streeck (2009) puts forward his notion of depicting and “ceiving” gesture categories. Further exemplary studies investigating the phenomenon include Sowa and Wachsmuth (2009), Hassemer and Winter (2016), Kopp, Tepper and Cassell (2004), Masson-Carro et al. (2016) and Hwang et al. (2017). Of the described techniques, Müller’s (1998a, 2008b) modes of representation (acting, molding, drawing and representing) have provided a solid base for analysing iconic strategies for many contemporary researchers.

The following outline of the four modes comes from Müller et al. (2013). In the acting mode, the hands “mime or re-enact actual manual activities” (p. 712). The authors give examples of grabbing, giving and receiving, to cite just a few. In the molding mode, the hands form “a transient sculpture, such as a frame or a bowl” (p. 712). In the drawing/tracing mode, the hands “outline the contours of objects or they trace the path of movements in space” (p. 712). Finally, in the representing mode, the hand “embodies an object as a whole and becomes itself a kind of “manual sculpture”” (p. 712). In this way, one object can be differently portrayed with the use of gestures, as different speakers use various means of gestural depiction, with each mode stressing different qualities. Molding, for instance, emphasizes the physicality of a given object, whereas drawing condenses it via sketching its contours.

Cienki & Müller (2014) make a distinction between gestures made with the help of acting/molding/drawing and representing modes. Gestures formed by acting, molding or drawing are created by means of metonymic processes when a part represents a whole, whereas those arising via representation differ from the previous group, as their creation involves metaphor as the main cognitive-semiotic process. In this case, the hand is metaphorically transformed into an imaginary entity or manoeuvres in the air to convey the characteristics of an imaginary process. In short, in the first group, gestures are motivated by contiguity and metonymic processes; and in the second by similarity and metaphor. On some occasions, metonymy is joined by metaphor in the process called *metaphtonymy* (Goossens, 1990). To exemplify this interaction Cienki & Müller (2014) present the same example of acting out opening a window. Internal metonymy is manifested here by the action scheme of opening the window and contiguity relation is shown to a window handle, but the handle is only surmised, in other words, metaphorically implied. Subsequently, the four modes are reduced to two, acting and representing, with molding and drawing falling into the acting mode (Müller, 2014b).

To conclude this section, the literature identifies various strategies used to encode iconic form in the manual modality. In fact, close parallels could be drawn between certain strategies carrying different labels that are employed in sign and gesture depiction (see Ortega & Özyürek, 2019a), bringing these forms of communication even closer. The section below describes main patterns in selecting a depiction strategy in sign language and silent gesture.

2.3.3 Systematicity in depiction strategy selection in sign language and silent gesture

An examination of patterning in other forms of communication in the manual modality is crucial for this study, as this could predict how co-speech gestures form analogies between their conceptual representations and diverse configurations of the body (Ortega & Özyürek, 2019a). In general, it has been demonstrated that non-signers use more handling forms than signers, while signers use more instrument forms than silent gesturers (Padden et al., 2013). Similarly, in Padden et al. (2015),

gesturers clearly favored the handling strategy in both conditions (pictures of tools and video vignettes of actions with the same tools), while signers preferred the instrument forms. However, while depicting actions, the signers were more likely to opt out of producing more handling forms, and the gesturers generated more instrument forms describing pictures and more handling gestures depicting actions. Furthermore, different types of depictive strategies were employed to differentiate between actions and objects and the type of input modality employed, whether pictures or videos. Overall, this study highlighted the fact that gesturers and signers can alternate between strategies, depending on the stimuli used.

The concept that the selection of an iconic strategy is determined by stimuli has been replicated in other studies. Hwang et al. (2017) investigated recurring patterns across eight sign languages and in the silent gestures of American non-signers, during which systematic iconic patterns emerged across signs and gestures. Across all groups, the MANIPULATION strategy was favored for tools, PERSONIFICATION for animals and OBJECT forms for fruit and vegetables. In Ortega and Özyürek (2019a), the analysis involved Dutch silent gesturers. Acting (90%) was the main strategy for actions with objects, actions without objects and manipulable objects; acting (53%) and drawing (29%) were preferred for nonmanipulable objects; and personification (50%) followed by representing (30%) for animate entities. The acting mode was the most favored (70.64% of all concepts), followed by representing (14.67%), drawing (8.25%) and personification (6.42%). Overall, the results corroborated the concept of affordances (Gibson, 1979), which can be described as actions permitted by various items (e.g., a doorknob can be grasped, a key can be turned). The findings further indicated that acting is applied only if the referent permits it; in other words, the referent itself is an action or an object that can be manipulated with hands. When the referent displays low manual affordances, gesturers select other representation techniques; for instance, drawing for nonmanipulable objects that do not exhibit clear characteristics as to how they could be handled. What is more, the researchers imply that drawing could be a better alternative in connection with speech where speech provides a referent's label and gestural drawing gives information about the referent's shape. Representing examples that accounted for less than 15% of all silent gestures were hypothesized to display conventional manual structures with emblem-like characteristics (Kendon, 2004). The study results related to representation, in line with other studies (Padden et al., 2013), suggest that this technique could be implemented as a starting point for creating object representation in sign languages (Kendon, 2008). Finally, animate entities, in contrast to other groups that favored acting, employed personification succeeded by representing.

A strong preference for acting in silent gesture has been also observed cross-culturally. Ortega and Özyürek (2019b), in their investigation of silent gestures in Dutch and Mexican speakers, found in the single-gesture representation that both groups favored acting for actions with objects and manipulable items. For non-manipulable objects, a balance in depiction strategies was observed

for the Mexican participants, whereas the Dutch opted for the drawing mode. Representing was again the least favored strategy for both groups. It can be generalized that despite the different linguistic and cultural contexts, the Dutch and Mexican participants displayed a clear bias towards the acting mode to portray actions and manipulable objects. When referents did not allow to employ manipulating with hands, as in the previous studies, gestures favored a different strategy; for instance, drawing, for a large proportion of the Dutch.

Taken together, the studies reviewed in this section provide substantial evidence for systematicity in the depicting strategy selection in sign and silent gesture. A strong inclination towards producing gestures depicting embodied actions is in evidence. Furthermore, signers and gesturers seem to favor different iconic modes across semantic categories to depict a referent. It must be stressed that it is the referent's natural affordances that determine the choice of a strategy. The next section moves on to explore systematicity in co-speech gesture.

2.3.4 Systematicity in depiction strategy selection in co-speech gesture

Turning now to co-speech gesture, we can note that several studies have investigated systematic patterns in iconic strategies and how object affordances (Gibson, 1979) affect gesture production. First, it has been detected that speakers gesture more with high-affordance objects than low-affordance objects (Chu & Kita, 2016; Hostetter, 2014; Masson-Carro et al., 2016). Second, a connection has been established between a depiction strategy, also referred to as a representation technique, and object features. We can draw on two studies to corroborate this. First, Masson-Carro et al. (2016) examined imitating, molding, tracing, portraying (Müller, 1998a) and placing in Dutch speakers, stating that theirs was the first study to methodically demonstrate links between object features and representation techniques in spontaneous gesture. They drew the following conclusions:

- (1) high-affordance objects were predominantly represented by the imitating strategy (handling);
- (2) molding and placing gestures were produced with low-affordance objects;
- (3) high-affordance objects elicited more gestures than low-affordance ones;
- (4) a different simulation type could be involved in molding gesture production (i.e., simulations of touching as in haptic perception (Lederman & Klatzky, 1987)); and
- (5) tracing and portraying strategies arose at such a low frequency that they did not reveal any informative differences (this finding raises a question about generating tracing and portrayal (representing) gestures)).

In the second study (Masson-Carro, Goudbeek, & Krahmer, 2017), the researchers analysed iconic creations in Dutch speakers across two input modalities: words and pictures. In addition, they introduced a task in which speakers could name an object or not to measure task complexity. They revealed the following results:

- (1) molding and handling gestures were predominant;
- (2) speakers generated more gestures in a picture condition than in a word condition;
- (3) when naming was permitted, specific patterns emerged – more handling gestures were produced in the word condition than in the picture condition, and more molding gestures were executed in the picture condition than in the word condition; and
- (4) when the task complexity was boosted by denying access to naming objects, the patterns vanished.

Overall, it seems that speakers alternate between existing iconic strategies and select a strategy that seems to satisfy the task's demands.

2.3.5 Multiple and simultaneous realizations

Single, multiple and simultaneous realizations highlight differences in gesture production. The definitions below encompass the discrepancies between these various realization types that will be analysed in Chapter 4. These definitions are followed by the theoretical background justifying the taking of various realization types into consideration.

Single realization is understood in this work as a gesture stroke that forms the very core of a gestural unit referred to as “nucleus” by Kendon (2004, p. 124). When there is more than one stroke, realizations are annotated in both ways. The strokes are included as one realization if they form a sequence of strokes happening very fast one after the other and/or they differ in one parameter (e.g., orientation). Strokes are generally described as two separate realizations if they are divided by a considerable time period, refer to different concepts or their forms vary substantially.

Multiple realizations are gestures depicting a referent using more than one depiction strategy in separate gestural specimens produced by the same speaker. In other words, a particular entity or item can be recreated in gesture in various ways; for instance, by profiling its shape (molding), the participant's hand/fingers becoming the thing itself (portrayal) or by manipulating the item in a specific way (handling).

2.3.5.1 Multiple realizations: theoretical background

A relation between single and multiple gestures and a specific strategy has been reported. For instance, Ortega and Özyürek (2016) conducted a study on gestural strategies in silent gesture among Dutch participants, in which they split gestures according to the following categories: acting; representing; drawing (including Müller's (2014b) drawing and molding); and deictic. Even though deictic gestures are not a mode of representation, they were included as a category due to their high frequency in the dataset. The researchers found that actions with tools triggered mostly single gestures presenting action execution. Manipulable objects (e.g., a lighter) were mainly represented with more than one gesture, and non-manipulable objects were almost equally presented with single

and multiple gestures. Actions with objects and manipulable objects were mostly used in the acting mode, whereas non-manipulable objects deployed the drawing strategy. Finally, actions with objects and non-manipulable objects elicited a low percentage of deictics, whereas manipulable objects represented a remarkably bigger proportion.

In another study, Ortega and Özyürek (2019b) analysed silent gestures produced by Dutch and Mexican participants. The researchers observed that multiple gestures were produced, particularly in object depiction. In both groups, the preferred combination for actions was acting + representing and for manipulable and non-manipulable objects, drawing + acting. Actions with objects were more likely to be represented by single gestures employing the acting strategy. Furthermore, deictic creations accompanied a large proportion of gestures representing manipulable objects and a small proportion of gestures referring to actions and non-manipulable objects. A feasible explanation for such multi-gesture combinations was the fact that a single gesture could result in misinterpretation, so participants supplied more details to lessen the chances of creating ambiguity. The second part of their study involved concept-guessing, in which the authors found that single gestures in an acting mode were most accurately interpreted, whereas gestures representing manipulable and non-manipulable objects yielded less accuracy. Multiple manipulable and non-manipulable-object gestures also rendered more accurate interpretations than single ones. There was a tendency to interpret gestures as actions (verbs) rather than objects (nouns), which was appropriate for actions with objects but not for manipulable objects. Deictic and multiple gestures aided participants to interpret them as objects in the manipulable objects category. Contrastingly, gestures in the drawing mode (non-manipulable objects) were significantly more accurately interpreted as objects, and the multiple gestures did not contribute greatly to their interpretation. Accordingly, these findings would seem to suggest that drawing carries such an enormous semantic weight that it enforces the referent being seen as an object. Finally, the fact that the results were relevant to both groups makes these patterns generalizable across the two cultural contexts.

2.3.5.2 Simultaneous realizations: theoretical background

Miller (1994) presents various simultaneous strategies that have been identified as occurring in signed languages. Leeson and Saeed (2012, p. 193) present the following overview:⁸

1. Two hands producing two different lexical items simultaneously;
2. Preservation of one sign on one hand while the second hand articulates a series of other signs;
3. Production of the “topic” on one hand while the “comment” is articulated on the second hand;

⁸ This draws on Vermeerbergen, Leeson and Crasborn (2007).

4. Placing a sign articulated on the dominant hand on or in relation to an enumeration morpheme, which is expressed by the non-dominant hand (referred as a “listing” strategy);
5. One hand represents the locative position of one argument while the second hand represents the relative locative position of the second argument.

Inspired by Miller’s (1994) division and Talmy’s work (1996), Leeson and Saeed (2012) propose a theory regarding simultaneity in ISL. The foregrounded entities are signed on the dominant hand, whereas the backgrounded items are signed on the non-dominant hand. In sign language, simultaneous constructions typically exist with location verbs specifically in contexts when there is a spatial relationship between two entities (Leeson & Saeed, 2012). One entity is usually selected as the most salient and consequently portrayed by the dominant hand, whereas the less important one is executed on the non-dominant hand. Frequently, the less prominent backgrounded entity is introduced as a topic first, and subsequently the spatial relation is depicted. To illustrate this, the researchers present an example taken from Leeson (2001, p. 108) of a car going under a bridge. First, the bridge is executed on the dominant hand, after which the relationship between the car and the bridge is presented: the dynamic item, the car, is signed on the dominant hand; and the static item, the bridge, is depicted on the non-dominant hand. Overall, the dominant hand executes the more animate part, whereas the non-dominant hand executes the less animate part. The signer’s decision regarding what information is foregrounded and backgrounded is motivated by iconicity, and the arrangement of entities in the real world that is iconically recreated in the signing space. Finally, such foregrounding and backgrounding is also concordant with the figure and the ground theory (Talmy, 1978).

The non-dominant hand that participates in scene depiction frequently remains static. It can be speculated that this hand serves as an anchor for the other hand that is involved in movement. Such practices are observed in signed languages and is referred to as *buoys* (Liddell, 2003, p. 223). These signs, acting as conceptual landmarks and assisting in discourse management, are typically executed with the weak hand. They include list buoys, theme buoys, fragment buoys and pointer buoys.

List buoys mark mental connections with ordered and unordered collections of entities, whose handshapes are comparable to the handshapes of numeral signs. They are usually placed ahead of the chest with fingers oriented to the side, more horizontally rather than vertically, and can be touched or tapped.

Theme buoys indicate that a significant theme is being communicated. They are normally generated by an index finger held vertically, while the strong hand performs one or more signs. In ISL, they fulfil two functions: (1) they announce and establish some elements in discourse; and (2) they introduce new information where new referents are communicated through one-handed signs. In addition, and in contrast to some other sign languages, theme buoys in ISL can be maintained

across the following two-handed sign, provided that the phonology of the two-handed sign is not compromised (Leeson & Saeed, 2012).

Fragment buoys are produced when a one-handed sign follows a two-handed sign. In such cases, the weak hand is reported to perseverate into the following one-handed sign (Liddell & Johnson, 1989). Leeson and Saeed (2012) suggest that dispersing information on the strong and weak hand provides direct insight into embodiment: the signer's angle on foregrounding and backgrounding material. As a result, fragment buoys often portray body parts such as hands, paws or antlers. Frequently, the referent is not the body part for which the buoy stands but an implied object that relates to it, normally introduced in the prior discourse. The researchers present an example where a fragment buoy is the signer's arm and the implied referent is the invisible hosepipe. Another example from this publication is a placeholder which, via the action of holding, induces the image of the intended glass jar. In ISL, fragment buoys may maintain a two-handed sign on one hand, or a one-handed sign may be executed on the non-dominant hand and backgrounded.

List buoys, theme buoys and fragment buoys blend with the discourse entities and turn into their visible instantiations. In contrast to the previously discussed, pointer buoys point to significant discourse elements and the arrangement of entities in the real world that is iconically executed on the non-dominant hand. With this buoy type, the weak hand does not evolve into this particular entity via blending but simply gesturally points at it. Frequently the less prominent backgrounded entity is introduced as a topic first and subsequently the spatial relation is depicted. To illustrate it, the researchers present an example taken from Leeson (2001, p. 108) of a car going under a bridge. There are also cases in which the strong hand executes a depicting verb, and the weak hand executes BROAD-SURFACE L1↓. BROAD-SURFACE L1↓ stays in the same place while other signs are generated by the dominant hand. Since the sign created by the weak hand has the potential to exist *in situ* depicting a broad surface, it can be referred to as a depicting buoy (Liddell, 2003, p. 263).

Last but not least, Nilsson (2007) offers a further division of simultaneity devices inspired by Liddell (2003a), whose categories include, for example, mirroring, doubling and sign fragments. These categories used for sign language have been adapted for this study and will be further discussed subsequently. Mirroring is the term used for signs when the non-dominant hand "mirrors" the sign articulated on the dominant hand (Nilsson, 2007, p. 10). Frequently, the non-dominant hand assumes the same handshape and orientation as the dominant hand. It can even engage in the same movement; however, it is executed at a slightly lower position (Nilsson, 2007). Doubling creations (Nilsson, 2007, p. 11) are signs that are one-handed in citation form but articulated with both hands engaged in the same movement at the same height. It seems possible that several realizations display comparable characteristics. Sign fragments (Nilsson, 2007, p. 11) are examples of perseveration, in which the non-dominant hand has participated in the articulation of a two-handed sign and then holds the same position, while the dominant hand proceeds to generate signs.

Overall, this chapter has displayed the relevant theoretical background that has contributed to the development of the research questions in this thesis. It has begun with an overview of gesture production models, followed by a presentation of cognitive-semiotic principles as indispensable ingredients of sign creation. Next, exemplars of depiction strategies in a manual modality have been reviewed, with examples of systematic patterns of strategies in the manual modality. Finally, differences between single, multiple and simultaneous realizations have been clarified. Chapter 3 will introduce the methodological design of the project and the coding system used to generate the results in Chapters 4 and 5.

Chapter 3: Experimental design

In this chapter we give an account of how we carried out our research. First, the research questions are re-stated and signposted to the relevant sections in the Literature Review. Second, the design of the study is introduced including settings, participants, stimuli, procedure. Third, analysis and coding steps are presented. Fourth, calculating inter-rater agreement is described.

3.1 Research Questions

The research questions to be addressed in this study are:

1. How do different semantic characteristics affect iconicity in depiction strategy selection and creation?
2. How do different communities affect iconicity in depiction strategy selection and creation?
3. What is the role of metaphor in creating depiction strategies?

The rationale for developing each question is discussed below along with instances of signposting the research questions to the relevant sections in the supporting literature. Regarding the first question, several studies have reported a link between object properties and depiction strategy selection; however, very little is known about the nature of this relationship, especially in co-speech gesture. Section 2.5.1.2 presents systematic patterns in depiction strategy selection in sign language and silent gesture whereas Section 2.5.2 describes systematicity in depiction strategy selection in co-speech gesture.

The second research question arises from analysing community/cultural impact on depiction strategies in gesture. It has been primarily inspired by Wilcox (2000, p. 35).

Thus we come to understand cultural and linguistic abstractions by way of preconceptual structures that are meaningful in a physical way. These conceptual patterns are not individual innate conceptions; they are culturally influenced by the interaction of the people surrounding us.

The existing literature has highlighted examples of the cultural impact on image schemas (Section 2.2.5.1), mimetic schemas (Section 2.2.4.2), metaphor (Section 2.2.5.4). As these cognitive-semiotic principles take an active part in gesture production, the way they are affected by different communities cannot be ignored. Furthermore Section 2.5.1.2 on systematicity in depiction strategy selection in sign language and silent gesture has shown specific cultural variations. Also, Section 1.8 mentions various linguistic constraints on gesture production. Although investigating the impact of

linguistic factors on gesture (Kita & Özyürek, 2003) is not the primary aim of this study, the existence of language constraints will be acknowledged as they could affect gesture patterning in a specific language community. Finally, the third research question draws on metaphor, the conceptual metaphor theory and metaphor types (Lakoff & Johnson, 1980) presented in the Literature Review (Section 2.2.3). It attempts to uncover and systematize metaphor's involvement in representational gesture production.

3.2 Design of the study

The study comprises, a data collection project, which is a memory task. The way the project has been envisaged and changed was explained in Chapter 1. Gestural examples from Australian, Irish, and Polish speakers are extracted from video data comprising face-to-face and Skype picture description sessions. Ethics approval for the study was granted on 30th July, 2015 from the School of Linguistics, Speech and Communication Sciences Research Ethics Committee (see Appendix VI and Appendix VII for a copy of the approval confirmation).

3.2.1. Settings

The primary locations were classrooms and staff offices in schools and colleges in Dublin and Olsztyn, Poland. The Australian participants in Australia were recorded via Skype in their colleges, cafes and their homes between 2015 and 2020. Site visits were always arranged according to Lone Researcher Guidelines.⁹ The room in which a recording session took place had adequate lighting facilities to ensure a high quality of recording and excellent hand visibility. It was also located away from the external noise with windows and doors closed. The size of the room was sufficiently spacious enough to contain three chairs: one for the participant, other for the researcher, and finally one for positioning facing the laptop computer with the video camera. The adequate distance between the participant and the computer was preserved to enable the recording of the participant from their knees up.

3.2.2 Participants

As it was mentioned in Chapter 1, the participants were native speakers of English living in Australia, native speakers of English living in Ireland and native speakers of Polish living in Poland. An adult population was selected as it takes a substantial period of time for gestures to develop language-specific differences (Özyürek et al., 2008). All participants were self-selecting and included school and

⁹ See https://www.tcd.ie/slscs/assets/documents/research/ethics/SLSCS_Lone_Researcher_Guidelines.pdf

college staff, college students, and students' parents. Some participants agreed to participate in the study on the recommendation of their friends who had been recorded. As a result, the range of occupations and professions represented in the sample was wide and well-balanced across the three environments. It is important to remember that the intention was to investigate the community's impact on a given population, and not gesture types in a given profession.

The participants (n=87) were recorded on an individual basis. See the table below for a breakdown across communities.

Table 3.1

Participant breakdown across the three communities

Participants	Numbers
Australian	26
Irish	27
Polish	34 (in Polish) 21 (in Polish and English)

3.2.3 Stimuli

A picture description task was used to elicit gestures in this study. A set of pictures was compiled according to the information packaging hypothesis (Kita, 2000), Kita & Ozyürek (2003), de Ruiter (2000) and the GSA framework (Hostetter & Alibali, 2008) (see Appendix I). As it was already shown in Section 2.1, the information packaging hypothesis stipulates those gestures assist in organising spatio-motoric knowledge into units that can be verbalized. They parse mental images into smaller pieces more suitable for linear speaking. It is also predicted that during conveying spatial information that is not organized or parsed, speakers are expected to produce gestures in order to prepare it for speech (Hostetter et al., 2007). The GSA model emphasizes the importance of physical action. There are two action types that could result in gesture production. The first one relates to the situation in which the speaker imagines that he/she performs a particular action (e.g., hammering). The other one involves the speaker imagining a given object in motion (e.g., a swinging pendulum (Hostetter, 2014)). These actions trigger embodied simulations, with the first type more likely to lead to gesture since the same neural circuitry is engaged in performing the action. In short, the GSA framework emphasizes the importance of physical action and, as a result, action properties are more likely to generate gesture than spatial properties, whereas other theories (e.g., Kita & Ozyürek (2003), de

Ruiter (2000)) suggest a broader gesture origin in which any spatial or motor property is predicted to give rise to gesture (Hostetter, 2014).

The images for gesture elicitation were selected according to specific semantic characteristics. Semantic characteristics compiling various object properties are not equivalent to semantic fields. Semantic characteristics of a message denote “the extent to which the message evokes thoughts of spatial or motor properties” (Hostetter, 2014, p. 1). Examples of semantic characteristics are manipulability and spatiality (Hostetter, 2014). Semantic fields whose “starting point is the sign’s content or meaning” contain semantic features and “the semantic features shared by all lexical items define the semantic field and delineate it from other fields” (Fricke, Bressemer, & Müller, 2014, p. 1632). An instantiation of a semantic field is the field of negation. The most common forms of negation expressed through the use of our body are a head shake, wagging of the index finger, and Open Hand Prone family members (Bressemer & Müller, 2014b; Calbris, 1990; Harrison, 2009a, 2013; Harrison & Larrivière, 2016; Kendon, 2004). Bressemer and Müller (2014b, p. 1603) document the emergence of the negation field analysing the family of away gestures. Accordingly, gestures arranged around a shared semantic theme of ‘excluding’ employ basic actions of clearing off body space or keeping away/removing unwanted items. In this way, simple physical actions are employed to convey concepts such as rejecting topics of talk or removing annoying invisible objects and thus contribute to the embodied approach towards gestural meaning creation.

The images used for elicitation were sourced from Google Images and grouped according to the following semantic characteristics: spatiality, animatedness, manipulability, plurality. Iconic spatiality has been inspired by Hostetter (2014, p. 5) and her understanding of a noun that could be described in terms of a particular size and shape. These features were recognized as its dominant features; for an example, the researcher offered a globe and the way it can be depicted as round and spherical. The stimuli contained two referents that were intended to trigger simulations of touching as in (see Masson-Carro et al. (2016)), and molding gestures were predicted to exceed other gesture types.

Iconic animatedness refers to a dimension describing a noun moving on its own and in its own particular way (Hostetter, 2014, p. 5). This particular movement is seen as its dominant characteristic. A representative example is a ceiling fan spinning in circles (Hostetter, 2014, p. 5). Two such referents were used: excavator and shark. The excavator was predicted to move its claw up and down as if extracting soil, while the shark was predicted to chase the swimmer also presented in the photo. If the swimmer was depicted in relation to the shark, its form was annotated as well.

Iconic manipulability group includes nouns that could be touched, held or used, whose dominant feature was the distinct way they were manipulated (Hostetter, 2014, p. 5). This is exemplified by scissors and the way they are used to cut items (Hostetter, 2014, p. 5). Two such

referents were analysed. In line with GSA theory (Hostetter & Alibali, 2008) and Hostetter (2014), these referents were anticipated to have generated the largest number of gestural realizations.

The analysis of this group of referents hinges on prior studies investigating the concept of plurality in sign language. Börstell, Lepic and Belsitzman (2016, p. 15) argue that semantic plurality can be represented by the use of an iconic strategy, “articulatory plurality,” that entails “recruiting multiple articulators to represent (relationships among) multiple referents.” Subtypes of articulatory plurality involve plural articulation; e.g., reduplication, plural places of articulation and plural articulators. Lepic, Börstell, Belsitzman and Sandler (2016) report that some two-handed signs embrace Figure/Ground relationships, as in Talmy (1978); for instance, NEAR in ASL, ISL and SSL, in which the non-dominant hand is static and the dominant hand lessens the distance from the non-dominant hand. In other signs, two hands stand for multiple component elements or the perimeter of a normally symmetrical form. The researchers speculate that such concepts exhibit some sort of inherent plurality. This is exemplified in ASL/ISL/SSL BICYCLE and HOUSE. Using two hands for such signs is motivated by the fact that humans have only two hands rather than because they relate to two entities. Furthermore, employing two hands instead of one is “an iconic representation of the notion of ‘more than one’” (Lepic et al., 2016, pp. 25–26). To sum up, they predict that four relationship types motivate two-handed signs: interaction; location; dimension; and composition.

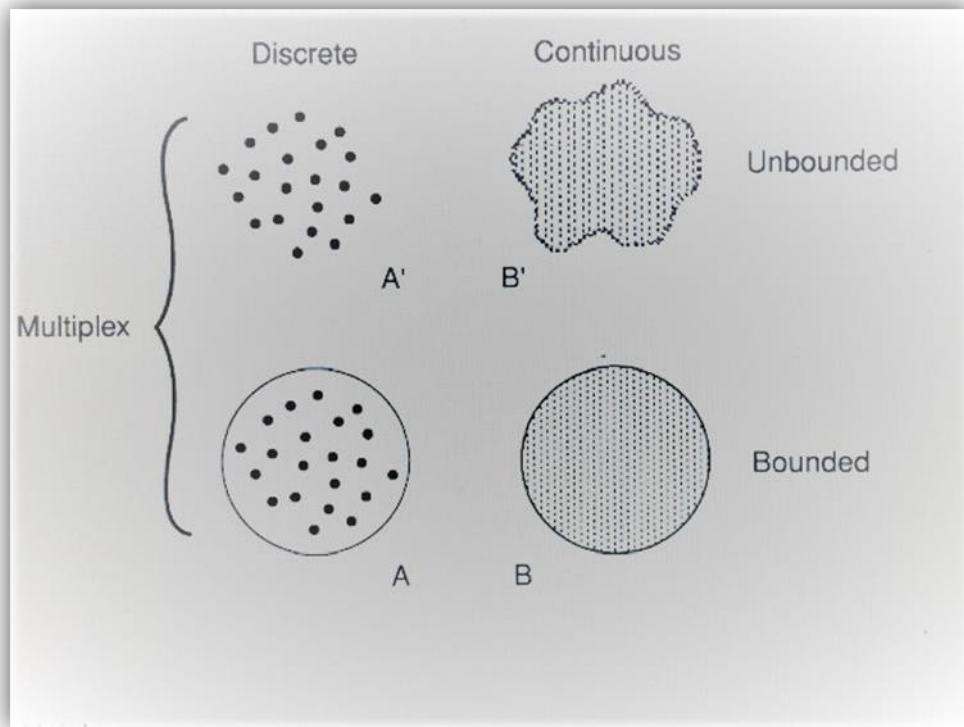
- (a) Interaction: Paired, interacting entities are mapped onto each of the two hands.
 - (b) Location: Paired entities and their locations are mapped onto each of the two hands.
 - (c) Dimension: Boundaries of an entity's shape/volume are mapped onto the two hands.
 - (d) Composition: Component parts of an entity are mapped onto the two hands.
- (Lepic et al., 2016, p. 15)

Last, analysing iconic plurality was also motivated by Langacker (2008) and Talmy (2000) and their understanding of bounded spaces. An item “is bounded in a straightforward sense of having a discernible boundary” (Langacker, 2008, p. 136). In an abstract way, an item “is bounded when there is some limit to the set of constitutive entities... a set of interconnected entities, grouped and reified to form a unitary entity for higher-level cognitive purposes...” (Langacker, 2008, p. 136 italics in original). One of his examples refers to the spatial boundary encompassing a contiguous collection of individual organisms or items (Langacker, 2008, p. 139). Such a collection is the outcome of a mental operation called “conceptual grouping.” The operation utilises spatial contiguity that does not have to be actual but virtual; a herd of cattle, for instance, can be visualized as a spatially adjacent, virtually bounded entity.

A quantity might be discrete or continuous (see Figure 3.1). A quantity is composite or (internally) discrete if it is conceptualized as having breaks, or interruptions, through its composition; otherwise, the quantity is conceptualized as (internally) continuous (Talmy, 2000, p. 54).

Fig. 3.1

Quantity schematisation



Note: Adapted from Talmy (2000, p. 59).

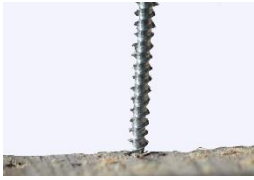
To sum up, Table 3.3 provides the breakdown of various semantic characteristics with the allocated referents and examples of visuals.¹⁰

Table 3.2

Breakdown of semantic characteristics with example stimuli

Semantic characteristic	Referents	Example stimuli
Spatiality	coffee pot, path	 Path
Animatedness	excavator, shark	

¹⁰ A full list of the stimuli is presented in Appendix I.

		
		Excavator
Manipulability	lightsabers, screw	
		Screw
Plurality	leaves, crowds, worms	
		Crowds

3.2.4 Procedure

The procedure section provides an overview of the methodological design steps used to collect the project data. First, the pre-recording arrangements are briefly introduced. Second, the recording sessions are described.

3.2.4.1 Pre-recording arrangements

Principals and heads of schools and faculties were initially contacted by email to introduce the study and to request access to participants. A copy of the participant information leaflet and the consent form can be found in Appendix II and Appendix III. After a period of between three and seven days, the principal/head of school was contacted again for an answer. The participants were contacted by email and given a copy of the participant information leaflet and the consent form. After three to seven days, they were contacted again, and an interview date and time for those who were still interested was arranged.

Prior to the recording, the participants signed the consent form. The participants in Australia either signed the consent form and emailed it back or sent an email to the researcher's university address stating that they had read the consent form and agreed to participate in the study. This option was proposed by the researcher and approved by the School's Research Ethics Committee to facilitate participation in the project. Next, the participants answered the questions about their language background (see Appendix IV), which related to the participants' gender, handedness, age,

profession, spoken languages and visits to other countries. These contributed important information on the participants' linguistic and cultural background and might be helpful in establishing common gestural tendencies (e.g., in females versus males or monolinguals versus multilinguals). For Question 8, the respondents' proficiency in other languages, the interlocutor/researcher helped them to decide using the assessment grid (see Appendix V). They were also told they were participating in a memory task and should try to tell the interlocutor/researcher as many details as possible. The literature shows that people gesture more when they see their interlocutor and when they believe that their gestures assist their discourse partner (Alibali, Heath & Myers, 2001).

The participants were recorded on an individual basis. Australian and Irish participants were recorded once, while Polish participants were recorded twice in Polish and English during two separate meetings. They had the option to decline being recorded in English if they did not feel confident being recorded in a second language. The second recording took place after a period of time not shorter than five days, which was arranged to prevent two languages being simultaneously active. Brown (2008) and Brown & Gullberg (2008), for instance, recommend at least a three-day break before the appointments. Nagpal, Nicoladis & Marentette (2011) also recommend separating two sessions by at least a week. The order of language was also counterbalanced across Polish participants, as in many studies recording speakers with more than one language (e.g., Nicoladis, Pika, Yin, and Marentette (2007); Schrauf (2009); Nagpal et al. (2011)). The number 1 was put next to the participant's code when the participant was recorded in English, as in QQQ1, while those participants who were recorded in English first had the letter c next to their code, as in AAAAAA1c, for counterbalanced. As the Australian participants were recorded on Skype, some Polish participants were recorded on Skype as well to counterbalance this condition (see Table 3.3).¹¹

Table 3.3

Breakdown of participants across language and Skype conditions

Participants	Skype condition	Language counterbalanced condition
Australian	26	n/a
Polish	6	4

3.2.4.2 Recording sessions

Each session lasted for approximately twenty minutes. The participant sat on a chair, so they were visible on the computer screen from their knees up. Most participants were sitting, with some

¹¹ Table 3.3 presents the data that were included for analysis. It does not include participants who participated in the project and did not produce any gesture or recordings that were excluded for technical reasons (e.g., poor visibility).

exceptions (e.g., Participant RRRRR AP was standing as it was more beneficial for his spine). Only the gestures that were not affected by the standing position were included. The computer was located on a chair next to the interlocutor. The interlocutor/researcher sat on the chair opposite the participant and presented the pictures. The participants recorded on Skype were told to sit close to their computer/phone so the interlocutor/researcher could see them from their knees up. Each photo was shown for five seconds and subsequently withdrawn. The participant described a picture from memory. This approach was justified by the fact that the number of representational gestures increases in descriptions of spatial data when speakers describe them from memory, rather than when they look at them and describe them simultaneously (Morsella & Krauss, 2004). The participants were also asked to state if there was any relation between them and the photo. This question was added to encourage participants to talk about their personal experiences related to a particular picture and elicit more gestural examples. The gesture-boosting factors did not compromise the study as the intention was to focus on gestural form and not to measure the gesture rate. There was no time limit on the length of describing each picture, and it was the participant's decision to finish describing a visual and proceed to the next one. The sessions were recorded directly on the researcher's laptop computer using Movie Maker, Skype and Evaer. The participants had not been aware that gestures were the primary focus of investigation. After the recording session, each participant was debriefed about the gesture analysis.

3.3 Analysis

This section presents the steps that were taken to select gestural examples for further analysis and coding procedures.

3.3.1 Selecting for coding

Only hand co-speech representational gestures (Kendon, 2004; McNeill, 1992) that depict the aspects of objects or actions to which they refer were considered. Non-representational gestures (e.g., beats) were included when they showed features of both, viz representational and non-representational gestures, in line with McNeill's (2005) perception of gestures as dimensions rather than separate categories. Subsequently, entities consistently represented by co-speech representational gestures were selected from the recording output. Short clips were cut out of video and arranged according to the relevant referent. In this way, the gestural realizations were compiled for further analysis.

Focusing on certain gesture types and limiting the scope for further analysis has been documented in other studies. In her investigation of gesture viewpoint in Japanese and English,

Brown (2008), for instance, singled out four motion events from the stimulus material that were depicted by participants. Bressemer and Müller (2014a) focused on investigating recurrent gestures with pragmatic functions and excluded forms with deictic and concrete referential functions. Bressemer, Stein, and Wegener (2015) selected one particular type of pragmatic gesture, the holding away gesture, and Harrison (2009a, 2009b, 2013) researched gestural negation instances.

3.3.2 Establishing units of analysis

In line with Kendon's (1972, 1980) theory of gesture units and gesture phrases, this coding system assumes that gestures display a phrasal structure that can be decomposed. A gesture unit is the interval from the moment the articulators move from the resting position to the moment they move back to the same position of relaxation. It is the largest structure in Kendon's hierarchy, which he calls "an entire excursion" (Kendon, 2004, p. 111). Each gesture unit also consists of gesture phases such as rest position, preparation, stroke, hold and retraction (Kendon, 1972, 1980). The stroke phase is thought to be the most significant as it normally bears gestural meaning, forms nucleus of gestural units (Kendon, 2004) and co-exists with the most relevant segment of verbal articulation (McNeill, 1992). "The gesture phrase always and only contains but one *stroke*, but it also contains any *preparation* that leads to the stroke, as just mentioned, any period that follows in which the gesture instrument (hands or head, for example) is *held* or otherwise maintained in the position it reaches at the end of the stroke (Kendon, 2004, p. 112). These two levels, gesture units and gesture phrases, lay a foundation for all the annotations in the study.

3.3.2.1 Coding gesture phases

Defining gesture phases was performed in line with Kita, van Gijn, and van der Hulst (1998) and the segmentation procedure referred to as the frame-by-frame marking procedure by Seyfeddinipur (2006). The procedure entails identifying onsets and offsets of gesture phases with the help of the video image quality; the image of the hand is blurred when it is in motion and becomes clear when it reaches a standstill. The author distinguishes three varieties of transitions in a gestural movement: (1) transition from a dynamic to a static phase; (2) transition from a static to a dynamic phase; and (3) transition from a dynamic to a dynamic phase. These transitions determine the allocation of different parts of gestural movement to the appropriate gesture phases.

Transition from a dynamic to a static stage

A dynamic phase ends when the hand reaches a standstill and the image is clear again. The first frame presenting a clear image is regarded as the last phase of the dynamic phase, and the next frame is regarded as the first frame of the static phase.

Transition from a static to a dynamic phase

The first frame in which a movement is observed is regarded as the first frame of the dynamic phase. This movement does not include slight drifting that can occur in holds – on some occasions a slight motion occurs; however, the real acceleration follows subsequently. The video image becoming blurry is the real indicator as to when the next phase begins, and the blurred frame is annotated as the first frame of the new phase.

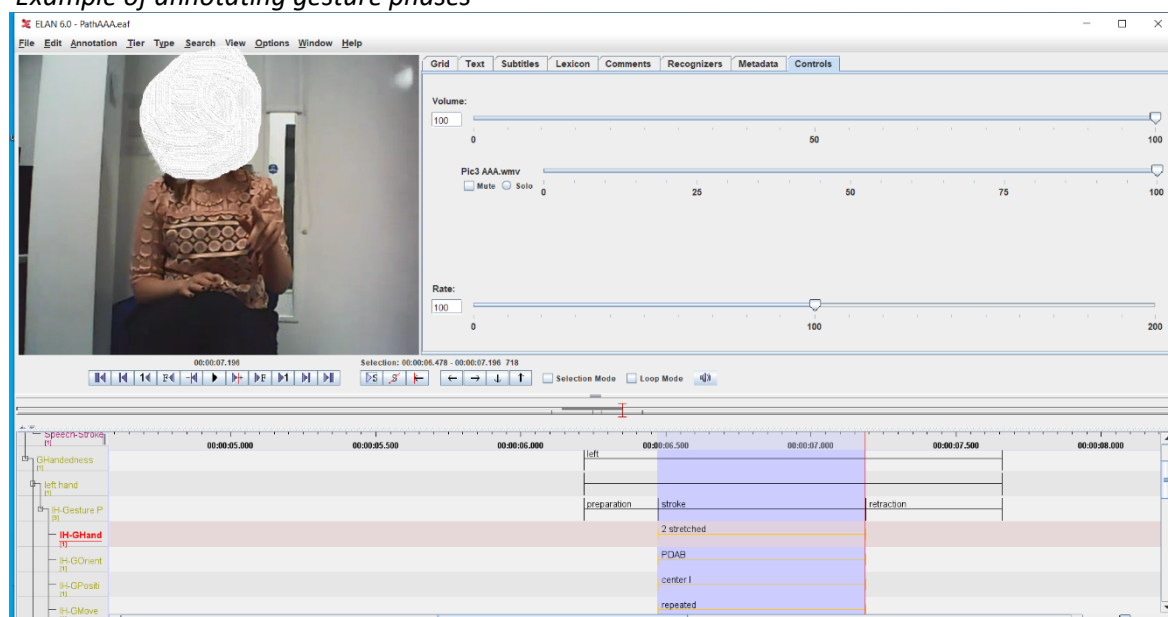
Transition from a dynamic to a dynamic phase

This transition entails a change in the movement direction or velocity. The hand slows down significantly and/or comes to a halt. This change is regarded as the last frame of the existing dynamic phase. The next frame where the change in the movement direction or velocity can be detected is regarded as the first frame of the new phase.

Following the selection of static and dynamic phases in the gestural movement, gesture phases were identified. Figure 3.2 presents an example of annotating gesture phases. The subsequent gesture phases were distinguished: preparation; hold; stroke; retraction; partial retraction; and rest position. Their definitions below are in line with Seyfeddinipur (2006) unless stated otherwise.

Fig. 3.2

Example of annotating gesture phases



Preparation

Preparation can be described as “a movement of the hands to a location from where a stroke was deployed, for example, the hand moved from the rest position (lap) up to chest height” (Seyfeddinipur, 2006, p. 107). During this movement, the hand developed a specific configuration; for instance, all the fingers were bent, the hand was clenched into a fist, and the palm pointed

downward. Preparations can occur between two strokes or as two preparation phases in succession; for example, the hand ascended to chest height and stopped, before rising to forehead height where the stroke was initiated, after which the hand proceeded rapidly to the right. The phase was identified as preparation if this particular movement was performed in order to enable execution of another phase, as in Ladewig & Bressemer (2013).

Hold

A phase was referred to as a hold when “the hand/s were held in a static position other than the rest position” (Seyfeddinipur, 2006, p. 107). This phase can exist independently but generally it extends the scope of the stroke by preceding or following it (Ladewig & Bressemer, 2013). A pre-stroke hold “is a period in which the gesture waits for speech to establish cohesion, so that the stroke co-occurs with the co-expressive portion of speech” (Kita, van Gijn, & van der Hulst, 1998, p. 26). A post-stroke hold is “a way to temporarily extend a single movement stroke so that the stroke and the post-stroke hold together will synchronize with the co-expressive portion of speech” (Kita et al., 1998, p. 26). It could involve a slight drifting movement with no changes in velocity. In those instances when the change in the movement velocity occurs, with a direction altering distinctively, the hand could come to a stop for a single frame. Such a movement was not coded as a hold as it was thought to be a by-product of the velocity/direction change rather than an actively formed phase.

Stroke

The stroke is a phase that exhibits “the meaning of gesture” (Seyfeddinipur, 2006, p. 107) concordant with Kendon(1972) and McNeill (1992). It forms the very core of a gestural unit referred to as a *nucleus* by Kendon(2004). This is the only phase characterized by the occurrence of multiple direction changes (e.g., a zigzag line) or continuous direction changes (e.g., a circle). The stroke generally displays a clearly expressed hand configuration and well-executed movement, which is why it is described as the phrase that “is supposed to be more forceful compared to its neighbouring phases” (Kita et al., 1998, p. 32).

Movements that were performed repeatedly were depicted in two ways. These movements that were symmetrical and consistent in trajectory, velocity and configuration, thus forming a single expressive unit, were coded as a single stroke (e.g., hammering). Analogously, the movements that were repetitions of a single expressive unit (e.g., repeatedly tracing the outline of a room) were treated as a single stroke. These repeated movements that varied in trajectory and velocity were coded as a series of preparations and strokes. If the configuration was changing from relaxed to more precisely articulated, the movements were also segmented and coded as preparations and strokes.

Sequences of movements (e.g., up-and-down and back-and-forth movements) were coded in two ways. The movement was segmented into the preparation and stroke if they were clearly discernible as a preparatory and more articulate phase. If the distinction was not possible due to a

high velocity or a too short length of space covered, the whole movement was coded as a single stroke.

When there was more than one stroke, they were annotated in both ways, either belonging to one annotation, or else two separate annotations were created. They were included in one annotation if they formed a sequence of strokes happening very fast one after the other and/or they differed in one parameter (e.g., movement). Strokes were generally described with two separate annotations where they were divided by a considerable time period, referred to different concepts or their forms varied substantially. On some occasions, a stroke phase was noted on the gesture phases tiers, but its form and speech tiers were not annotated. Such strokes were left out as they were not the subject of investigation but preceded or followed the analysed stroke(s).

Retraction

This phase was characterized by the hands moving back to the rest position (e.g., the lap, the armrests, arms folded in front of the chest). On some occasions retraction was not “full” but partial. The partial retraction was a phase in which the hands were moving towards the rest position; however, they halted in the intermediate position before the rest position was reached. This movement was controlled by muscular relaxation and was not a directed activity. A phase was also classified as a partial retraction if a well-articulated hand configuration of the former stroke became less tense or hands moved from the configuration but stayed in the air and did not come back to the rest position. Movements such as self-adaptors (e.g., self-touching behaviours) or object manipulation (e.g., fidgeting with a pen) were also classified as part of the retraction phase.

Rest position

A rest position was regarded as a default condition, following Ladewig & Bressemer (2013), since its most prominent characteristic is a state of muscular relaxation of hands and arms. Therefore, the condition acted as a point of reference to determine the presence or absence of tension in the upper limbs.

3.3.2.2 Coding gestural form

The depiction of gestural form was the next step. The description of gestures by applying the four parameters was performed according to the notational system for coverbal gestures by Bressemer (2008a, 2013). As Ortega and Özyürek (2019a) have pointed out, a perfect annotation system does not exist, and this system also has its limitations. It does not record all the structural and kinematic features and some articulators; for instance, shoulders or arms are not depicted. However, it offers an adequate description of gestural form that does not rely on lengthy paraphrasing or is not speech-/text-dependent. It also allows for precision in gestural notation and eliminates long descriptive phrases. Furthermore, this system facilitates coding gestures with the sound turned off. It has been developed from the assumptions underpinning the “four-feature-scheme” (Becker, 2008) that

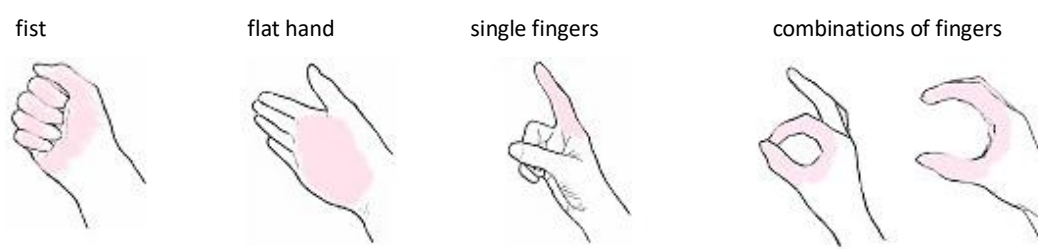
advocates describing gestures according to the four parameters of sign language: hand shape; orientation; movement; and position. Excluding any of these parameters could cause the omission of a meaningful realization. All the necessary steps for notating the four parameters in line with Bressem (2008a, 2013) are provided below.

Hand shape

The system commences with the notation of hand shape, as it postulates that hand shapes are the most prominent gestural form features. Description of the hand configuration entails following three stages: an allocation of the handshape to one of four categories or its categorization as a configuration consisting of both hands; numbering all fingers; and indicating the shape of the digit. The hand shape comprises four categories: (1) fist; (2) flat hand; (3) single fingers; and (4) combinations of fingers (Figure 3.3).

Figure 3.3

Basic categories of hand configuration

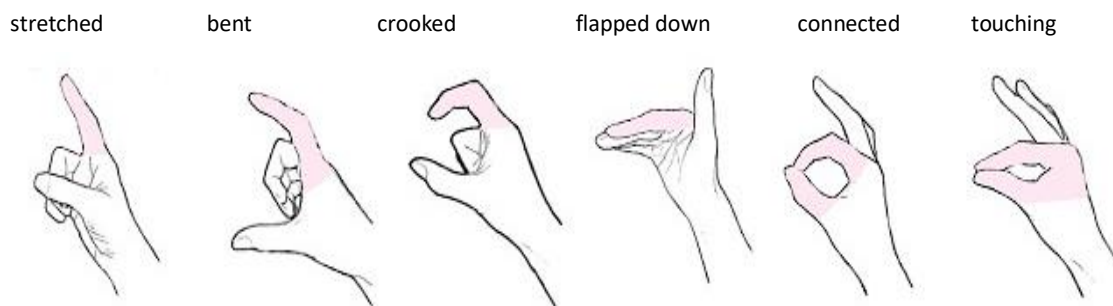


Note: Adapted from Bressem (2008a).

Category differentiation has been developed from the notion that all of the categories display different principal features determining the hand shape. For instance, in the flat hand category, the palm assumes control over the shape of the whole configuration. In the combinations of fingers category, the fingers along with the palm decide on the hand configuration jointly. Thus, in the description of the hand shape, the hand configuration was described according to its most prominent feature: whether the hand was forming a fist; the palm was the most discernible feature of the configuration; single fingers decided on its configuration; or combinations of fingers determined the hand shape. The next step involves numbering all fingers, from 1 (thumb) to 5 (little finger). Following the identification and numbering of fingers, their form is depicted according to six different shapes. A digit can be (a) stretched, (b) bent, (c) crooked, d) flapped down, (e) connected or (f) touching (Figure 3.3).

Figure 3.4

Overview of the six shapes of the digits



Note: Adapted from Bressem (2008a).

The shapes correlate with discrepancies in the flexing of the joints of the fingers. By way of illustration, in the shape referred to as “stretched”, there is no joint flexion observed, whereas in the shape described as “bent”, there is a little flexion at the fingertip and the middle knuckle joint. In the “crooked” shape, the joints at the fingertip, the middle knuckle joint and the joint at the digit rudiment are flexed. The finger that is described as “flapped down” is flexed at the rudiment, at nearly 90° to the palm. The “connected” and “touching” forms involve two or more digits in contact, in the first of which, the fingers are bent and connected at the fingertip, whereas in the second, the fingers are flapped down and touch each other at the whole first limb of the finger. Additionally, the marker “spread” is added in the combinations of fingers category if the fingers are separated from one another.

Finally, hand shapes based on the involvement of the two hands are depicted in two ways. The first one separates two hands and describes them according to the four categories and the number and shape of the engaged fingers. In the other one, the form is named individually (e.g., hands interlocked). In conclusion, Table 3.4 presents an overview of hand configurations employed in the study.

Table 3.4

Overview of hand configurations used in the study

1 stretched	1+2 stretched	2 stretched	1-3 stretched	2+3 stretched	1+2 bent
1-3 bent	1+2 connected	1-3 connected	1+2 touching	2-4 spread	1+2 crooked

					
1-3 crooked	1-5 connected	1-5 touching	1-5 bent	1-5 spread bent	1-5 crooked bent
					
1-5 spread crooked	lax flat hand	spread flat hand	flat hand	fist	invisible/other
					

Note: The majority of handshapes were adapted from Bressemer, 2008a). Several were created for the purpose of the study by Alexandra English (1-3 bent, 1-3 connected, 1-3 crooked, 1-3 stretched, 2-4 spread). The 1-5 spread crooked handshape was designed for the study and the image was adapted from Ortega and Özyürek (2019a). The categories “invisible” and “other” were also added. The first one was selected when a handshape was not fully visible, and it was not possible to assign it to one of the hand configurations. The other related to realizations where a hand configuration that is not listed above was used.

Orientation

Description of this parameter was built upon McNeill (1992) and involved coding orientation of the palm and gesture space. It is a two-step procedure: first, orientation of the palm is described; and subsequently the hand’s orientation in relation to gesture space is recognized. It is always performed from the speaker’s perspective and the orientation of their head and upper body. Orientation of the palm is coded according to four angles: (1) palm up; (2) palm down; (3) palm lateral; and (4) palm vertical, as in McNeill (1992). With respect to palm lateral, the hand is positioned parallel to the sagittal line of the center of the body. Additionally, the marker “diagonal” (Bressemer, 2006) has been introduced to discriminate the differences between the four angles to a larger degree. It specifies a 45-degree angle to the body’s center line. Gesture space is described according to the four types: (1) towards center; (2) away center; (3) towards body; and (4) away body. The following abbreviations, as in Bressemer (2008b), were used to notate (1) palm and (2) gesture space:

1. palm

- palm up PU
- palm down PD

- palm lateral PL
 - palm vertical PV
 - marker diagonal Di
2. gesture space
- towards center TC
 - away center AC
 - towards body TB
 - away body AB

The annotation of the orientation parameter was always the total of the (1) palm orientation and (2) gesture space orientation (see Figures 3.5 and 3.6).

Figure 3.5

Diagonal orientation in relation to body center line (viewed from above)

PDdiTC



PLTC



PUdiTC



Note: Adapted from Bressem, (2008a).

Figure 3.6

Diagonal orientation in relation to body of speaker (viewed from the side)

PDdiAB



PVAB



PUdiTB



Note: Adapted from Bressema, (2008a).

Movement

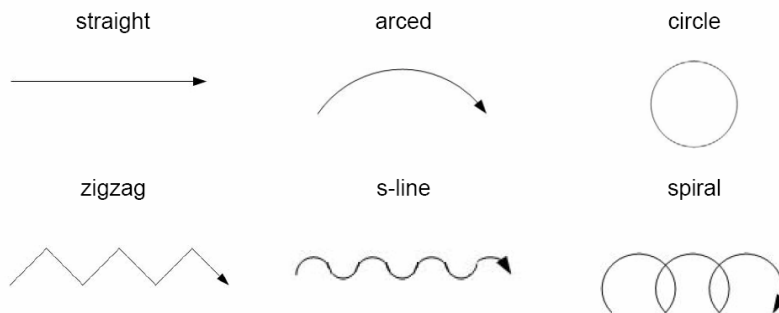
Next, the movement parameter was described. It was divided into three aspects: a) type of movement; b) direction of movement; and c) character/quality of movement.

Movement type

The movement type indicates the shape of motion. This system splits movement varieties according to the different parts of the body engaged in performing the gesture: arm and shoulder; wrist of the hand; and the fingers. The arm and shoulder movements include six types: (1) straight movement; (2) arced movement; (3) circle; (4) spiral; (5) zigzag; 6. s-line (Figure 3.7), while ellipse has been added for the purpose of this study (Figure 3.8). The movements can be produced by the forearm and secured at the elbow or by the whole arm and secured at the shoulder. This indication of securing a movement at a particular point or the movement's anchorage, as the author labels it, is especially useful while creating detailed depictions of specific motion patterns.

Figure 3.7

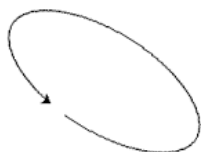
Types of movement



Note: Adapted from Bressema (2008a).

Figure 3.8

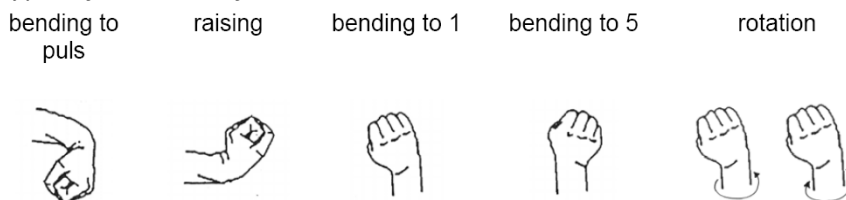
Types of movement: ellipse



For the movements produced by the wrist of the hand three types are identified: bending, raising and rotation (Figure 3.9). Bending to 1 means bending to the thumb whereas bending to 5 means bending to the little finger.

Figure 3.9

Types of movement for wrist



Note: Adapted from Prillwitz et al. (1989).

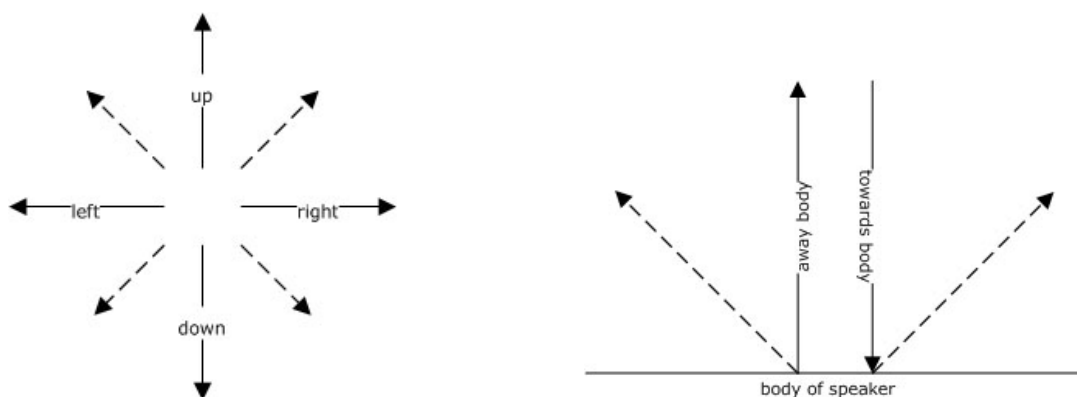
Finger movements are described consonant with the elementary movement types: straight; arced; and circle. Finally, the movements produced by all the fingers of a hand are notated as beating of fingers, flapping down, grabbing movement and closing of fingers.

Direction of movement

To describe the movements of arm, shoulder and individual fingers, three directions are used: motion along the horizontal axis (right and left); motion along the vertical axis (up and down) (Figure 3.10); and motion along the sagittal axis (away from body and toward body) (Figure 3.10). These three directions can be supplemented by adding the diagonal marker in case further identification of the basic direction is required, e.g., diagonal up right.

Figure 3.10

Directions of movement 1 and 2



Note: Adapted from Bressem (2008a).

Apart from the movement directions just discussed, circular and spiral motions can be distinguished. These motion types can be clockwise or counter-clockwise. Moreover, spiral forms can be further described in respect of the direction on the axes. For instance, a spiral movement can be characterized as clockwise right. The directions are also employed for depicting single fingers. Regarding the wrist movement, bending is characterized by the use of the four directions, rotation with clockwise and counter-clockwise direction, and the raising form does not require any additional specification.

Character/quality of movement

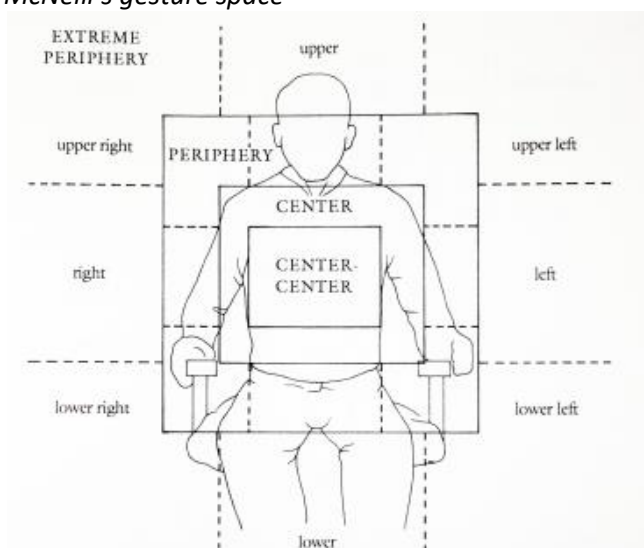
This aspect attempts to identify additional features of movement patterns. Accordingly, it focuses on (a) size (reduced or enlarged), b) speed (decelerated, accelerated) and (c) flow of movement (accentuated ending). Recording the character of movement is not mandatory and is only required if a particular movement possesses a distinctive quality not present in other movements due to its additional features; for instance, an accelerated straight movement downwards is not synonymous with a straight movement downwards. The phrases proposed for describing this aspect can be integrated with one another, whereby a movement can be classified as enlarged and as having an accentuated ending.

Position

The position parameter is based on the gesture space proposed by McNeill (1992). Accordingly, this notational system splits the entire gesture space into four basic sectors: center center; center; periphery; and extreme periphery (subdivided into upper/lower, right/left periphery) (Figure 3.11).

Figure 3.11

McNeill's gesture space



Note: Adapted from McNeill (1992).

3.3.2.3 Coding speech

Speech arising within the boundaries of a gesture unit was annotated on the basis of intonation units (Chafe, 1994). An intonation unit is defined as “a sequence of words combined under a single, coherent intonation contour, usually preceded by a pause. An intonation unit in English typically contains about five or six words, and new intonation units typically begin about two seconds apart (Chafe, 1987). Intonation units create a unit of mental and linguistic processing that “verbalises the speaker’s focus of consciousness” (Chafe, 1994, p. 63) when speech and gesture are produced. As a result, every intonation unit expresses information pertaining to a different idea, occurrence or state. Furthermore, the intonation unit approach permits a comparison of gestures and speech containing more than one word and investigating gestures in respect to speech (Bressem, 2012).

Speech was transcribed according to the conventions of the “GAT2,” as in Couper-Kuhlen & Barth-Weingarten (2011) adapted for the purposes of this project.¹² The wording of the contributions and their rough segmentation into intonation phrases were notated on a relevant tier. The transcript also incorporated hesitation markers, pausing, laughter and unintelligible speech. The wording was notated in agreement with the orthography conventions of English and Polish (accompanied with English translation).

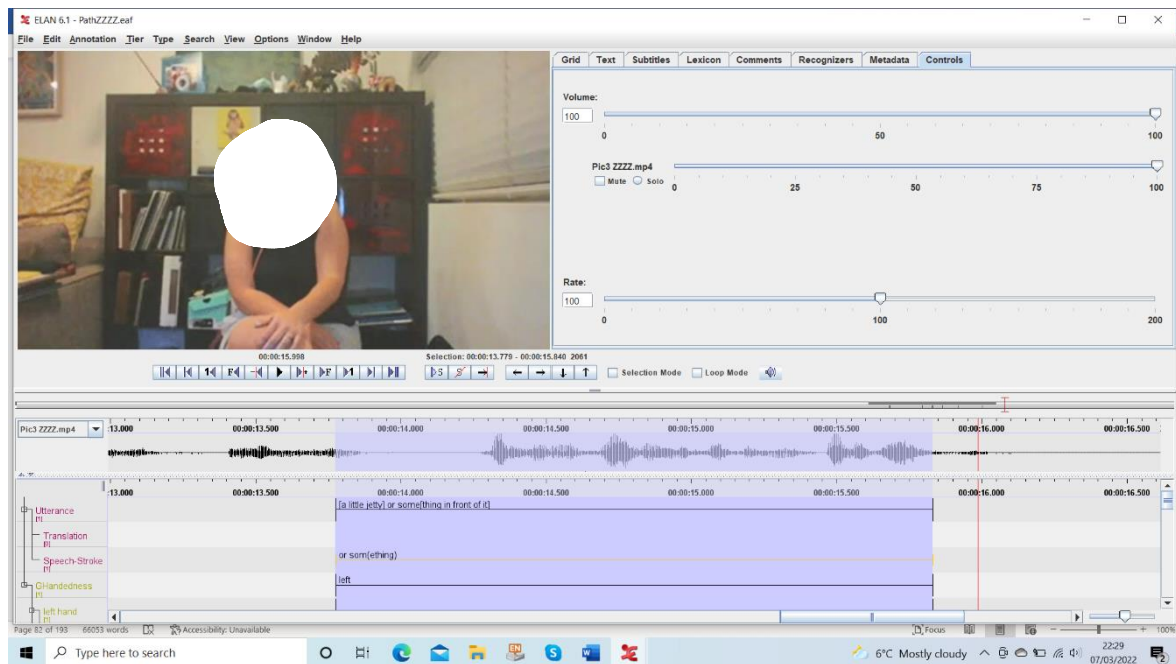
3.3.2.4 Coding gesture-speech co-occurrence

Initially, the speech-gesture co-occurrence was marked by placing a word or words that co-existed with the stroke above the stroke on the utterance tier, graphically separated from the remaining part of the utterance. In the course of further annotation, a separate speech-gesture, co-occurrence tier, was created and added to the template. The decision was justified by making the phrase that accompanied a stroke more easily detectable for the further analysis. Square brackets were used when incomplete words or intonation units co-occurred with a gesture stroke. In such cases, syllables or words that did not co-exist with the stroke were annotated in square brackets (e.g., [a little jetty] or some[thing] PathZZZZ). Figure 3.12 exemplifies a separate speech-gesture co-occurrence tier.

Fig. 3.12

Adding a separate speech-gesture co-occurrence tier

¹² For details see Appendix VII. Overview of the Most Important GAT 2 Transcription Conventions adapted for the project.



With certain gestural examples, determining the exact co-existence between speech and gesture have proven more challenging. For instance, in several two-handed gestures, one hand could start slightly earlier than the other. In such cases, the gesture-speech co-occurrence's starting point was marked with the start of the hand that commenced the action earlier. When a stroke performed by both hands lasted substantially longer on one hand, the speech gesture co-occurrence was annotated separately for both hands i.e., first left then right hand separated by + on the relevant tier. This is exemplified by two-handed gestures where one articulator maintained a static stroke throughout one intonation unit and the other produced a short-duration stroke that terminated well before the cessation of the static one. Furthermore, several gestures occurred in the absence of speech. For example, a participant produced two intonation units and the gesture occurred in between. Another example would be generating a gesture after finalising the intonation unit. In such cases "no words" phrase was used on the speech-gesture co-occurrence tier. Such creations were included in further analysis as gestures preceding/following the co-expressive speech segment or occurring in pauses have been documented in the literature (Bressemer, Ladewig, & Müller, 2013). Additionally, Kendon's (2004) transcription was used to present the gesture-speech relationship with photos of gesture examples (for a full overview of Kendon's (2004) conventions see Appendix IX).

3.3.2.5 Coding depiction strategies

The taxonomy that has been developed in this study follows Müller (1998a), Masson-Carro et al. (2016), Masson-Carro et al. (2017) and Hwang et al. (2017). Table 3.5 presents the depiction strategy types that emerged from the data.

Table 3.5*Depiction strategy types and definitions*

Depiction Strategy	Definition
Handling	Handling refers to a transitive action involving imitating operating a tool or a device (e.g., handling a brush (Masson-Carro et al., 2017), holding a pen (Masson-Carro et al., 2016)) or <i>handling</i> gestures (Streeck, 2008).
Enactment	Enactment refers to an intransitive action which entails imitating an action with no object use (e.g., imitating alternating arm movements for running (Masson-Carro et al., 2016)).
Portrayal	Portrayal specifies gestures in which hands embody the item they portray. In other words, they become the item themselves (e.g., index and middle fingers become a pair of scissors (Masson-Carro et al., 2016), an extended index finger represents a pen (Müller, 2014b)).
Molding	Molding gestures are produced by hands sculpting a 3D shape. Two sub-groups are distinguished: static and dynamic. Molding static gestures enclose a shape with no movement involved (e.g., molding the shape of a picture (Müller, 2014b)). Molding dynamic gestures depict an object's shape with hands in motion (e.g., the hand moves along horizontally depicting the "flatness" of the object's surface (Masson-Carro et al., 2016)).
Drawing	Drawing indicates the hand (very often with an index finger) tracing a shape or a trajectory (e.g., a quadratic shape of a window (Masson-Carro et al., 2016)). This strategy depicts 2D shapes and is more schematic than the molding type. With ambiguous realizations that could be categorized as either drawing or molding dynamic, a clear indication to classify a gesture as drawing is tracing a line or a 2D shape, with no emphasis on the thickness or depth of a referent.

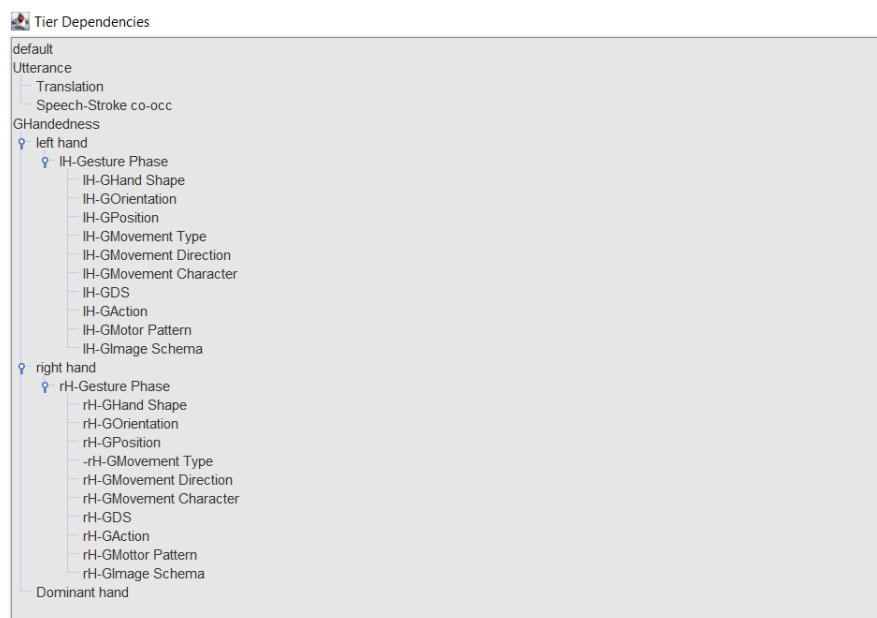
Personification	Personification entails participants becoming the entity they wish to represent by “mapping the body of a non-human entity onto the human body, using the human head to represent parallel locations on a non-human head, the human body to represent a non-human body, and human appendages to represent non-human appendages” (Hwang et al., 2017, p. 576) (e.g., impersonating a bird or a lobster (Ortega & Özyürek, 2019a)).
Placing	These gestures place an imaginary item in gesture space or inform about a spatial relation between two or more imaginary items (e.g., specifying the location of actors (Masson-Carro et al., 2016), describing a giraffe by placing dots on one’s own body (Masson-Carro et al., 2017)).
Other (e.g., presenting, beats or pointing)	All other gestures are classified as “other”. For instance, presenting is not a depiction strategy per se. Specific examples are included when participants (1) opt for presenting the referent on Palm Up Open Hand (PUOH), instead of adopting one of the iconic strategies and the co-occurring speech indicates the referent or (2) adopt elements of a depiction strategy combined with presenting. In such realizations, the hands seem to be on display or move closer to the addressee, in line with PUOH gestures (Müller, 2004) and the <i>presenting gesture</i> (Parrill, 2008). The speaker may also present the referent by lifting it in gesture space. Furthermore, instantiations of beat gestures (McNeill, 1992) are included when they are part of simultaneous realizations. Beats are quick movements of the hand(s), up and down or back and forth whose main function is to pace the speaking process and add emphasis. Finally, pointing involves giving information about the location of a given entity in space by pointing to it with a hand or an index finger (e.g., indexing in Lücking et al. (2013)).
Inconclusive	“Inconclusive” is selected when a realization does not fit a definition of one of the categories above.
Invisible	“Invisible” is selected when articulators are not fully visible.

3.3.2.6 Annotation software

Regarding the practical implementation of the system in the study, the annotation software ELAN was selected in line with the recommendations of Bressem et al. (2013). ELAN is a tool used for creating annotations on video and audio resources ("ELAN (Version 5.0.0-beta) [Computer software]," 2017, April 18). It was created at the Max Planck Institute for Psycholinguistics, Nijmegen, the Netherlands for the purpose of analysing languages, sign languages and gestures. The following introduction to ELAN has been compiled on the basis of Sloetjes & Wittenburg (2008). In its most basic form, an annotation is a fragment of text making reference to a segment of the media. This segment is identified by a start/end time. Annotations comprised multiple levels called tiers. Multiple tiers were arranged hierarchically through determining parent-child relations that formed a dependency or subordination relation. Annotations created with no parent tier, e.g., at the top level, were time-aligned by their start and end time, establishing a segment in the media. Annotations on the remaining tiers directly or indirectly related to an annotation on the parent tier. Every aspect was annotated on a separate tier, and gestural form description is provided separately for both palms, as in Bressem et al. (2013). For a detailed overview of tier dependencies, see Figure 3.13.

Figure 3.13

Overview of tier dependencies in this study



3.3.2.7 Controlled vocabularies

The majority of the tiers had a list of controlled vocabulary entries attached for the stroke phase and annotating was performed by selecting one entry. A controlled vocabulary comprises “a number of

predefined values that a user can choose from when editing an annotation, thus making the task of the annotator less error-prone ("ELAN (Version 6.2) [Computer software] ", 2021, p. 231). See examples of entries for the orientation parameter and movement type arranged in Table 3.6 and Table 3.7.

Table 3.6

*Controlled vocabulary entries for orientation*¹³

PUTB	PDAB	PVTB	PLTC	other
PUTC	PDTC	PVAB	PLAB	Invisible
PUDiTB	PDTB	PVTC	PLTB	
PUDiTC	PDdiAB	PVAC	PLdiTC	
	PDdiTC	PVdiTC	PLdiTB	
		PVdiAB		
		PVdiTB		

Table 3.7

Controlled vocabulary entries for movement type

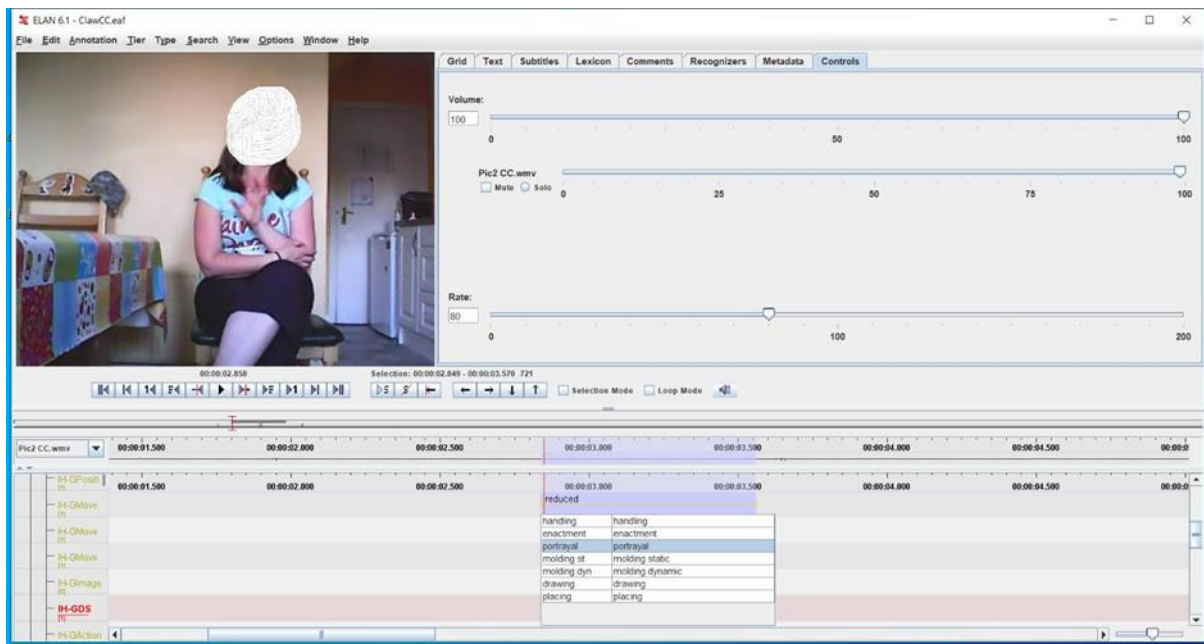
straight	bending to puls	flapping down	Invisible
arced	bending to puls and away	closing of fingers	
circle	Raising	closing of fingers (partial)	
ellipse	bending to 1	opening of fingers	
spiral	bending to 5	irregular fingers	
zigzag	rotation wrist	missing	
s-line	beating of fingers	other	

Selecting a depiction strategy was also executed by opting for one of the controlled vocabulary entries (see the ELAN screenshot below).

Figure 3.14

Example of selecting a depiction strategy type from the depiction strategy controlled vocabulary

¹³ See list of abbreviations.



With realizations when more than one option was possible (e.g., gestures spread over more than one position), the system of controlled vocabularies could be overridden (shift + double click on a relevant tier) and the options were entered manually separated with a dash (e.g., center center – center right). Furthermore, on some occasions it was impossible to discern between two alternative forms. In such circumstances, two or more alternatives were given separated with / (e.g., two possible handshapes).

Finally, several form-controlled vocabulary entries used abbreviated variants. For example, the position entries were abbreviated using the following forms:

- “l” – left
- “r” – right
- “extr” – extreme
- “peri” – periphery
- “center c” – center center

3.3.2.8 Calculating the interrater agreement

A second coder independently classified 20% of the data (n = 66 realizations out of 329) into one of the depiction strategy types described above. Analogous methods of calculating the interrater agreement have been found in other studies investigating iconic patterns in gesture (e.g., Ortega and Özyürek 2019a,b). In addition, one more depiction strategy type was added: “combination of strategies.” This option was to be selected by the second coder if more than one strategy was employed within a single realization. It entailed more than one strategy implemented on the same

hand (e.g., a dominant hand displaying features of more than one strategy) or more than one strategy used by two hands (e.g., two hands displaying features of two different strategies).

An interrater reliability analysis using Kappa was conducted to determine the level of agreement between the two independent raters. The agreement was found to be substantial: $K = .702$ ($p < 0.001$), 95% CI (0.575, 0.829) (Landis & Koch, 1977). Once the substantial interrater agreement was achieved, the results were further analysed. The next two chapters present the findings centered around (1) iconicity and the semantic and community impact on depiction strategy selection and creation; and (2) metaphor's involvement in depiction strategy selection and creation.

Chapter 4: Semantic and Community Impact on Iconicity in Depiction

Strategies

This chapter is subdivided into two major parts. The first part includes sections providing a theoretical framework necessary for further analysis of cognitive iconicity, its definition as adopted in this project and the characteristics of the analogue-building model of iconicity (Taub, 2001). The second part moves on to analyse in greater detail the extracted realizations and presents results from two of the research questions:

1. How do different semantic characteristics affect depiction strategy selection and creation?
2. How do different communities affect depiction strategy selection and creation?

The realizations have been grouped around the same semantic characteristic across the three groups of participants: spatiality; animatedness; manipulability; and plurality. An account of multiple and simultaneous realizations is also provided.

4.1 Defining iconicity

In Chapter 2, we presented a range of definitions of iconicity, its theoretical foundations and its manifestations in gesture. Here, we explain how iconicity is understood in this study. We draw on the notion of conceptual mappings that iconicity uses to create iconic forms Taub (2001). Conceptual mappings are defined as “sets of correspondences between domains of thought and linguistic forms” (Taub, 2001, p. 5). Individual domains and forms have a certain structure, for instance, a particular shape, and structural parts of one domain can be connected to the structure of another domain. These mappings are not accidental; they preserve the part/whole structure of each domain and form. In this way, the form parts stand for the corresponding referent parts; for example, a pair of fingers may stand for a pair of legs. Furthermore, this understanding of iconicity stresses the importance of various cultural contexts, which is one of the tenets in this study:

Iconicity is not an objective relationship between image and referent; rather, it is a relationship between our mental models of image and referent. These models are partially motivated by our embodied experiences common to all humans and partially by our experiences in particular cultures and societies. (Taub, 2001, pp. 19-20)

Finally, iconic forms are motivated. To clarify the concept of motivation, Taub (2001) brings in different tree representations in sign language from the study of Klima and Bellugi (1979). ASL represents a tree by the placing of hands and forearms so they resemble a tree growing from the

ground. In Danish Sign Language, hands trace a contour of a trunk and branches from top to bottom, while the tree representation in Chinese Sign Language is created by two curved hands tracing a trunk from the bottom to the top. These forms are all different, and all visually correspond to an image of a tree in different ways. This is what Taub (2001) calls “motivated” in contrast to being arbitrary or predictable. To establish such a motivation, two requirements must be satisfied: (1) there must be a tendency observed rather than a rule; and (2) this tendency should be associated with “reason external to the linguistic system” (Taub, 2001, p. 9). The existence of a general tendency, a certain pattern rather than an isolated example, constitutes solid grounds for creating the validity of the theory.

To sum up, this section has discussed the perception of iconicity that will be followed by further data analysis. The following section will address ways of creating iconic items by the use of the analogue-building model of iconicity (Taub, 2001). Understanding how the model operates is crucial, as its stages will be applied in examining gestural realizations.

4.1.1 The analogue-building model of iconicity

Taub (2001, pp. 43-62) proposes the *analogue-building model of iconicity* that could be implemented for sign, gesture, and spoken languages. Even though the model is presented in stages, the cognitive mechanisms pertaining to these stages could act simultaneously and not necessarily sequentially, whose stages might be perceived as aspects offering an array of constraints. What is more, this model does not portray processes occurring in the mind every time an iconic item is uttered/articulated; it is only utilized when iconic items are created, and once the creation process is completed the forms can be stored and exploited. A detailed description of the three stages – selection, schematization and encoding – is presented below.

The image selection component involves singling out a sensory image that represents the complete concept. Such concepts can be multimodal and are extremely rich in information. It is clearly illustrated by the example of the tree concept combining images from different modalities: visual images of various trees; tactile images of bark and leaves; auditory images of rustling leaves; and kinaesthetic images of climbing trees. The selected image is always in a modality a language represents. In the case of sign languages, this is a visual modality, while spoken languages employ an auditory one. There is also more than one image that meets the criteria for selection, and the alternatives differ across languages and cultures. Choosing one image to represent the complete concept involves a cognitive process called metonymy.

Once the image has been selected, it needs to be modified so its form fits a particular language. Very often, images contain rich-in-detail information that requires chunking and modifying actions. This is achieved in the process called schematization (Taub, 2001, p. 46). As a result, all the

important information is extracted and the image is concordant with the language semantic categories and meets the requirements of the language phonetic resources.

Encoding involves giving a sensory image a physical form. As the image consists of several parts, a physical form to depict each part of the image is selected so that the entire structure of the image is retained. This is called an *iconic linguistic form-meaning pairing* (Taub, 2001, p. 47). Two levels are crucial in this process: (1) the selection of iconic building blocks to represent linguistic form; and (2) the selection of combinations of these blocks to be preserved as lexical or syntactic items. Individual languages boast their own specific systems of *iconic tools* utilized for representing parts of the image. Such a tool comprises a link between a semantic category and a form in a structure-preserving correspondence. For example, in ASL, the semantic category “flat” is linked with the form “horizontal forearm” or “legs” with “V shape.” The appropriate combination of these tools will generate a form bearing a resemblance to its referent.

Iconic tools are language-specific to a large extent. This does not come as a surprise since semantic categories are also themselves highly specific. The forms exploited are singled out from the forms existing in a language, and this language only uses a subgroup of conventional form-meaning pairings. At the same time, the existence of more universal tools, occurring across languages or modalities, is not denied: the use of temporal dimension in different languages.

Iconic tools also reveal varying degrees of conventionalization, some of which are quite ubiquitous in a language, while others only occur sporadically. To illustrate this, ASL uses two prevalent tools for TREE: the flat-surface-horizontal-forearm and tall-thin-object-vertical-forearm pairings; and the more infrequent branching-structure-spread-hand.

Overall, the previous sections have attempted to provide the perspective on iconicity adopted in this study and on how iconic forms are created. The following paragraphs discuss depiction strategies as manifestations of iconicity, their example classifications and the systematic patterns they develop.

4.2 Overview of realizations

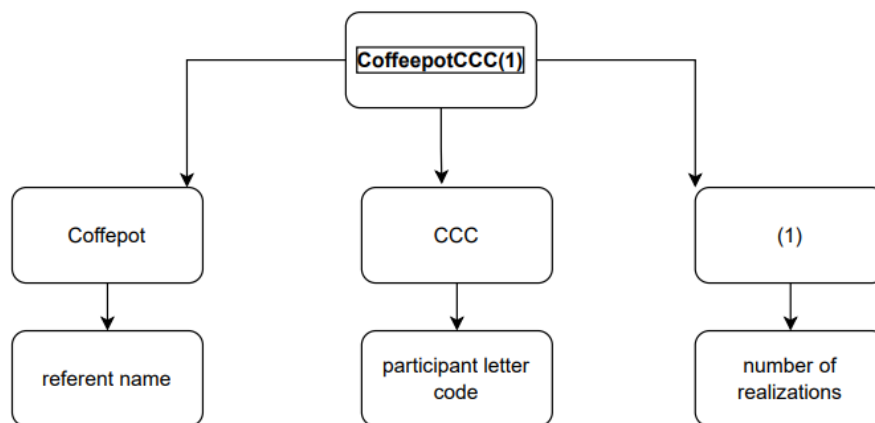
Gestures in this chapter are analysed as various types of realizations. “Single realization” is a gesture stroke (1992) that forms the very core of a gestural unit referred to as a nucleus by Kendon (2004). When there is more than one stroke, realizations are annotated in both ways. The strokes are included as one realization if they form a sequence of strokes happening very fast one after the other and/or they differ in one parameter (e.g., orientation). Strokes are generally described as two separate realizations if they are divided by a considerable time period, refer to different concepts or their forms vary substantially.

“Multiple realizations” are gestures depicting a referent using more than one depiction strategy in separate gestural specimens produced by the same speaker. In other words, a particular entity or item can be recreated in gesture in various ways; for instance, by profiling its shape in molding; the participant’s hand/fingers becoming the thing itself in portrayal; or by manipulating the item in a specific way in handling.

“Simultaneous realizations” refer to gestures that depict (1) the same referent with an analogous form on both hands; (2) the same referent with more than one form and/or different strategies on two hands; (3) two referents on two hands; and (4) the same referent with more than one strategy on one hand. Unlike multiple realizations, these creations are generated within the same realization. The names of realizations were coded using a specific coding system. Figure 4.1 presents an example of the coding procedure for an example realization CoffeepotCCC(1).

Figure 4.1

Example of the coding procedure for realization CoffeepotCCC(1)



In this example, “Coffeepot” stood for the specific referent used, which in this case was a coffee pot. Letters CCC related to a letter code allocated to the specific participant. Number (1) related to a number of realizations used to describe the same referent. At times, more than one gesture/realization was produced to depict the same referent. In such cases, the numbers in brackets revealed multiple realizations ordered as they appeared in recordings. Certain realizations contained “1”, as in CoffeepotBBBBBB1c. This coding feature is related to the Polish participants only and described realizations recorded in English. The letter “c” was used with these gestures recorded in a counter-balanced order. The coded realizations were also accompanied with AP (Australian participants), IP (Irish participants) and PP (Polish participants). These abbreviations will be used consistently in the subsequent sections and chapters in this study (also see the full list of abbreviations).

The analysis began by examining the gestural form in line with the encoding process in the analogue-building model of iconicity (Taub, 2001). First, the realizations with their form and depiction strategy type were compiled on individual spreadsheets (see Appendix X: “Example of grouping realizations per referent for the screw stimulus”). The handshape was the first parameter to be analysed. This decision was dictated by the existing research suggesting the handshape’s superiority over the remaining parameters. Bressem (2007), for instance, in her analysis of the co-speech gestures of German speakers, investigated the co-occurrence of parameter realizations for the six recurrent handshapes in relation to other parameters: orientation; movement; and position. In a similar vein, Ladewig and Bressem (2013) suggest that handshape is the most prominent feature, whose annotation system places this parameter before others. In this project, arranging the realizations around the handshape allowed for the investigation of co-occurrences of the latter with other form parameters and the detection of tendencies in the depiction strategy selection and creation within and across communities.

4.2.1 Spatiality

This semantic group included referents grouped around the spatiality characteristic (i.e., depicting shape and size). It comprised coffee pot and path referents and yielded the following results.

Molding as a prominent strategy in spatiality depiction

With both referents, molding (static and dynamic) was the most favored. To start with, the coffee pot referent generated 30 representations across the three groups of participants: 11 (PP); 5 (IP); and 14 (AP). The majority were classified as molding (static or dynamic), depicting the shape and size of the referent, with only a few exceptions involving other strategies and/or focusing on other features than the shape: molding combined with placing: CoffeepotCCC(1) (PP), molding the shape of the handle CoffeepotPPP (PP), handling: CoffeepotSSS (PP), CoffeepotO (IP), CoffeepotVVVV (AP), handling combined with placing: CoffeepotP(2) (IP), handling a lid: CoffeepotAAAAAA1c(3) (PP), drawing: CoffeepotZZZZ (AP). Figure 4.2 presents an example of combining molding and holding in realization CoffeepotAAAAAA1c(3) (PP).

Figure 4.2

Presenting, molding and handling a lid in CoffeepotAAAAAA1c(3) (PP)



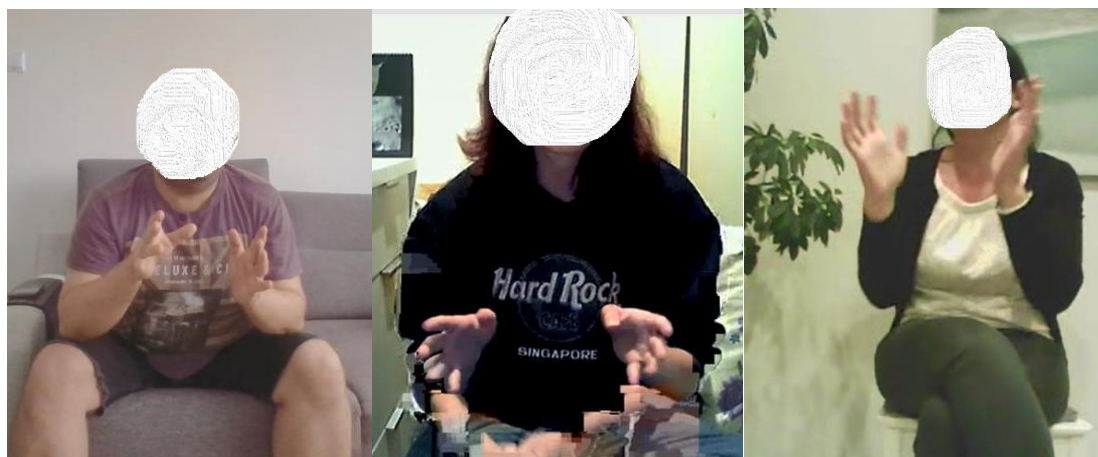
With a lid (.)
|~~~~~***|

Molding static examples included four realizations in the Polish group: CoffeepotCCC(1) (combined with placing), CoffeepotHHH, CoffeepotAAAAAA1c(1), CoffeepotBBBBBB1c (one hand static, the other dynamic), two realizations in the Irish group: CoffeepotP(1), CoffeepotQ and nine realizations in the Australian group: CoffeepotCCCCC(1), CoffeepotDDDD(1), CoffeepotJJJJ, CoffeepotLLLL(1), CoffeepotLLLL(2), CoffeepotRRRR, CoffeepotSSSS(1), CoffeepotSSSS(2), CoffeepotWWWW, indicating a clear bias towards the molding static strategy among the Australian participants.

A further profiled feature was the depiction of various degrees of roundness of the pot. The three examples of the molding static strategy profiling roundness are presented in Figure 4.3.

Figure 4.3

Examples of roundness depiction in the molding static strategy: CoffeepotAAAAAA1c(1) (PP); CoffeepotCCCCC (AP); CoffeepotP(1) (IP)



coffee pot
|~~~~~*****|

type of pot
|~~~~~*****|

teapot
|~~~~~*****|

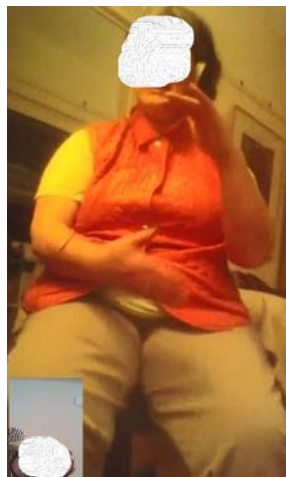
Well over half of all the participants highlighted roundness in their realizations. These were mostly produced with 1-5 spread bent or 1-5 crooked, lax flat in the palm lateral towards center (PLTC) or palm vertical towards center (PVTC) orientation. Such realizations were detected across the three

groups and included the Polish group: CoffeepotCCC1, CoffeepotAAAAA1c(1), CoffeepotBBBBBB1c, the Irish group: CoffeepotP(1), CoffeepotQ and the Australian group: CoffeepotCCCCC1, CoffeepotLLLL(2), CoffeepotSSSS(1), CoffeepotSSSS(2). These results suggest that the roundness feature might be more universally selected than others (e.g., profiling a handle).

Tendencies in the adoption of different orientations were found in the three groups of participants. For instance, some Australian participants favored representing the coffee pot on the horizontal axis, with palms positioned horizontally: one palm adopting PD and the other PU orientation. This trend was observed in molding static realizations and included CoffeepotDDDD(1), CoffeepotLLLL(1), CoffeepotRRRR (one-handed) and CoffeepotWWWW (see Figure 4.4).

Fig. 4.4

Presenting a referent on a horizontal axis: CoffeepotDDDD(1) and CoffeepotLLLL(1)



it's a bit] tall (intelligible) teapot
|~~~~~*****~~~~~*****|



oval pot
|***/**|

—

Apart from the Australian participants, a comparable realization was created by only one Polish participant: a one-handed molding gesture using the palm up diagonal towards body (PUdiTB) orientation.

The molding dynamic strategy generated a smaller number of coffee pot realizations than the molding static and involved movement with the hand(s) engaged in haptic exploration of the surface. These realizations were not as homogenous as molding static representations as their movement parameter was diversified. Most, however, shared analogous handshape features emphasizing the curve of the coffee pot: 1-5 spread bent; 1-5 spread crooked; spread hand. Such realizations included CoffeepotCCC(2), CoffeepotQQQ, CoffeepotAAAAA1c(2), CoffeepotBBBBBB1c and CoffeepotTTT1 in the Polish group, CoffeepotAAAAA and CoffeepotCCCCC(2) in the Australian group and one realization in the Irish group: CoffeepotS. Three illustrations of this strategy from the three groups are displayed in Figure 4.5.

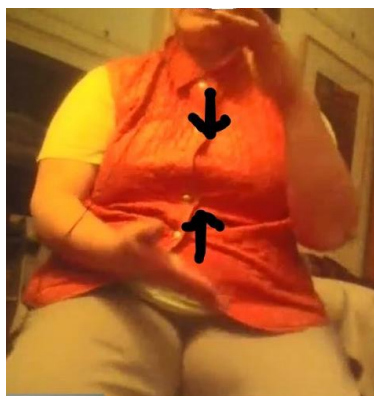
Examples of the molding dynamic strategy: 1) CoffeepotCCCCC(2) (AP), 2) CoffeepotQQQ (PP), 3) CoffeepotS (IP)



- 1)the china and pretty flower and colors
|~~~**~~~~|~~~~~***~~~~~|~~**|
- 2) a beautiful set with a teapot
i taki piękny secik z takim imbryczkiem
|~~~~~***~~~~~|
- 3) [pattern] on [the china]
|~~~~~**|

Similar to molding static realizations, a cross-community difference was observed regarding the vertical versus horizontal axis in the molding dynamic; namely, only one horizontal realization was elicited (see Figure 4.6). As in the case of the molding static technique, it was generated by a representative of the Australian group: CoffeepotDDDD(2). The flat hands took on the palm up (PU) and palm down (PD) orientation and engaged in a repeated and simultaneous up-down motion converging and diverging. The realization was executed in a pause and was followed by “too tall (unintelligible) it’s probably a coffee pot.”

Horizontal representation of the coffee pot: CoffeepotDDDD(2)



(pause) too tall it's probably a coffee pot
|*****|

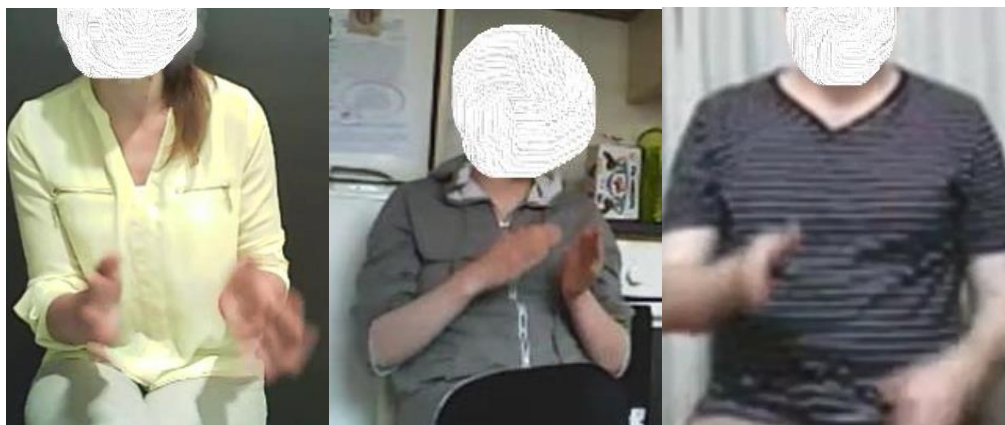
It is possible that the movement was applied to haptically investigate the height of the coffee pot necessary for reaching the conclusion that it is, in fact, a coffee pot and not a teapot.

Regarding the path referent, the opposite trend was observed: Molding dynamic realizations exceeded the molding static gestures in terms of number. These were executed on a horizontal plane with flat hand (lax) and spread flat hand selected for the greatest proportion of realizations in the three populations. In these creations, one or two hands were haptically exploring either two boundaries of the path with palm lateral towards center (PLTC) or its flat surface with palm down away body (PDAB). An accompanying movement was mainly executed away from the body in molding dynamic realizations.

In molding static path gestures, well over half of the realizations were generated with palm lateral towards center (PLTC) (see examples in Figure 4.7).

Figure 4.7

Examples of palm lateral towards center (PLTC) path realizations: 1) PathRRR (PP), 2) PathS (IP), 3) PathIIIII (AP)



1) road

droga
|****|

2) bridge

|****|

3) a path leading out to the

|~~~~~|

The prevailing handshapes were the flat hand (lax) and flat spread hand. The Polish two-handed examples included PathRRR, PathIII and PathMMM1(1), and the one-handed example PathCCC. One such realization was created by an Irish participant, two-handed PathS, and one by an Australian speaker, one handed PathIIIII. Additionally, one Australian speaker preserved PLTC, but adopted 1-5 spread bent and created two-handed PathKKKKK. This finding was unexpected and suggests that the participant's intention could be profiling the thickness of the path. Other orientations were also observed but did not generate a significant number of realizations. The palm down away body

(PDAB) example was detected in the Australian group: one-handed PathZZZZ. In the Irish group, palm up diagonal towards body (PUdiTB) was applied on the non-dominant hand in PathP, whereas the dominant hand employed palm down away body (PDAB) (described with molding dynamic realizations). Similarly, in one Australian example, PathAAAAA, the non-dominant hand reminded *in situ* in palm up towards body (PUTB), and the dominant hand became legs walking on a path.

Figure 4.8



a pier with a road
molo z drogą
|~*~*~*~*~*~*|

In the Polish group, the highest proportion of participants opted for PLTC, predominantly employing two hands. The two-handed examples are PathAAAAAA1c, PathQQQ, PathWWWWW1c, PathXXX and PathSSS, while the one-handed alternatives comprise PathAAAAAAc, PathHHH and PathQQQ1. Comparable realizations were detected in the Australian group: PathLLLL(1), PathLLLL(2), PathRRRRR and PathJJJJ(2). The PDAB orientation and the away body motion parameters were prevalent in the Irish participants, as exemplified in one-handed PathP, PathEEEE, PathI and PathN (generated with PVAB in which only the away body element was preserved). The examples with PDAB did not occur in the Polish group; however, two such realizations were produced by the Australian speakers: PathWWWWW and PathVVVV.

and Özyürek (2019a)) of a piece of equipment, such as the crane. The co-occurring speech seems to corroborate this hypothesis by providing a label for the device: “jib” or “long leg.” While a jib might move between a horizontal and vertical position, legs are typically held vertically, such as the legs of a walking person, an animal or those supporting a chair or other structure. In the Polish group, the highest proportion of participants opted for palm lateral towards center (PLTC), predominantly employing two hands. The two-handed examples are PathAAAAAA1c, PathQQQ, PathWWWW1c, PathXXX and PathSSS, while the one-handed alternatives comprise PathAAAAAAc, PathHHH and PathQQQ1. Comparable realizations were detected in the Australian group: PathLLLL(1); PathLLLL(2); PathRRRRR; and PathJJJJ(2). The PDAB orientation and the away body motion parameters were prevalent in the Irish participants. This is exemplified in one-handed PathP, PathEEEE, PathI and PathN (generated with PVAB in which only the away body element was preserved). The examples with palm down away body (PDAB) did not occur in the Polish group; however, two such realizations were produced by the Australian speakers: PathWWWW and PathVVVV.

The final difference refers to the selection of a different subtype of articulatory plurality in the molding dynamic, “plural fingers” (Börstell, Lepic & Belsitzman, 2016) in path realizations. In these examples, not plural hands but plural fingers demarcated the path. Precisely, the hand adopted either 1-5 bent or 1+2 bent and moved away body with fingers molding two sides of the referent. Such realizations were detected in the Irish group: PathJJ, PathV(1), PathQ and PathV(2). All of these were one-handed and took on the away body orientation. One example was identified in the Australian cohort, two-handed PathJJJJ(1), and none in the Polish group. Overall, it remains to be verified if the movement parameter generates cross-communal varieties in the molding dynamic strategy.

Other strategies

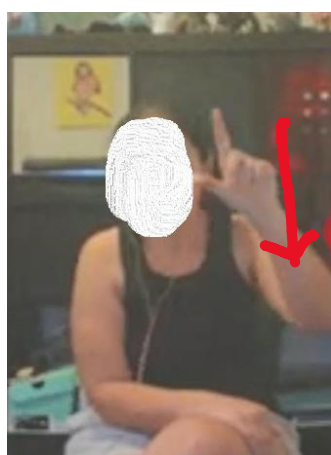
Turning now to other strategies, no significant numbers were found. For instance, in coffee pot depictions, handling was recruited sporadically with a small number of realizations across the three groups: CoffeepotSSS (PP), CoffeepotO (IP), handling combined with placing: CoffeepotP(2) (IP), CoffeepotVVVV (AP), handling a lid: CoffeepotAAAAAA1c(3) (PP). The selection of this strategy could be motivated by the participants’ decision to highlight other features than the shape/size of the referent (i.e., handling the imaginary item). This assumption seems to be supported by co-occurring speech. In CoffeepotSSS, the participant attempted to decide between the two options “kettle” and “jug,” finally agreeing with the second option “[czajnik nie to czajnik] no [dzbanek]” ([kettle no it's kettle] well [it's a jug]) and trying to grab an invisible handle. The CoffeepotO realization was accompanied by speech referring to an action, whereby “pour[ing out tea or coffee]” clearly implied

holding a vessel while pouring a hot beverage. In two realizations, CoffeepotP(2) and CoffeepotVVVV, the fist handshape moved the imaginary pot to the central position that coincided with speech identifying the referent as “the teapot/tea jug.” Subsequently, past the stroke phase, speech provided information about its location: “in the middle”. Finally, in CoffeepotAAAAA1c(3) PP, one hand sculpted the shape of the pot, whereas the other, with the thumb and index finger connected, depicted putting down a lid. The highlighted feature was the action of using a lid functionally rather than handling the entire object. Taken together, in all these examples the profiled action is holding or manipulating an object.

Regarding strategies other than molding and handling, only one example of drawing was recorded for this referent, produced by an Australian participant: CoffeepotZZZZ. The speech provided a label, “the teapot, and the co-existing gesture depicted the referent’s size, drawing a straight line downwards with the index finger (see Figure 4.9).

Figure 4.9

CoffeepotZZZZ (AP) employing drawing



the teapot

|*****|

The path referent replicated the coffee pot results: no significant numbers were found in other depiction strategies. Three examples of drawing were detected. PathMMM1(2) was produced by a Polish speaker. Both hands took on 1-5 connected and with a synchronous down arced movement transitioned to the palm lateral towards center (PLTC) orientation. The remaining two realizations were generated by the Irish participants: PathAAA and PathYY. Both applied the 2 stretched handshape for the away body movement and palm down away body (PDAB). Finally, two examples

of portrayal were identified in the Australian group. In PathAAAAA, the dominant hand in PDAB became legs moving away from the body with fingers additionally engaged in irregular movements. (The multi-motion was so fast that it was not possible to determine how many fingers were involved.) PathTTTT co-occurred with “a pointy thing” [a house sitting on] a pointy thing in speech. In this gesture, two flat hands adopted the palm vertical diagonal towards center (PVdiTC) orientation and seemed to become the structure. As the realization occurred on a vertical axis, two possible explanations are available: (1) the participant talked about “a pointy thing” but represented “a house”; or (2) the participant’s mental representation of the house positioned at the end of a vertical structure overrode the horizontal arrangement presented in the stimulus.

Discussion

Overall, these results are concordant with Padden et al. (2015) and their findings that participants exposed to pictures are likely to focus on the shape of the referent. They are also in line with the hypothesis that drawing (drawing and molding collapsed) is a better choice for co-speech gestures where oral modality labels a referent and manual modality informs about its shape (Ortega & Özyürek, 2019a). In the case of these two referents, in the majority of realizations, the speech delivered a label (e.g., teapot, coffee pot, path), and gestures provided the information about their size and shape.

Interestingly, the coffee pot referent generated more molding static than molding dynamic realizations, while the path revealed the opposite trend. It remains unknown what motivation lies behind favoring sculpting the shape of an object with hands or applying the movement parameter to trace the contour of an item. Regarding the coffee pot, a bias towards dynamic creations has been documented in both signed language and silent gesture. In Ortega and Özyürek (2019a), systematic mappings between semantic categories and their iconic representations in silent gesture were established for similar referents boasting a roundish shape (e.g., a ball or a bottle). In both cases, drawing (drawing and molding dynamic collapsed) was selected, and the shape was traced using both synchronous flat hands. In Lu and Goldin-Meadow (2018), ASL signers used the so called *embellished depictions* to describe a vase. First, they used a lexical sign for vase and then continued with spontaneous depiction by tracing a silhouette of the vase with two hands. Further investigation is needed to determine if the molding static strategy is a better candidate for co-speech gestures. In addition, the majority of participants labeled the coffee pot as a teapot. It could be speculated that the round realizations of the referent meant, in fact, to describe a prototypical concept of the teapot and not the tall coffee pot presented in the picture.

Regarding the path, these results indicate that the molding dynamic with variants of flat hand moving away from the body is a prevalent strategy to describe the referent. The variants are concordant with the research on silent gesture where similar referents are described with the hand

tracing the shape and employing the movement away from the body; e.g., the bridge representation in Ortega and Özyürek (2019a).

Furthermore, tendencies in adopting different orientations were found in the three groups of participants across the molding static and dynamic modes. For instance, some Australian participants favored the representation of the coffee pot on the horizontal axis, with palms positioned horizontally, one palm adopting PD and the other PU orientation, whereas such trends were not observed in two other populations. A further example is the path. In the Polish group, the highest proportion of participants opted for PLTC, predominantly employing two hands, whereas the PDAB orientation and the away body motion parameters were prevalent among the Irish participants. A further tendency was the employment of either hands or fingers to describe the path by different groups. Singular and plural hands were described above. Regarding the selection of fingers, they demarcated the boundaries of the path and were produced in the Australian and Irish groups. These findings are in line with various subtypes of articulatory plurality (Börstell, Lepic & Belsitzman, 2016) and the fact that certain sign languages would use two hands and others two fingers to describe the same action. An example of DOWNHILL-SKIING comes from Lepic, Börstell, Belsitzman and Sandler (2016). ASL and SSL make use of the two legs and skis as the base for this iconic mapping. ASL, however, employs two single-finger handshapes extending and bending index fingers, while SSL utilizes one dual-finger handshape with the index and middle fingers extended; in other words, two hands stand for two legs in ASL, and two fingers on one hand represent two legs in SSL. Nevertheless, the specific plurality types require further research (Börstell et al., 2016). It can thus be proposed that various groups of speakers opt to depict the path using different iconic representations: one-handed gestures with the PDAB orientation; and two-handed gestures with the PLTC orientation or gestures created by plural fingers.

Finally, the unexpected result was the depiction of the path referent vertically by two Polish participants. This finding might be explained by the fact that houses are universally located on vertical legs or stilts, and their mental representation overrode the iconic arrangement of the stimulus. It is concordant with Rosch (1977) and prototypes serving as cultural models in both sign creation and interpretation.

4.2.2 Animatedness

Iconic animatedness pertained to a dimension describing a noun moving on its own, in its own particular way (Hostetter, (2014). The stimuli included a visual of (1) excavator and (2) shark chasing a swimmer. Since the swimmer generated sporadic gestures, its realizations were only included when they were deemed crucial for the further shark gestures' analysis. A summary of the main findings is provided in the following sections.

Portrayal as a prominent strategy in animated objects depiction

The portrayal strategy was the most frequently selected for the excavator depicting the claw and portrayal (combined with placing) for the shark referent (see Figure 4.10).

Figure 4.10

Examples of representing the excavator: ClawWWW (PP) and the shark: SharkJJJJ(1)



in its I don't know its technical name (pause)
w tej swojej nie wiem jak to się fachowo nazywa (p)
|~~~~~|



a great white shark
|*****|

Even though this movement was predicted to be the dominant feature represented in gesture, other prominent characteristics have also been identified. The excavator stimulus generated gestural realizations highlighting the three images, viz, claw, boulder and caterpillar track, each employing a different depiction strategy. Regarding the excavator, the claw representation was the most frequently produced, with 38 realizations (15 PP, 12 IP and 11 AP). This trend is concordant with Taub's (2001) shape-for-shape iconicity and the iconic device stating that the shape of articulators represents the shape of referent. In this case, the hand became the claw, usually with spread bent fingers extracting or picking up a heavy load. Other hand configurations involved 1-5 crooked, 1-5 spread crooked, 1-5 bent, spread flat hand and 1-5 touching (one Australian participant). As for the palm orientation, palm down was predominant among the Irish participants and palm up among the Polish participants. Nine claw representations were produced with PUTB, some of which coincided with movement along a horizontal axis.

Portrayal with various degrees of schematization

A number of realizations were classified as portrayal when one or two hands encoded the shark's mouth while describing the shark referent. Such realizations were generated with the spread hand variants: 1-5 spread bent and spread flat hand. Consequently, it is possible that the spreading of

fingers could evoke the image of teeth distributed in a shark's mouth. Some realizations were one or two-handed and employed various orientations that would suggest various degrees of schematization. Clear tendencies were observed across the three populations. For instance, the Australian participants used the palm vertical (PV) orientation on both hands (e.g., SharkJJJJ(1) and SharkJJJJ(2) with palm vertical diagonal away body (PVdiAB), SharkLLLL and SharkJJJJ(2) with palm vertical towards center (PVTC)). It is possible that these realizations were more schematized than some of those generated by the Polish participants that applied PU(di)TB on the one hand and PV or PD on the other, thus preserving a larger proportion of the referent's structure. In addition, the Polish speakers generated the greatest number of such shark portrayal realizations: SharkPPP, SharkQQQ(2), SharkOOO and SharkGGG. Two further realizations in the Polish group were generated with PLTC: one-handed SharkHHH and two-handed SharkQQQ1(3). The first example appears to be a highly schematized, one-handed version of jaws representation: the hand did not travel from its rest position and only for a few seconds adopted the 1-5 spread bent handshape. The other example was classified as portrayal and/or molding static. Portrayal, as it possibly depicts the spread teeth and molding, as it seems to encode the jaw's size. As the stroke coincided with "those" followed by "big jaws" in speech, a likely explanation is that the BIG metaphor was executed on a horizontal axis and overrode the representation of jaws (see Section 5.41). Finally, as for the Irish participants, the sole realization with portrayal elements was one-handed SharkCC articulated with 1-5 spread bent and PUdiTB.

Alternatives in the portrayal movement parameter

With respect to the movement parameter in the claw referent, a few realizations were created in line with the movement of articulators representing movement of the referent iconic device (Taub, 2001). Most of the movements were single actions produced along a vertical axis with the claw going up, down or along up-down/down-up pathways (e.g., 11 (IP) out of 12 (one participant created a reduced version of a claw with no movement), 8 (PP), 7 (AP)). The action depicted picking up, grasping or holding a big item and was often accompanied by (1) a relevant action verb, (2) a noun phrase referring to a claw or (3) a noun phrase referring to a round object. A further variation was a repeated (reduced) movement on the vertical axis. It was annotated for the three groups of participants: PPs (ClawAAAAAAc, ClawWWW and ClawHHH1 with PU); IPs (ClawG, ClawYY(2)); and Aps (ClawAAAAA(1), ClawVVVV and ClawWWWW). These results are concordant with Perniss, Thompson, and Vigliocco (2010), who state that in sign forms reduplicated movement patterns communicate acts of iteration or continuity, with reduplication varieties providing further details: short, punctuated movements are contrasted with smooth, continuous recurrent motions referring to object and action representation. For instance, ASL BOOK is articulated with short, reduplicated movements, whereas OPEN-BOOK is articulated with one long motion (Armstrong & Wilcox, 2007).

Similarly, Klima and Bellugi (1979), as quoted in Armstrong and Wilcox (2007), report that even though the verb forms display both continuous and hold manner, they tend to employ a continuous sweeping motion rather than bring a sign to an abrupt halt. The noun signs, in contrast, feature reduplicated motion and a restrained manner. Therefore, verbs are typically articulated with larger movements than their corresponding nouns. In the case of claw realizations, a possible interpretation could be highlighting the action of claws going up and down or opening and closing. The short, repeated (reduced) up-down motions could denote the claw itself.

Several vertical realizations were additionally enriched with partial or full closing of fingers at the end and categorized as having an accentuated ending. They were produced by the Irish (ClawJJ, ClawP(2), ClawR(1) and ClawYY(1)) and Australian participants (ClawAAAAA(1), ClawTTTT(1), ClawVVVV and ClawZZZZ(1)). In most cases, the closing of fingers coincided with an action verb: ClawJJ “grabbing”; ClawP(2) “to pick up”; ClawR(1) “lifting”; ClawAAAAA(1) “picking rather than just (pause)”; ClawTTTT(1) “picking up like”; ClawZZZZ(1) “[picking] up a”; except for ClawYY(1) “rock in its” and ClawVVVV “rock in it”, alluding to representing a verb.

Interestingly, a motion along a horizontal axis was observed only in Polish participants (ClawNNN, ClawPPP(2), ClawMMM1, ClawWWWW1c, ClawYYYYY1c and ClawQQQ – with arced movement) and one AP (ClawAAAAA(2)). The inferred action might be smoothing ground, carrying soil from one side to the other or pushing a substance such as soil or sludge (AP). In addition, it should be noted that the Australian participant mentioned above speculated that the excavator was “picking rather than just pushing” and produced two gestures portraying picking (vertical) and pushing (horizontal). In the end, she considered lifting expressed vertically as a more feasible alternative. Overall, a possible explanation is that these Polish participants depicted the action that they had in mind rather than the one produced by a typical excavator presented in the stimulus.

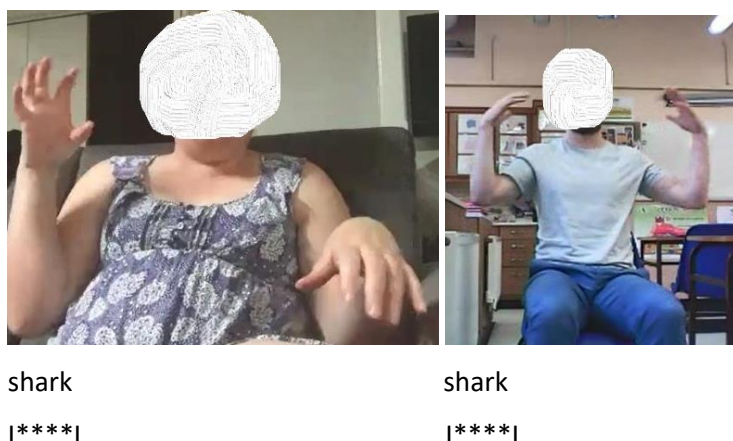
As for the movement parameter in the shark realizations, the most frequently imitated motion present in the three groups was the away from the body movement with the implied swimmer in front. Differences among the three groups were also detected, with the Polish speakers being the only group that portrayed the action of opening/closing jaws (SharkPPP, SharkOOO and SharkGGG). Altogether, with the difference in the movement parameter detected in the claw realizations, this finding corroborates the theory that different communities can overtly simulate actions in different ways.

Placing as a way of iconically recreating the referent’s location

Numerous participants used the placing strategy where one or two hands showed the location of the shark positioned in the upper gesture space concordant with BEHIND IS ON THE UPPER RIGHT/LEFT SIDE (Figure 4.11).

Figure 4.11

Examples of BEHIND IS ON THE UPPER RIGHT/LEFT SIDE: SharkVVVV (AP), SharkBB (IP)



The examples of such realizations are SharkAAAAA, SharkVVVV, SharkZZZZ(2) and SharkWWWW in the Australian group; SharkBB in the Irish group and SharkWWW(1), SharkWWW(2) and SharkCCC in the Polish group. The prevailing orientations were 1-5 spread bent and spread flat hand, positioned away from the body, mostly with palm vertical or palm down. It is possible that these realizations could also contain a portrayal element with spread fingers depicting teeth laid out in the shark's mouth. The accompanying motion was generally away body arced or straight. In this construal, the body could be interpreted as a bystander witnessing the shark attacking an imaginary swimmer located in front of the gesturer.

There were also other variations in the movement parameter. One realization exhibited repeated motion of the spread flat hand on the horizontal axis: SharkCCC (PP). The repeated movement could be interpreted as an iconic search for the location of the shark. Two Australian realizations made by the same participant (SharkZZZZ(2) and SharkZZZZ(3)) that maintained the 1-5 spread bent handshape were articulated with the closing of fingers movement that could further allude to the hands portraying the shark closing its mouth.

The realizations that were articulated with flat hand (lax) were classified as placing only, with no portrayal elements, as the flat hand provided the sole information about the shark's position in gesture space. Such examples included SharkAAA in the Irish group and SharkQQQ1(1) in the Polish group. These gestures could be seen as more schematized variants of the realizations classified as placing with portrayal. Finally, the most schematized example was SharkDDDDD (IP) that gave information about the location of the referent in an even more curtailed fashion: the participant moved his left 1-5 crooked hand slightly and placed it in center right, in line with BEHIND IS ON THE RIGHT SIDE. It is worth noting that the handshape did not change much from the one used in the rest position, and the minor movement and change of the location were the only parameters that decided about classifying this gesture as placing.

Two realizations encoded the positions of both the swimmer and the shark. These included SharkTTTT(1) and SharkTTTT(2) made by an Australian participant. In SharkTTTT(1) and SharkTTTT(2), the shark was depicted in line with BEHIND IS BEHIND and preserved the visual arrangement of the stimulus. The left hand in the palm vertical away body (PVAB) orientation encoded the swimmer and the right hand in palm lateral towards body (PLTB) encoded the shark. Additionally, SharkTTTT(2) included alternating repeated movements on both hands: the left hand was moving along a horizontal axis, whereas the right hand was moving along the sagittal axis. The motivation behind these reduplicated movements remains unclear. It is possible that their aim was to depict two entities in continuous motion, comparable to reduplication communicating continuity in sign language (Perniss, Thompson, & Vigliocco, 2010). Finally, one uncommon realization classified as placing included placing combined with drawing (SharkOOO (PP)) when the gesturer's hand approached her mouth and drew a circle outlining the shape of the jaws.

All things considered, the data reported in this section appear to be in line with Talmy's theory of Figure and Ground (Talmy, 1978, 2000).

The Figure is a moving or conceptually movable entity whose site, path, or orientation is conceived as a variable the particular value of which is the relevant issue. The Ground is a reference entity, one that has a stationary setting relative to a reference frame, with respect to which the Figure's site, path, or orientation is characterized. (Talmy, 2000, p. 184)

In this way, the shark might be interpreted as a Figure, starting its attack in the upper gesture space on the left or right side, depending on which hand is involved in gesture execution. The gesturer's body could become the Ground, and the swimmer could be imagined in gesture space, somewhere in front of the gesturer's body. In those realizations where one hand depicted the shark and the other articulator the swimmer, the two hands could be speculated as representing two Figures bound by a specific spatial relation. Finally, in the realizations where the hands represent the shark and the gesturer's body becomes a witness or two hands become two entities, the shark and the swimmer could also be compared to body partitioning (Dudis, 2004) and to dual viewpoint gestures (Parrill, 2009).¹⁴

Other strategies: miscellaneous

Having discussed two chief strategies, portrayal and placing, let us now consider realizations incorporating other strategies, including non-iconic representation. Although these categories are not the subject of investigation in this study, they were included in this analysis as they could

¹⁴ Body partitioning (Dudis, 2004) refers to subdividing the signer or gesturer's body to represent different entities/items at the same time to generate "mega blends" based on the blends created in an earlier communication. Dual viewpoint gestures (Parrill, 2009, p. 271) refer to creations that "simultaneously express multiple perspectives on an event or scene."

possibly shed light on which referents/semantic characteristics opt out to select an iconic method of representation. The first example is SharkKKKKK(1) (AA), which presented the referent on two PU hands engaged in a repeated up and down movement. The fingers on both hands adopted the 1-5 spread bent handshape; however, it is impossible to deduce whether the handshape alluding to portraying the shark's teeth was an integral part of a presenting interactive gesture or possibly presented the shark's teeth with the elements of an interactive gesture. A further example of presenting was SharkEEE, made by a Polish speaker. This realization did not preserve the visual arrangement of the stimulus: the swimmer was located in center center, whereas the shark was in a slightly lower location center lower, both presenting the referents on PUTB hands. Interestingly, "the shark" co-existed with "behind" in speech. SharkZZZZ(1) (AA) is another instantiation of the employment of a non-iconic technique, which possibly belongs to a category of gestures that frequently accompany the "I don't know" phrase. Their characteristic component is hands opening to PUTB and is associated with expressing doubt or uncertainty. In this case, the gesture co-occurred with "shark" in speech. Last, one example of pointing was detected, SharkKKKKK(2) (AA), in which the speaker pointed right with her thumb to identify the location of the shark while at the same time uttering: "[there's something you're gonna] watch out [for when you're swimming in the water]."

Other strategies: selecting different images for the same referent

It is quite common that more than one image is available to represent a given concept during the image selection stage, the choice of which could vary from language to language and culture to culture (Taub, 2001). The excavator referent is one example where the vast majority of participants selected the claw (see the sections above); however, two more images have been consistently detected as well: 1) the boulder being held by the claw and 2) the excavator's track pad referred to as the belt in the study.

Regarding the boulder, the Australian speakers produced two such realizations, the Irish three and the Polish five. All but one realization (BoulderWWW, PP) were two-handed. Not surprisingly, a spherical shape is easier to convey using two hands. Molding strategies were solely selected to depict this referent. Molding static realizations included BoulderAAAAA1c(1) (PP), BoulderAAAAA (AP) and BoulderWWW(AP), making the molding dynamic technique the prevalent one in the Irish and Polish groups. The molding dynamic gestures included various types of contouring the invisible item. The Polish participants generated four such realizations: BoulderRRR included an arced downward movement of two hands; BoulderAAAAA1c involved a reduced movement of partially closing fingers on both hands; and BoulderOOO1 evoked the image of sculpting a round shape with two hands coming closer together on a horizontal axis. Interestingly, the BoulderWWW representation was the only one executed with one hand, and the hand trajectory covered the way needed to complete nearly the entire circle. In the Irish group, three molding

dynamic representations were extracted: BoulderO with an arced downward movement of two hands; BoulderDD(1) tracing the shape of the boulder to one side; and BoulderDD(2) molding the shape with hands coming closer on a vertical axis. Overall, it could be speculated that analogous techniques were used across the three different communities in different quantities to represent round items: sculpting a sphere with molding static hands; tracing an arc or a sphere with the molding dynamic; or two hands converging, emphasizing the shape in the molding dynamic. In addition, the speech labeled the boulder in most realizations: stone; lump; boulder; clay; rock; and the gesture provided information about its shape.

Belt realizations were not as frequent as those of the claw and boulder. They were elicited in only one Irish participant and five Australian speakers, which suggests that this excavator image was not salient in the Polish group. The common form characteristics for all participants involved drawing with a stretched finger (typically digit 2, occasionally accompanied by 1 or 3) performing a repeated elliptical or circular movement. The movement was repeated twice by the Australian participants BeltJJJJ, BeltSSSS, BeltWWWW and BeltYYYY, and three times by the Irish participant. It is possible that the repetition could have been evoking the continuity of the belt's motion. Regarding the gesture-speech co-occurrence, these gestures complemented the information conveyed in speech, either defining how the belt moves (BeltQ – “it was a conveyor belt motion”; BeltJJJJ – “it goes around like that”) or attempting to label it (BeltSSSS – “[I was too] busy looking what is the word for”; BeltWWWW – “with caterpillar [tracks]”; BeltYYYY – “[lo]ng round [caterpillar tyres]”). Finally, one belt realization stood out as atypical: BeltOOOO (AP). This was performed by 2 hands with 1+2 stretched in the PUTB orientation pointing to the invisible belt. It coincided with the speech information “on tracks” labeling the referent and was classified as pointing.

To sum up, image selection is likely to be affected by different communities and deciding about the salient features in a given population. Furthermore, the choice of a depiction strategy seems to be motivated by the affordances a selected image offers. With the Excavator examples, when the claw was selected, portrayal was the most favored candidate, embodying the prototypical claw lifting debris/soil, moving it between different locations or smoothing it. The Boulder image determined the employing of molding strategies and foregrounding of the referent's shape. Finally, the belt profiled the continuity of the moving belt with the drawing technique.

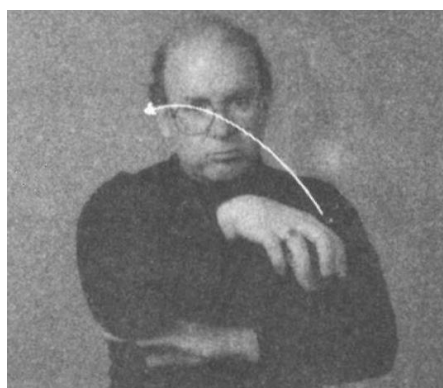
Discussion

To sum up, two prevailing strategies have been identified for referents classified as animated: portrayal for the excavator and placing (with and without portrayal elements) for the shark. With the excavator stimuli, the hand(s) generally became the claw. The results also show that the vast

majority of the participants represented the movement of the claw vertically, the way it typically moves. The literature documents examples when an animal is described by the way it moves (Calbris, 2011) when one action evokes the entire organism. Several Polish participants, however, foregrounded a horizontal action, implying carrying or smoothing instead of lifting or holding. This might suggest that these Polish speakers drew on their mental representations of a similar vehicle existent in their community. These findings are in line with the theory that a representation technique is a starting point for creating object representation in sign languages (Kendon, 2008; Ortega & Özyürek, 2019a); for instance, BSL uses of the 5 bent hand for MECHANICAL GRABBER (Brennan, 1990) (see Figure 4.12). Different images were also selected to profile other referent components (e.g., the boulder and belt in the excavator stimulus). The belt examples show that this image was considered a salient feature in Australian community but deemed insignificant in the Polish group. In contrast, foregrounding boulder and its shape was considered important in the three groups. This result is unsurprising, since informing about the referent's shape via co-speech gestures has been reported in the literature (Ortega & Özyürek, 2019a).

Figure 4.12

Example of representing the mechanical grabber



Note: Adapted from Brennan (1990)

Placing or placing combined with portrayal was usually selected to depict the shark. In portrayal, one or two-handed creations represented jaws. The spreading of teeth was the most robust feature of the referent's structure that was preserved in the majority of realizations. There were also tendencies across groups, with the Australian speakers favoring placing and the Polish equally selecting placing and portrayal. The Polish speakers also yielded the most portrayal examples, while the Irish speakers generated the lowest proportion of realizations with the largest number of placing and one portrayal realization. The results are partially in line with Ortega and Özyürek (2019a), who found that representing was favored for object-related concepts and personification for animate entities in silent gesture. Only one personification example of the shark was elicited in this study and

representing (portrayal) was favored for animated (including animate) entities. Finally, the shark stimulus (shark and shark combined with swimmer) yielded the highest number of non-iconic realizations. Further research is needed to determine if the inclusion of one animate entity or the topographical position of two animate entities boosts non-iconic gesture production.

4.2.3 Manipulability

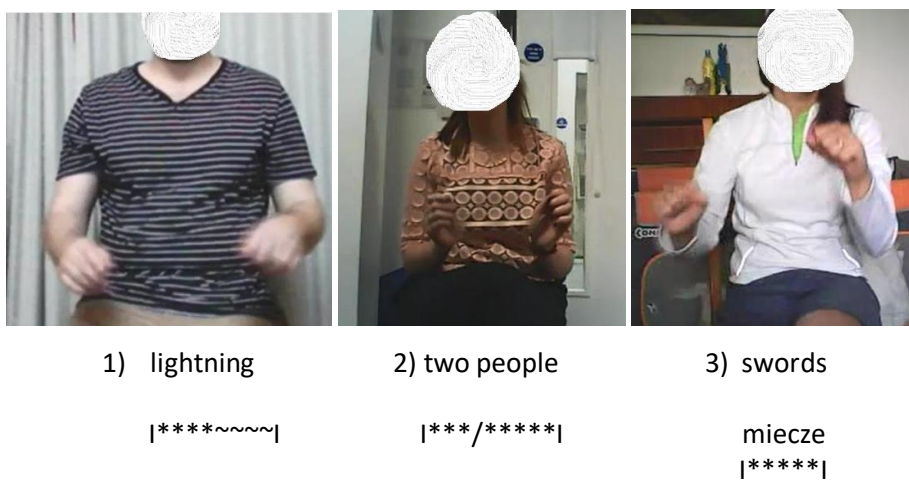
The screw (51 realizations) and lightsabers (44 realizations) stimuli generated the highest number of realizations in comparison to other referents. The specific examples along with highlighting prominent strategies are discussed below.

Handling as a prominent strategy in manipulable objects depiction

Handling was the major strategy to be selected for depicting both manipulable referents. Regarding the first referent, the Australian and Irish participants generated a comparable number of realizations, with the Polish participants creating the smallest number of such realizations (see Figure 4.13 for example realizations in the three groups).

Figure 4.13

Examples of handling for lightsabers: 1) LightsabersIIIII(1) (AP), 2) LightsabersAAA(1) (IP), 3) LightsabersPPP (PP)



Handling employing the fist handshake and the palm lateral towards center (PLTC) orientation was the most frequently used combination of parameters in the Australian group. Such examples included two-handed LightsabersIIIII(1), LightsabersDDDD, LightsabersGGGG, LightsabersKKKKK and LightsabersWWWW. Other instantiations combined one-handed LightsabersZZZZ created with the fist and palm vertical towards center (PVTC) and one-handed LightsabersRRRR(1) utilizing the fist and

palm up away center (PUAC). This uncommon orientation could have been facilitated by the proximity of the desk and the participant's elbow seeking its support. Similarly, the Irish speakers employed the fist handshake in the eight realizations; however, only two realizations were generated with palm lateral towards center (PLTC): two-handed LightsabersAAA(1) and LightsabersV. Realizations with palm vertical towards center (PVTC) included LightsabersDD(2), LightsabersW, LightsabersP(2) and LightsabersQ(4) (transitioned from palm up (PU)), and various palm up (PU) orientations: LightsabersDD(1), LightsabersQ(2) and LightsabersQ(4). As in the case of the Australian instances, the majority were two-handed. The Polish group generated the smallest number of such gestures. Two-handed realizations created with the fist and palm lateral towards center (PLTC) included LightsabersPPP, LightsabersAAAAAA1c and LightsabersTTT1. The fist and palm up diagonal towards body (PUdiTB) combination was detected in LightsabersQQQ1(2). To sum up, the fist handshake and towards center (TC) orientation seem to be the most universal parameters.

With regard to the movement criterion in handling, well over half of the Australian realizations were static: LightsabersIIII(1); LightsabersDDDD; LightsabersGGGG; LightsabersKKKKK; and LightsabersZZZZ. Other examples included the repeated alternating up-down movement depicted by LightsabersWWWW and the repeated away-towards-body movement incorporated by one-handed LightsabersRRRR(1). No significant tendencies were detected in the Irish and Polish groups. The missing movement parameter was observed in LightsabersAAA(1), LightsabersDD(2) in the Irish group and LightsabersQQQ1(2) in the Polish group. Other instances depicted a diverse array of movement types. The realizations produced by the Polish speakers included the repeated synchronous up-down movement in LightsabersAAAAAA1c, synchronous left-right in LightsabersTTT1 and down straight picturing crossing the weapons in LightsabersPPP, whereas the Irish instances depicted one-handed repeated up-down motion in LightsabersQ(2) or two-handed alternating movements towards-away body in LightsabersV. It is likely that these diversified movement patterns could be due to participants describing two lightsabers in motion, engaged in an imaginary fight.

The screw stimulus implemented a wide array of handshapes. Table 4.1 illustrates the distribution of handling realizations in the three groups. Combining all handling examples, the Polish participants generated the highest proportion of realizations, followed by an equal number of realizations in the Australian and Irish groups. Closer inspection of Table 4.1 shows that some handshapes were more readily selected than others. For instance, certain combinations of fingers 1 and 2 were adopted by representatives of all the groups, whereas others were employed by single participants from different groups; for example, various combinations of 1-5 fingers.

Table 4.1

Distribution of the handling handshapes across realizations in the three groups for the screw referent

Handshape												
	Fist	1+2 touching	1+2 connected	1-3 connected	1+2 crooked	1+2 bent	1-3 bent	1+2 stretched	1-5 touching	1-5 connected	1-5 crooked	1-5 bent
Realizations	ScrewTTTT(5)	ScrewRRRR(2)	ScrewMMMM	ScrewHHH(2)	ScrewDDD*	ScrewVVVV(1)	ScrewTTTT(1)	ScrewRRRR(1)	ScrewwP(2)	ScrewQQQ1(1)*	ScrewAAAAA	ScrewQQQ1(1)*
	ScrewO(2)	Screw	ScrewDDD		ScrewRRR	ScrewTTTT(2)		ScrewP(3)	Screw			
	ScrewO(1)	ScrewO(2)*	ScrewP(1)*		ScrewAA AAAA1c(1)	ScrewHHH(1)*		ScrewR(2)				
	ScrewDDD	ScrewO(1)*	ScrewWWWW1c(1)		ScrewQQQ1(1)	ScrewHHH(2)*		ScrewAA AAAA1c(2)				
		ScrewHHH(1)	ScrewWWWW1c(2)									
		ScrewHHH1										

Note: Color coding for the three groups:

Yellow: Australian realizations

Green: Irish realizations

Red: Polish realizations

The inclination towards 1+2 combinations was likely to be motivated by the referent's affordances. Admittedly, manipulating a small object such as a screw requires a precise hold. Grasping small narrow items using the thumb and index fingers has been documented in sign language (see the use of shape F in Brennan (1990) and gesture (see precision grip in Morris (1978) or Kendon (2004) and his analysis of the R-family gestures). The gestures marked with "*" in Table 4.1 were not included in this part of the analysis. It is possible that they serve buoy-like functions (Liddell, 2003) and will be discussed separately in the sections devoted to simultaneity.

It is also possible that various types of iconic motivation lie behind the different ways the referent was manipulated, thus affecting the handshape parameter. To begin with, the realizations that were generated with the fist(s) seem to depict the action of operating some sort of a device or a tool. ScrewDDD (PP), for instance, employed two fists as if holding something and coexisted with providing a label by speech: "urządzenie" [device]. In ScrewO(2) (IP), the participant handled a tool like a screwdriver and rotated it in ScrewO(1) (IP) with the dominant hand while the non-dominant hand adopted 1+2 touching. The gesture co-occurred with "there's someone actually doing this" that supplied additional information that the action was in progress. In ScrewTTTT(5), the fist handshape coincided with the utterance identifying the instrument "someone with a drill." The 1+2 connected

and 1+2 touching examples clearly allude to handling a small item, as confirmed by the co-occurring phrases ScrewRRRR(2) (AP) “sticking in,” ScrewI (IP) “[a screw that is] being [(unintelligible) screwed into],” ScrewHHH(1) (PP) “screw,” and ScrewMMMM (AP) “screw or something.” As for the movement parameter, the straight motion, generally down, depicted the action of pushing the screw into the imaginary surface. A wide range of handshapes was selected across the three groups for this particular movement, and no handshape preference was detected (see Table 4.2).

Table 4.2
Distribution of screw handling handshapes with straight movement

Handshape								
	1-5 touching	1+2 crooked	1+2 bent	1+2 Connected	1-3 bent	1-3 connected	1-5 bent	1+2 touching
Movement								
Realizations	ScrewP(2)	ScrewAAAA AA1c(1)	ScrewTTT T(2)	ScrewW WWWW W1c(2)	Screw TTTT(1)	ScrewHH H(2)	Screw R(1)	ScrewRR RR(2)
		ScrewQQQ 1(1)		ScrewDD DD				

Note: Color coding for the three groups:
Yellow: Australian realizations
Green: Irish realizations
Red: Polish realizations

Another prominent action depicted turning a screw either with a rotating movement of the wrist or revolving fingers (see Table 4.3). As with the handling realizations employing the straight movement, these realizations utilized a wide range of handshapes.

Table 4.3
Distribution of screw handling handshapes with rotating wrist and revolving fingers

Rotating Wrist	Revolving Fingers
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1+2 touching	1+2 crooked	1+2 connected	1+2 stretched	1-5 crooked	1+2 touching	1+2 Bent	1+2 stretched	1+2 connected
ScrewI	ScrewRRR	ScrewMMM	ScrewR2)	ScrewAAAA	ScrewHH(1)	ScrewVVV(1)	ScrewAAAAA1c(2)	ScrewWWW1c(1)
			ScrewRRRR(1)				ScrewP(3)	

Note: Color coding for the three groups:

Yellow: Australian realizations

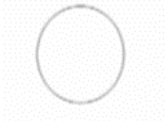
Green: Irish realizations

Red: Polish realizations

Portrayal as the second favored strategy in manipulable objects depiction

In portrayal, two types of articulatory plurality (Börstell, Lepic & Belsitzman, 2016) were detected: plural hands and plural fingers. With plural hands, the flat hand on both articulators was the dominant handshape positioned in PVTC or PDTC. The Australian and Irish speakers generated a comparable number of such realizations: LightsabersLLLL(1); LightsabersLLLL(2); LightsabersVVVV(1); and LightsabersVVVV(2) in the Australian group; and LightsabersAAA(2); LightsabersP(1); and LightsabersAAA(3) in the Irish one. Several realizations in the Polish group have proven difficult to classify either as portrayal or instances of interactive gestures (Bavelas, Chovil, Lawrie & Wade, 1992) or gestures with pragmatic functions (Kendon, 2004). For instance, LightsabersQQQ was coded as plural hands portrayal, with hands possibly representing moving lightsabers. The left dominant hand adopted the spread flat hand, and the right hand could be a reduced version of the dominant one with 2+3 stretched (the participant is left-handed). Other problematic examples included LightsabersQQQ1(3), LightsabersDDD, LightsabersFFF and LightsabersQ(3) (IP). Eventually, they were classified as presenting, as the speakers seemed to have presented the referent on PU hands rather than employed hands to become lightsabers, as in the case of the portrayal examples. Even though it was not intended that gestures serving a pragmatic role be investigated in this project, these examples were included in the analysis as their function remained ambiguous, and it cannot be ruled out that they also played a referential role.

Table 4.4 *Movement variations in portrayal realizations*

movement					
	missing				
realization	ScrewTTT1(1)	ScrewAAAAAAc	ScrewLLLL(2)	ScrewAAA	ScrewLLLL(1)
			ScrewVVVV(2)		ScrewQQQ(2)
			ScrewJJJJ(1)		ScrewQQQ1(3)
			ScrewP(4)		ScrewQQQ1(2)
			ScrewDD		Screw TTT1(2)
			ScrewOOO		

Note: Color coding for the three groups:

Yellow: Australian realizations

Green: Irish realizations

Red: Polish realizations

Interestingly, the plural fingers portrayal examples, except for one Polish realization LightsabersQQQ1(1), were generated exclusively by the Australian participants: LightsabersIIIII(2); LightsabersSSSS(1); LightsabersSSSS(2); LightsabersAAAAA(1); LightsabersJJJJ; and LightsabersAAAAA(2). In these cases, two stretched index fingers were transformed into two lightsabers caught in the act of crossing, attempting to cross or remaining crossed in gesture space in front of the speaker.

Portrayal was the second favored strategy to depict the screw. The Polish participants generated the highest proportion of such realizations, while the Irish speakers generated the lowest. The 2 stretched handshape was selected for all but one realization, showing a clear preference for this handshape across the three groups (see also G shape and analogous ways of representing long thin objects; e.g., cigarette, pencil or long narrow instruments such as chopsticks, sharp blade in BSL (Brennan, 1990). The only realization that was executed with a different handshape was ScrewTTTT(3) AP, in which 1-5 spread crooked opened to 1-5 bent. It is probable that this gesture contains metaphoric elements, and it will be analysed in detail in Chapter 5. In the second parameter, the PD orientation was the most frequently adopted. In addition, several movement

variations were exposed (see Table 4.4). The movement straight down was selected in the three populations, while the circle repeated parameter was favored by the Polish group.

Other strategies

Other realizations were classified as molding static, molding dynamic and enactment and did not yield significant numbers. With regard to the Lightsabers referent, two realizations classified as molding static and one as molding dynamic were produced by the same Australian participant: one-handed LightsabersRRRR(2); two-handed LightsabersRRRR(3); and two-handed LightsabersRRRR(4) with the away-body motion. Two-handed LightsabersRRRR(3) and LightsabersRRRR(3) are interesting examples from a simultaneity perspective and will be discussed in Section 4.4. One molding dynamic example was detected in the Irish group: LightsabersQ(1). The same handshape was favored for all these realizations – 1+2 bent, however, different orientations were selected. Palm up (PU) and palm lateral (PL) was selected by the Australian participant and palm down (PD) by the Irish participant. It remains to be seen if there is a clear bias towards PD orientation in the Irish population. In regard to the enactment strategy, one example was identified, LightsabersPPP1, made by a Polish participant. The realization depicted “shiny swords” with fingers engaged in irregular movements imitating swords reflecting light and will be further analysed in Chapter 5.

Screw generated a small number of molding gestures, with the Australian speakers producing the most realizations and the Irish the fewest. Molding static largely employed the 1+2 bent orientation. The examples contained ScrewTTTT(4), ScrewLLLL(3), ScrewLLLL(5) and ScrewLLLL(6) in the Australian group, and ScrewWWWWW1c(3) and ScrewQQQ(1) in the Polish group. Other handshapes included 1+2 stretched ScrewWWWW AP and 1+2 crooked ScrewP(1) IP. One example of the molding dynamic was elicited, ScrewLLLL(4) AP, which employed 1+2 crooked and a diagonal down-up movement. The orientation parameter showed a consistent pattern and employed PV and PD orientations. Further research should be undertaken to determine whether there is a link between a particular orientation and the referent’s shape depicted by molding. Overall, all these realizations seem to profile the length of the screw. The molding static examples described the length by demarcating its top and bottom, whereas the molding dynamic instance sculpted its sides with two fingers going diagonally down and coming back up along the same path. The accompanying speech generally either provided a label, e.g., ScrewQQQ(1) PP “metalowy wkręt” [metal screw] or ScrewWWWWW1c(3) PP “I don’t know this metal thing,” or alluded to the quality possessed by the referent, e.g., ScrewP(1) IP “quite a long [screw],” ScrewLLLL(3) AP “the thread is sil[ver]” and ScrewLLLL(4) AP “it looks as it m[ight] only be 2 or 3 millimetres.”

Discussion

Taken together, these results provide important insights into objects that afford manipulation. The screw and lightsabers referents generated the highest number of realizations in comparison to other referents. The result is concordant with other studies that have found that manipulability is a significant predictor of creating iconic gesture (Hostetter, 2014). As a result, the lightsabers and screw's affordances (Gibson, 1979) evoked action simulations overtly expressed as gesture in line with the GSA framework (Hostetter & Alibali, 2008).

Handling turned out to be the most prominent strategy for both referents. Regarding the lightsabers, the fist handshape was favored by the three groups. Analogous examples were found in Swedish silent gesture (Ortega & Özyürek, 2019a) for a range of various tools that can be handled: screwdriver; toothbrush; spoon; and actions with objects: to cut with a knife, to saw, to comb. With the screw referent, a diverse array of handshapes was detected and the inclination towards 1+2 combinations was also found across the three communities. This specific handshape preference is likely to be motivated by the referent's affordances and opportunities to handle a screw in various ways. In addition, the Australian speakers generated the biggest number of lightsabers handling realizations and the Polish participants the smallest. With the screw realizations, the Polish participants produced the highest proportion of realizations, followed by an equal number of realizations in the Australian and Irish groups.

The portrayal strategy yielded the second largest number of realizations for both referents. In the lightsaber realizations, the Australian and Irish speakers generated a comparable number of plural hands realizations, and the Polish speakers created the least. The dominant handshape was flat hand (for a similar representation, see a BSL B hand used to depict a flat blade (Brennan, 1990, p. 85)). Additionally, plural fingers realizations were produced exclusively by the Australian participants (except for one Polish realization), with 2 stretched as the sole handshape (see also a BSL G hand depicting long narrow instruments; e.g., a sharp blade (Brennan, 1990, p. 88)). In the screw gestures, the Polish participants generated the highest proportion of such realizations, while the Irish speakers generated the lowest. The 2 stretched handshape was also selected as the favorite across the three groups.

The data reported for the screw also appear to support the assumption that the same underlying action can be profiled in different strategies. The straight movement down in handling, depicting pushing the screw down, is analogous to the movement of the screw going down in portrayal. The circular action of revolving fingers in handling could be compared to the index finger travelling around in a circle.

Overall, handling followed by portrayal have been the most prominent strategies in manipulable objects depiction. Molding was the third selected strategy; however, this did not elicit as many realizations as the first two strategies. These results are in agreement with those obtained

by Padden et al. (2013), who found that handling and instrument types were most frequently used for tools in all groups (signers and silent gesturers), with instrument forms favored by signers and handling being preferred by gesturers. More finger complexity in representing an object was found in signs than in gestures. More finger complexity in handling handshapes was also detected in gestures than in signs in Brentari, Coppola, Mazzoni and Goldin-Meadow (2012), which agrees with the varied finger complexity in handling realizations extracted in this study. These findings are also in line with Masson-Carro et al. (2016), who determined that action affordances impact the number of gestures produced (the manipulability referents produced the largest number of gestures) and partially that high affordance items mostly generated action simulations triggering grasping objects gestures (here, not only handling but also portrayal elicited high numbers). To sum up, a depiction strategy selection hierarchy for manipulable objects could be created according to the criteria presented in Figure 4.14.

Figure 4.14

Preference criteria for depiction strategy selection with manipulable objects

Handling → Portrayal → Molding

4.2.4 Plurality

The plurality referents involved presenting a large number of entities of the same type in the same visual and included worms, crowds and leaves. Overall, molding strategies generated the highest number of realizations; however, clear tendencies towards a specific strategy were detected across communities for various referents. Worms implemented the widest range of strategies: portrayal; personification; molding; handling; and drawing, with portrayal as a second dominant strategy after molding. Crowds and leaves clearly favored molding strategies. The leaves stimulus did not elicit as many realizations as other referents presented in the analysis sections. Furthermore, several leaves realizations were problematic in terms of being categorized into one of the depiction strategies and were coded as inconclusive.

Molding employing internal and external metonymy to depict plurality

Two types of metonymic relations, internal and external metonymy, were particularly conspicuous in molding static strategies used to depict plural referents. Internal metonymy was singled out to represent a part for the whole by selecting one representative for the entire collection, and external metonymy employed an external contiguity relation in which the hand(s) explored the referents as an entire set. What follows is an account of realizations grouped around two molding strategies boasting internal and external metonymic affiliations.

Molding static with internal metonymy

In these examples, the hand(s) profiled a size of the referent depicting one representative of the entire set. Seven such realizations were identified in the Australian group, two in the Polish group and no examples were detected in the Irish participants. The Polish realizations included WormsXXX articulated with two mostly flat hands molding a long thick silhouette. The WormsSSS realization emphasized the size of the referent, with the hand taking on the 1+2crooked handshape and the PLTC orientation. In both cases, the accompanying speech provided the referent characteristics: “robaki ale takie dlugosci dwa, trzy centymetry” [worms] they were[two, three centimetres long] (WormsSSS) and “robaki w stadium takim gasien[cy]” [worms in the caterpillar stage] (WormsXXX).

Figure 4.15

WormsSSS (PP) coded as molding static

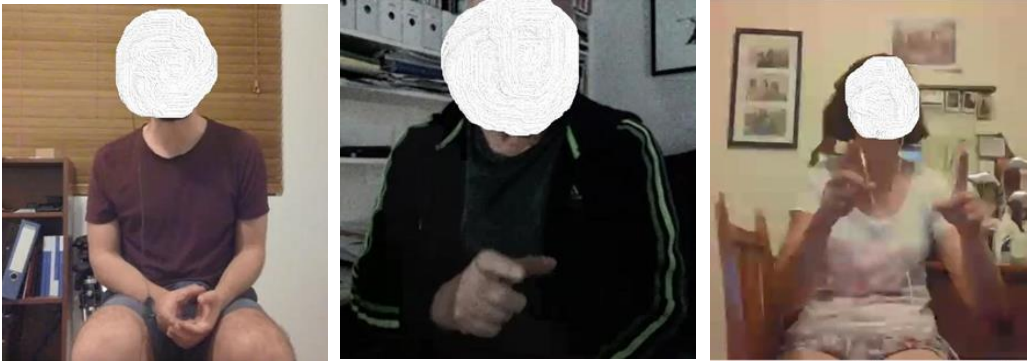


worms in the caterpillar stage
robaki w stadium takim gąsienicy
|~~~~~*****~|

Regarding the Australian variants, and similarly to the just discussed Polish realization WormsSSS, these seem to encode the size of the referent depicting its length (e.g., WormsGGGGG, WormsJJJJ(1) and WormsRRRR(2)). The length was not identical in each case, which was manifested by the selection of various two-fingered handshapes. For instance, WormsGGGGG adopted 1+2bent on his dominant hand and WormsRRRR(2) adopted 1+2 bent in a single-handed gesture. In comparison, WormsJJJJ(1) was coded as 1+2stretched on both hands, suggesting a bigger size (see Figure 4.16).

Figure 4.16

Australian realizations 1) WormsGGGGG, 2) WormsRRRR(2) and 3) WormsJJJJ(1) depicting the length of the referent



- 1) these long things that looked like kind of uhm large witchetty grubs
|~~~~~|
- 2) about uh 6 centimeters long
|~~~~~|
- 3) they look like witchetty grubs but I don't know if you know what that is they like they
~~~~~  
quite a bit bigger  
~~~~~|

Regarding the information communicated by speech, again, the utterances alluded to the size of the referent by providing its specific characteristics. Additionally, WormsGGGGG and WormsJJJJ(1) referred to the referent as “witchetty grubs” (see the speech transcription copied from the Excel document below). Not surprisingly, this particular label was used only by the Australian participants, as the larvae are native to Australia and do not exist in Ireland or Poland.

WormsGGGGG: “these long things that looked like kind of uhm large witchetty grubs”
 WormsJJJJ(1): “they look like witchetty grubs but I don't know if you know what that is they like they quite a bit bigger”
 WormsRRRR(2): “about uh six centimeters long”

The last three molding static realizations were produced by the same participant: XXXX. These were coded separately as they differed in form. In WormsXXXX(1) the left hand with 1+2bent was clearly dominant, while WormsXXXX(2) could be interpreted to include a beat gesture (McNeill, 1992) when the 1+2bent handshape was lifted. In WormsXXX(3), the two hands became dominant, adopting the 1-3bent handshape. Like the previously discussed molding static examples, these realizations profiled the size of the referent in a similar manner.

Finally, several realizations in the Australian group contained a mix of molding static features and other strategies and were classified as hybrid. The combinations included integrating molding static and dynamic, e.g., WormsAAAAA(2) and WormsVVVV, and portrayal and molding static, e.g., WormsRRRR(1). WormsRRRR(1) realization has already been analysed in the paragraph dedicated to portrayal. WormsAAAAA(2) and WormsVVVV will be closely examined in Section 4.4 devoted to simultaneity.

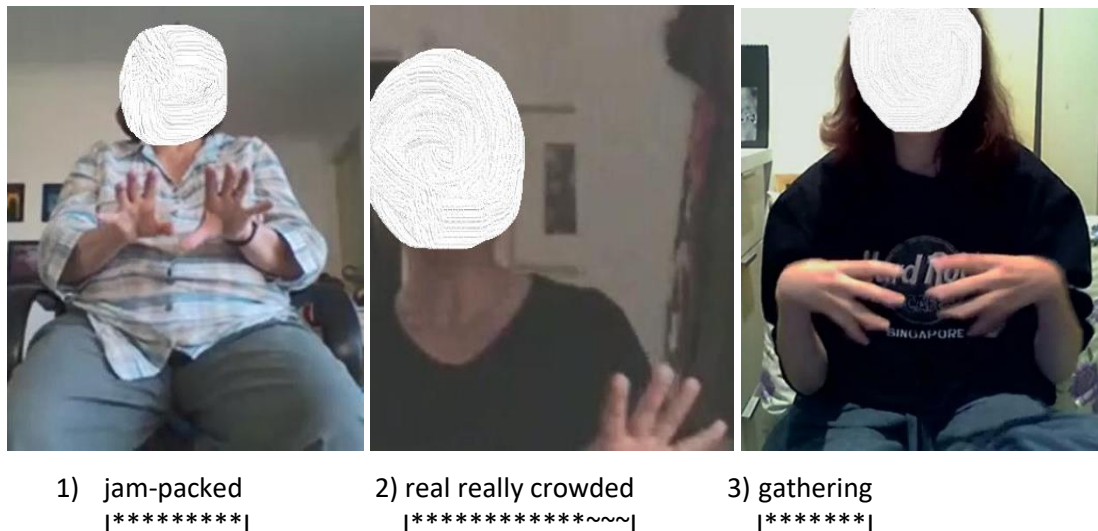
Molding static with external metonymy

Several realizations depicted a round form with the 1-5 spread bent handshape, as if sculpting a sphere, and were classified as molding static. This particular molding alternative combined with an external contiguity relation has proven to be more frequently employed than the previously discussed strategy and was identified in gestures generated by the three referents pertaining to plurality: Crowds, Leaves and Worms. The principal findings grouped around each referent are presented below.

The Australian participants produced the largest number of such gestures (seven realizations) with a range of orientations: PD; PL; and PV. The PD orientation examples included CrowdsAAAAA, where two hands molded a spherical shape with PDAB and 1-5spread bent that co-existed with “jam-packed” in speech, one-handed CrowdsTTTT where the spread flat hand in PDAB arose with “really really crow[ded]” and CrowdsCCCCC(2) where two hands adopted the PDTC orientation and the “other” handshape (fingers 2-4 were rather stretched than spread or bent). This gesture was accompanied with “[crowds] gathering.” Their visual representation is provided in Figure 4.17.

Figure 4.17

Crowds realizations molding a sphere: 1) CrowdsAAAAA, 2) CrowdsTTTT 3) CrowdsCCCCC(2)



All the realizations employing the PL orientation were two-handed. CrowdsCCCCC(1), for example, used PLTB with the right hand 1-5spread bent and the left hand more like 2-4 stretched. The co-existing speech provided the information “crowds.” CrowdsDDDD(2) was generated with PLTC, flat hands and occurred with “like [the outskirts of Rio].” CrowdsSSSS was created with PLTC 1-5 spread bent on the left hand, 1-5 spread crooked on the right hand and “[so many people on the beach you couldn't see the] san[d]” in speech. Overall, it seems that the smaller the distance between the two

hands, the more curved the handshape becomes in representing a smaller entity (for a detailed look, see Figure 4.18).

Figure 4.18

Differences in the size of the depicted entity: 1) CrowdsSSSS, 2) CrowdsCCCC(1), 3) CrowdsDDDD(2)

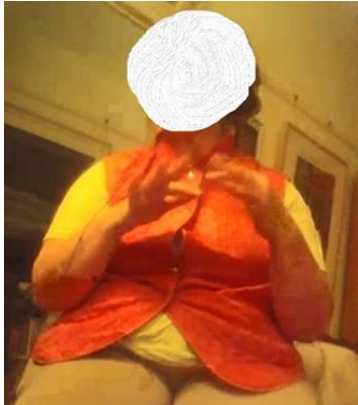


- 1) people on the beach you couldn't see the sand
|~~~~~|
 - 2) crowds
|***~|
 - 3) like the outskirts of Rio
|***/*****|
-

The next three Australian realizations using PV were also two-handed and comprised CrowdsJJJJJ(1) employing PVTC, CrowdsJJJJ(3) PVAB and PVTC, and CrowdsLLLL(2) 2h PVTC. Finally, the last Australian gesture, CrowdsDDDD(1), could be classified as hybrid: two hands took on PDTC 1-5 spread bent and molded a spherical shape. Additionally, fingers engaged in repeated irregular movements. As the gesture occurred with “or a [densely populated village],” it could be speculated that it also contained portrayal elements in which fingers became individual villagers.

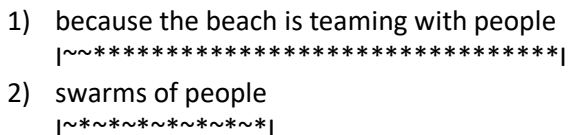
Figure 4.19

Irregular movement of fingers in CrowdsDDDD(1) (AP)



Regarding the Irish population, three such examples were elicited. In CrowdsP(2), the right hand took on the palm lateral towards center (PLTC) orientation and the spread flat hand handshake marked the boundaries of the entire collection co-occurring with “really [crowded beach].” This realization could contain elements of interactive gestures as it was clearly produced for the interlocutor by extending the speaker’s arm and reaching out to the interlocutor. CrowdsQ molded a spherical entity with two hands in 1-5 spread bent, palm lateral diagonal towards center (PLdiTC) and referred to crowds in speech: “[be]cause the beach is teeming with people.” Finally, CrowdsS applied two spread flat hands and PLTC that coincided with “swarms [of people]” (Figure 4.20).

Molding static crowds examples in the Irish group: 1) CrowdsQ and 2) CrowdsS



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“crowds”. In CrowdsAAAAAA1c, two hands adopted the spread flat hand handshape, which could suggest depicting a slightly bigger form and PLTC. The gesture also co-occurred with speech conveying the information about a large amount of people “crowded.”

Figure 4.21

Molding static crowds examples in the Polish group: 1) CrowdsQQQ1 and 2) CrowdsAAAAAA1c



- 1) crowds of people
|~***/*~~~~~|
- 2) crowded
|~~~~~|

Two more referents, leaves and worms, used the same strategy; however, they did not elicit as many examples as the crowds. In the leaves referent, for instance, spread hand variants and lax flat hand in palm down away body (PDAB) located in the lower gesture space sculpted the top of a pile of leaves. Such examples included two-handed LeavesAAAAAA1c(2) and one-handed LeavesAAAAAA1c(1) in the Polish group, and one-handed LeavesJJJJ(4) in the Australian group. One example in the worms category was identified: WormsCCCC (AP). With two hands in palm lateral towards center (PLTC) and 1-5spread bent, it looks as if the participant sculpted a roundish object between her hands. The information provided by speech, “worms” and the roundness of the shape may suggest that the participant depicted an entire collection of worms (Figure 4.22).

Figure 4.22

Sculpting a spherical shape in WormsCCCCC (AP)



worms
|*****|

Molding dynamic with internal metonymy

These creations included realizations that depicted the shape of one representative standing for the entire collection. They profiled a long thick object with the help of a tracing action along a horizontal axis. As in the case of examples employing molding static combined with internal and external metonymy, the Australian speakers elicited the greatest number of these gestures: three realizations, followed by one Polish realization, with none detected in the Irish group. The Australian examples included WormsAAAA(3), WormsAAAA(5) (both classified separately due to different handshape parameters) and WormsRRRR(3). In WormsAAAA(3), for instance, both hands assumed the 1+2crooked and 1-3crooked handshape and simultaneously engaged in molding the shape by moving in two opposite directions. The gesture was accompanied by "shape" in speech. In WormsAAAA(5) the movement parameter was analogous, but the handshape was coded as 1+2bent and 1+2bent moving to 1+2crooked, and the speech provided the information "worm thing." The WormsRRRR(3) realization featured the 1-5crooked hand engaged in haptic exploration repeatedly moving right-left. Again, the speech supplied a characteristic of the referent "quite plump." The only Polish realization, WormsHHH1(2), was created in a similar fashion. The hand with the 1-5bent handshape moved right with an arced motion molding a long-curved shape. The speech provided the referent's feature much differently than the shape "brownish". To sum up, all these creations indicated the referent's shape by tracing, and the co-occurring speech either provided a label or referred to its typical aspect.

Molding dynamic with external metonymy

Molding dynamic realizations exploiting external metonymy entailed an active haptic exploration of the entire collection. Eight such realizations were identified in the Polish group, four in the Australian and three in the Irish group. They followed two basic patterns. The first involved tracing the boundaries/extent of the entire collection typically arranged as a circular/spherical entity; the second entailed dynamically enclosing the collection into a small roundish shape (see Figure 4.23). A more detailed account of the two patterns accompanied by various examples is given below. Five Polish realizations followed the first pattern. In CrowdsAAAAAAc, the participant executed an arc right, and the 1-5 spread bent handshape was selected to explore the very top of the arc. The referent was also defined by speech: “pełne ludzi” [filled with people].

Figure 4.23

Example of tracing extent of the entire collection in CrowdsAAAAAAc (PP)



filled with people
pełne ludzi
|*****|

In CrowdsOOO, the participant performed a one-handed arced movement away from the body whereas in CrowdsDDD1 both hands were engaged in a simultaneous arced motion downwards conveying the concept of a collection arranged in a sphere that coincided with ‘people’ in speech. The hands adopted a 1-3 spread on the left hand and 1+2 spread on the right hand that seemed to contribute to conveying a 3D spherical shape. Other Polish examples that incorporated the movement type included LeavesQQQ and LeavesAAAAAA1c(1). Similarly, in Irish CrowdsP(1) (Figure 4.24), the right spread flat hand in palm vertical towards center (PVTTC) explored “loads of people” by producing a circular motion and LeavesR employed a circle co-existing with “leaves all around” in speech.

Figure 4.24

Exploring a round collection in CrowdsP(1) (IP)



there's loads of people
|~~~~~*****|

In the Australian group WormsRRRR(4) was the only realization applying a circular motion type. Others differed from the Irish and Polish gestures by adopting a different movement type. Instead of engaging a circular or arced motion, these utilized a straight alternative: CrowdsJJJJ(2) with PVAB exploring a vertical entity and CrowdsVVVV with PDAB a horizontal one. In addition, in Australian LeavesVVVV(2), the movement type matched the straight motion of the previously discussed CrowdsJJJJ(2) and CrowdsVVVV exploring a flat surface.

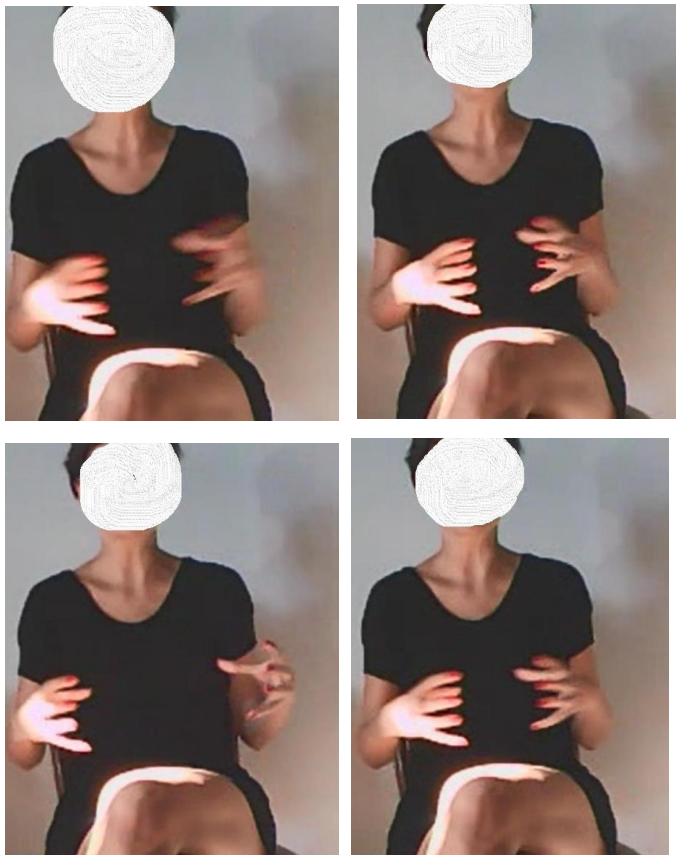
Just before we move to the second pattern, WormsRRRR(4) (AP) and WormsAAAAAAc ()PP will be discussed as examples of compiling the molding dynamic (tracing a circular entity) and portrayal (fingers engaged in irregular movement, possibly representing single worms). The fact that this combination has been observed in two communities might suggest that blending two strategies in one realization might be a more universal process envisaged for more than one particular community.

The second pattern involved an action of enclosing multiple invisible objects in a small, round space. These realizations were classified as a molding dynamic; however, it could also be argued that they contained handling elements. Ultimately, the hands manipulated the invisible objects trying to contain them. Nevertheless, they were coded as presenting a molding dynamic, as the final product was a collection of entities whose characteristic round shape was sculpted by two hands. The examples were extracted from the Polish group (three realizations), with only one Irish example and none found in the Australian speakers. The Polish instantiations included CrowdsDDD, CrowdsTTT(1) and CrowdsTTT(2). To take a closer look, in CrowdsDDD and CrowdsTTT(1), the participants enclosed

the invisible items with a simultaneous movement of both hands coming towards the center center gesture space. Additionally, the 1-5spread bent handshape informed about the roundish contour of the set. CrowdsTTT(2) profiled the same action; however, it was reduplicated several times at a higher velocity. In speech, these gestural manifestations were accompanied by expressions referring to large amounts of people: CrowdsDDD “jak mrówki” (like ants), CrowdsTTT(1) “w tłumach” (crowded) and CrowdsTTT(2) “w skupiskach.” Figure 4.25 displays CrowdsTTT(2) with a sequence of movements of two hands first converging then diverging and converging again.

Figure 4.25

Example of containing a collection in CrowdsTTT(2) (PP)



in clusters
w skupiskach
|*****|

The Irish example, CrowdsR (IP), replicated CrowdsTTT(2)’s parameters and the accompanying speech provided the information “don’t think it [ever gets that crazy].”

Interaction of two molding strategies across languages

A surprising finding emerged from the data in the Polish group relating to an interaction between two languages and the depiction type selection while describing crowds. Unlike in other studies

reporting that gestural contents are constrained by the language with which they co-exist (Kita & Özyürek, 2003), in these examples the participants DDD and AAAAAAc both generated different gestures whose patterns were analogous to the turn recorded (first or second) rather than bound to one particular language. Participant DDD used two hands to gather and mold an invisible collection of objects in Polish during the first recording and performed two symmetrical arcs to depict the collection in English during the second recording. Conversely, Participant AAAAAAc used two hands to sculpt an invisible collection in English during the first recording and performed a one-handed arc in Polish during the second session. A possible explanation is that constraints other than language played a more dominant part in creating these gestures. Goldin-Meadow and Alibali (2013) state that, according to the gesture as simulated action framework (Hostetter & Alibali, 2008), linguistic factors may but need not affect gestural form provided that they affect simulations activated during speech production, as gesture and speech arise from the same simulation. Furthermore, Galati and Brennan (2014) discussed a wide variety of cognitive and communicative factors constraining gesture creation, finding that speakers were more likely to produce fewer representational gestures to the old addressees rather than to the new ones. The speakers also tended to attenuate gesture size and iconic precision to the old addressees rather than the new ones. In this study, the two participants were recorded in a counterbalanced order. Participant DDD was recorded in Polish and then in English. Participant AAAAAAc was recorded in English first and then in Polish on Skype. When recorded for the first time, they both produced two-handed enclosing gestures to the new addressee. When recorded for the second time, they both produced the arced gestures to the same addressee that could be considered an old addressee. Accordingly, it is possible that there is a link between the selection of a particular depiction style and new/old addressees; however, with a small sample size, caution must be applied.

Portrayal selected with animate/animated plural entities

This technique was generally selected only for one referent pertaining to plurality, worms, and two representations of falling leaves. Therefore, it is possible to state that plural animate/animated entities favor other depiction strategies than plural non-animate/non-animated referents, and portrayal is a likely candidate for the first category. In the portrayal examples elicited in the study, the handshape took on the 1-5 bent or 1-5 spread bent handshape, the PDAB orientation and fingers engaged in the repeated irregular movement of the fingers. This could be compared to the way insects move their legs while crawling over something or in the movements of larvae. The realizations were detected in the Polish and Australian group. In the Polish group, four such examples were identified: WormsAAAAAAc; WormsHHH; WormsPPP and WormsTTT1. The WormsPPP realization executed with 1-5bent, PDAB and irregular movement of fingers is presented as an example below (Figure 4.26).

Figure 4.26

Irregular movement of fingers in WormsPPP (PP)



on the French toast I think there was something disgusting
na tych grzankach mi sie wydaje jakies coś tam ochydne
|~~~~~*****|

In the same vein, the hand in WormsAAAAAAc depicted the insect's legs with 1-5bent, PDAB and a repeated irregular movement of fingers (Figure 4.27). However, it also introduced additional information by producing a simultaneous circular motion that could emphasize a collection of insects crawling over a contained area (see the realizations gathered around molding dynamic with external metonymy above).

Figure 4.27

Irregular movement of fingers and circular motion in WormsAAAAAAc



and everywhere disgusting worms
i wszędzie takie paskudne robale
|~~~~~*****|

The WormsTTT1 realization did not display the same movement parameter (only one finger on one hand moved repeatedly up and down). Nonetheless, both hands in the PDAB orientation, one adopting the 1-5 spread bent handshape and the other 1-5 spread crooked, could convey the concept of an animate creature in motion.

Regarding the information communicated by speech, this referred to (1) something disgusting: WormsAAAAAAc “i wszedzie takie paskudne robale” (and everywhere disgusting worms) and WormsPPP “a na tych grzankach mi sie wydaje jakies cos tam ochydne” (on the French toast I think there was something disgusting); or (2) labeled the referent: WormsHHH “dздzownice” (earthworms) and WormsTTT1 “animals, these animals.”

Interestingly, there were no portrayal examples in the Irish group. The Australian participants produced the following realizations: WormsAAAAA(4); WormsRRRR(1) – a combination of portrayal and molding; WormsRRRR(4); WormsTTTT(2); and WormsZZZZ. Overall, as in the case of the Polish portrayal depictions, the hand or hands became the animal that could be interpreted as fingers encoding animal legs or fingers encoding a large but unspecified number of wriggling maggots. For example, in the WormAAAAA(4) realization, fingers on both hands engaged in repeated irregular movement, and the co-occurring speech labeled the referent “insects.” The orientation parameter, however, did not parallel the palm down (PD) orientation in the Polish group. Here, the left hand adopted palm up towards body (PUTB) and the right one transitioned from palm lateral towards center (PLTC) to palm up towards body (PUTB) (see Figure 4.28).

Figure 4.28

Example of depicting worms in WormsAAAAA(4) (AP)



they weren't like insects

|~~~~~*****|

Several Australian realizations displayed a form closely analogous to certain Polish realizations, suggesting that some mental images could be very much alike cross-culturally. For example, the WormsTTTT(2) portrayal bore a striking similarity to WormsTTT1 produced by a Polish participant by preserving the same handshape (1-5spread bent, orientation), PDAB and the absence of the irregular fingers motion. The co-existing speech identified the creature as a “crustacean” in WormsTTTT(2), and in TTT1 classified it as “animals.” It seems possible that these two realizations depicted little animals with shells, and fingers stood for the animals’ appendages. A further Australian realization, WormsRRRR(4), could be linked with WormsAAAAAAc (PP). Similarly, it employed the PDAB

orientation, the multi-motion of irregular fingers and the hand travelling along the circular axis. The gesture coincided with “insect larvae crawling over this” in speech. As was mentioned with the examples linked with the molding dynamic and external metonymy, certain ways of merging two different strategies appear to be more universal than others.

Other interesting examples in the Australian group are WormsRRRR(1) and WormsZZZZ, which are both hybrid realizations. WormsRRRR(1) is a combination of portrayal, where the right hand profiled wriggling creatures or a creature moving its legs and the molding static where the left hand depicted the size (Figure 4.29). WormsZZZZ integrated two portrayal strategies on two hands: the right depicted insects with PDAB and the movement of irregular fingers; and the left represented the bun.

Figure 4.29

Example of hybrid realization combining portrayal and molding static: WormsRRRR(1) (AP)



large larvae
|~~~~*****|

In regard to comparable representations found in other studies, in Ortega and Özyürek (2019a) the participants depicted the spider in silent gesture, and an analogous form was described. The mode of representation was classified as representing, whose definition is in line with the study’s portrayal examples. Similarly, in sign language, signs of animals are produced by encoding a salient part of the animal body which forms a metonymic connection with the concept of the entire animal (Taub, 2001). Finally, the interpretation that these creatures are maggots writhing over a certain area, with all the fingers referring to a great but unspecified number of larvae, is concordant with number-for-number iconicity (Taub, 2001) where the number of articulators stands for the number of referents in more or less precisely.

Turning now to portrayal with other referents, this strategy generated only two realizations: LeavesSSS made by a Polish speaker and LeavesP made by an Irish participant. Both employed the spread handshape, PD orientation and irregular movements of the fingers. It seems possible that the fingers stood for individual leaves falling off the tree. Together with the worms realizations, this

could be another example when an irregular movement of single fingers portrays individual animated entities.

Handling with plural entities

To move now to a consideration of handling, this strategy was implemented across the three groups for worms and leaves. None of the handling examples were selected for the crowds referent, which poses a question about the various ways of depicting different plural entities. A likely explanation is that of discrepancies in mental representation of small and big entities/items. Worms and leaves are small items that afford to be easily handled and manipulated, whereas crowds can be associated with representing a human body far too big to be lifted and manipulated by hands.

The handling technique generally entails operating on an object. In this case, the participants were trying to handle a small item by using a variety of fingers-in-contact handshapes and depict one representative of the entire group (internal metonymy). That is to say, fingers were grasping, rubbing and picking the referents. The Australian participants produced the largest number of handling realizations: WormsAAAAA(1); WormsOOOO; WormsTTTT(1); WormsWWWW; LeavesJJJJ(1); LeavesJJJJ(5); LeavesVVVV(1); and Leaves/TreesVVVV(3). The Irish generated two such gestures: WormsQ and WormsR. Interestingly, these were the only instances of Worms depictions produced by the Irish speakers. The Polish group contained two examples: WormsHHH1(1) and LeavesQQQ1. A more detailed account of specific examples is given below.

Regarding the worms referent, the Australian group boasted the most diversified handshape range, extending from 1-3 connected to 1-5 connected and numerous techniques of handling the referent. For instance, in WormsAAAAA(1), the participant adopted the 1-3 connected handshape on both hands that might be interpreted as holding something small. Additionally, her hands were moving up and down, as in the beat gesture (McNeill, 1992). The speech labeled them as “these dried out brown things.” Similarly, in WormsTTTT(1), the right hand, with 1-3 connected, was holding something and tossing it back and forth that the participant classified as “alien” in speech. Finally, in WormsOOOO, both hands engaged in simultaneous and repeated closing of fingers, alternating between 1-5 crooked and 1-5 connected, exploring squeezing or crunching the objects. It co-occurred with a pause followed by the object characteristic: “crunchy” “[they were] quite crunchy looking grubs”. In the two Irish examples, the participants also engaged in object manipulation. For instance, WormsR was executed with 1-3 connected on the right hand and straight movement away body that could be interpreted in both ways. The first alternative might be transporting the item; the other would be presenting the item to the interlocutor sitting in front of the participant. The co-occurring speech clarified what the item was by providing the label “insects.” In another example, WormsQ, the left hand took on 1-5 touching and the right 1-3 connected. Regarding the movement parameter, the fingers on both hands were engaged in haptic exploration of the item, with fingers on

both hands coming in contact and rubbing the invisible items. The gesture was also accompanied by “the unidentifiable objects” in speech that labeled the result of the haptic investigation. Finally, in the only realization created in the Polish cohort, WormsHHH(1), the right hand depicted holding a tiny object using 1-2 connected and the corresponding speech provided the definition “pieces” ([these couple of]pie[ces]) (Figure 4.30).

Figure 4.30

Example of handling strategy in WormsHHH1(1) (PP)



these couple of pieces
|~~~~~***_|

In regard to the leaves referent, the majority of handling realizations were generated by the Australian participants: LeavesJJJJ(1); LeavesJJJJ(5); LeavesVVVV(1); and Leaves/TreesVVVV(3). The handshapes ranged from 1+2 connected to 1-5 connected to a fist. The handshapes seemed to be concordant with an underlying action in handling, that of manipulating leaves: picking, grasping and pulling them off the tree. For example, in LeavesJJJJ(1) (AP), the participant selected 1+2 connected and gave the impression of holding something small between her thumb and index finger. In LeavesJJJJ(5) (AP), the participant used the same handshape accompanied by a movement down that could depict picking a leaf from a tree. The action coincided with “they were falling down” in speech. Similarly, in LeavesVVVV(1) (AP), both hands closed to 1-5 connected, and the gesture co-occurred with “leaves are falling.” Last, in Leaves/TreesVVVV(3) (AP), the speaker used two fists that looked to have been engaged in some sort of struggle: one fist holding a tree or a branch; and the other attempting to pull a leaf. The gesture co-existed with “trees didn’t have many leaves.” Interestingly, in all these examples, the participants suggested that the leaves fell on their own or there were no leaves on the trees in speech, but they resorted to manipulating them in gesture. In the sole Polish example, LeavesQQQ1, the participant used two spread flat hands and moved them towards the center position as if attempting to collect imaginary leaves in the space between.

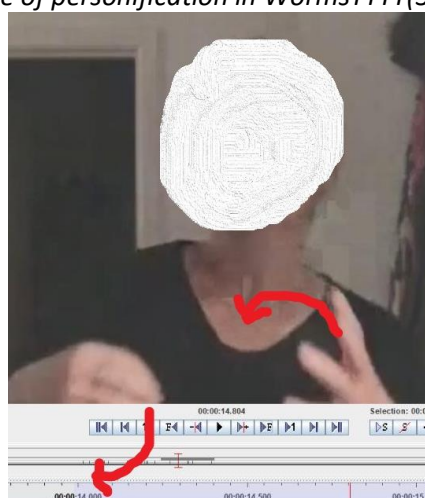
Although this example employed handling, its motivation seemed to be in line with the motivation of molding gestures employing external metonymy: the depiction of leaves as a collection or a pile.

Other strategies

An array of other strategies has been also selected and included, viz, personification, drawing and placing. These did not, however, generate as substantial numbers as the strategies described above. To start with, a strategy that is similar to portrayal in employing the gesturer's body or their body parts to become a specific entity is personification (Hwang et al., 2017). Only one instance of this strategy was detected: WormsTTTT(3) (AA). In this example, the referent's body became superimposed onto the body of the participant through both hands coming close to her chest, 1-5spread bent in PDTC, making alternate repeated circular movements as if she were crawling or climbing. The co-occurring speech defined the creatures: "crawlers on it." The image from the ELAN window below presents the right hand finalizing one round of the circle and the left hand travelling half the distance upward (Figure 4.31).

Figure 4.31

Example of personification in WormsTTTT(3) (AP)



crawlers on it
|*****|

Surprisingly, no other examples of this strategy were found in this study, which raises a question about other possible characteristics/affordances that trigger personification selection in animate/animated referents.

The next strategy to be discussed is drawing. Three examples that could be classified as drawing were elicited only in the Australian group: WormsJJJJ(2); WormsYYYY (drawing and portrayal); and WormsWWWW. Only one of these realizations employed a handshape typical for drawing. That is to say, a stretched index finger was used by WormsJJJJ(2), whereas WormsYYYY and WormsWWWW adopted 1+2 connected. In WormsJJJJ(2), the index finger on the right hand

traced a sequence of arcs to represent the indented surface of the referent. At the same time, the left hand with the stretched index finger remained *in situ* (Figure 4.32).

Figure 4.32

Example of drawing in WormsJJJJ(2)



they had like indents like a caterpillar
|~~~~~|

The corresponding speech identified the feature depicted by the gesture “the indents like a caterpillar].” In WormsWWWW, two hands executed the 1+2connected handshape and engaged in a simultaneous repeated arced motion left and right that could be compared to tracing two curved lines. The speech communicated “had a little thing” (had a little thing [on the top in the centre like they were bugs]). Similarly, in WormsYYYY, the right hand adopted 1+2 connected and repeatedly drew an arced form, whereas the speech provided “grilled they looked like witchetty grubs.” Interestingly, drawing is often executed with the index finger, and the 1+2 connected handshape is typically used in the handling technique during the manipulation of small imaginary objects. Therefore, it is possible that these two realizations either feature (1) drawing performed with the 1+2 connected handshape or (2) drawing and handling characteristics.

The last strategy to be discussed is placing. This normally entails placing an imaginary item in gesture space or informing about a spatial relation between two or more imaginary items. One such example was identified with the referents pertaining to plurality. CrowdsJJJJ(4) (AP) placed individuals in different locations with repeated movements of two stretched index fingers. In this way, via the employment of internal metonymy and repetition, one archetypical example was represented in multiple locations. The same strategy is used in sign language, e.g., SSL, in which paired body parts are articulated with the index finger pointing at two distinct locations, e.g., EYES (Börstell et al., 2016).

Discussion

Taken together, these results provide important insights into the production of form-meaning mappings arranged around different strategies to depict plural entities across different groups. The

findings suggest that (1) plural referents elicit different strategies depending on their affordances, (2) various groups are biased towards different strategies to depict plural referents, (3) certain communities are capable of employing a wider range of strategies than others and (4) similarities can be found between hand configurations used to depict the referent within the same strategy across different communities.

Regarding the first finding, worms implemented the widest range of strategies: portrayal; personification; molding; handling; and drawing, with portrayal the second dominant strategy after molding. Crowds and leaves clearly favored molding strategies. An explanation was provided that molding was selected when referents afforded profiling their shape arranged as a collection, with the help of external metonymy, or as depicting one representative of the entire group via internal metonymy. This finding is consistent with Ortega and Özyürek (2019a), who claim that if the referent does not allow for acting (i.e., handling), participants frequently select drawing (drawing and molding were collapsed into drawing in their project). The researchers also speculate that drawing is well-tailored to co-exist with speech: the oral modality provides a label, and gesture informs about the referent's shape. Moving on to portrayal, favoring this technique in Worms could be motivated by the theory that this referent evoked a high degree of animacy and imposed its representation in gesture. Such realizations involved irregular movement of fingers to convey a moving creature or represented animal appendages (e.g., fingers standing for legs). Handling was often selected to depict worms and leaves but not crowds. The first two referents are considered small items that afford to be easily handled and manipulated. Crowds, in contrast, can be associated with representing a human body far too big to be lifted or manipulated by hands.

With respect to the second finding, a clear preference across communities was observed for the worms referent. The Irish participants used handling as the only strategy to depict it in their two realizations. The Polish participants favored portrayal, and it could therefore be speculated that they found animacy a prominent feature for this referent. The Australian participants showed a clear preference for molding static with internal metonymy. In these examples, the thumb and the index finger depicted the size of the referent. An analogous gestural representation for "scorpion" was found in Hwang et al. (2017) that was coded as OBJECT. The authors speculate that many-legged insects are likely to generate the OBJECT strategy due to their small size and the challenging task of mapping them onto the human body. This could also explain the result of only one example of personification being detected for this referent in this study. In the crowds and leaves realizations, molding was favored across the three groups.

In regard to the implementation of a variety of strategies, the worms referent again stands out. The Irish group employed only one strategy, viz, handling, whereas the Polish group employed three strategies, viz, portrayal, molding and handling. The Australian participants used the widest range of modes, viz, portrayal, personification, molding, handling and drawing. Furthermore, it is

possible that an array of strategies could be linked with a total number of realizations; the more realizations generated, the greater the strategy diversification. In fact, the Irish participants produced two realizations, the Polish eight and the Australians twenty-four. Regarding crowds, molding was predominant in the three groups, and leaves elicited a diversified array of strategies, including molding, portrayal and handling. These strategies were distributed unevenly across the three communities. For several participants, favoring handling and recreating an action of manipulating a leaf was still a viable option (see the handling examples in the Australian and Polish groups). Other participants opted for the portrayal strategy and recreated the action of leaves falling: the Irish and Polish realizations. The results referring to actions displayed in overt gesture seem to be consistent with the Gesture as Simulated Action (GSA) framework (Hostetter & Alibali, 2008). Precisely, gestures are created from action simulations and inform about the speaker's active thoughts during the ongoing speech production. Therefore, it is possible that various groups of speakers used different simulation types, resulting in different strategy selection.

Finally, comparable form configurations were found for the same strategy depicting the same referent across communities. For instance, in worms portrayal realizations, the fingers were engaged in repeated irregular wriggly movements in the Australian and Polish group and/or adopted 1-5 spread bent and PDAB. Analogous examples have been documented in silent gesture and sign language (see, for example, the spider representation in Ortega and Özyürek (2019a)). Brennan (1990) presents another comparable sign: BSL BEES SWARMING. The form without the context would denote many small creatures moving. In this example, the 5 hand configuration highlights plurality, and the wiggling of the fingers conveys the semantic connotation of small size. The bent 5 hand is also used for many long, bent, thin entities (e.g., BSL 5-SASS-CL SPIDER (Brennan, 1990)), and the wiggling movement is deemed significant in examples such as BSL CATERPILLAR and WORM (Brennan, 1990).

4.3 Multiple realizations

Multiple realizations are defined as gestures depicting a referent that use more than one depiction strategy in separate gestural specimens produced by the same speaker. In other words, a particular entity or item can be recreated in gesture in various ways; for instance, by profiling its shape: molding, participant's hand/fingers becoming the thing itself: portrayal or by manipulating the item in a specific way: handling. The Literature Review has presented examples of multiple realizations in co-speech gesture (Section 2.6.1). Those studies have reported a relation between single and multiple gestures and a specific depiction strategy. This study attempts to further investigate the link between multiple gestures and a specific strategy. The examples of multiple gestures identified in

this study have been grouped according to the semantic characteristic of the referent (see Tables 4.5–4.8).

Table 4.5

Multiple gestures clustered around the spatiality referents

| Selected strategies | Participants |
|----------------------------|-------------------|
| molding + handling | CoffeepotAAAAAA1c |
| molding + handling/placing | CoffeepotP |
| molding + drawing | PathMMM1 |

Table 4.6

Multiple gestures clustered around the animatedness referent

| Selected strategies | Participants |
|---|--------------|
| placing/drawing + portrayal | SharkOOO |
| placing + portrayal + portrayal/molding | SharkQQQ1 |
| presenting + portrayal/placing | SharkZZZZ |
| presenting + pointing | SharkKKKKK |

Table 4.7

Multiple gestures clustered around the manipulability referents

| Selected strategies | Participants |
|---|-----------------|
| portrayal + handling + presenting | LightsabersQQQ1 |
| portrayal + handling | LightsabersAAA |
| | LightsabersP |
| | LightsabersIIII |
| | ScrewQQQ1 |
| | ScrewVVVV |
| molding + handling | ScrewWWWWWW1c |
| molding + portrayal | ScrewQQQ |
| | ScrewLLLL |
| molding + handling + portrayal | ScrewP |
| | ScrewTTTT |
| molding + handling + presenting | LightsabersQ |
| molding + handling + molding/presenting | LightsabersRRRR |

Table 4.8

Multiple gestures clustered around the plurality referents

| Selected strategies | Participants |
|-----------------------------|--------------|
| molding + portrayal | WormsRRRR |
| molding/portrayal + molding | CrowdsDDDD |
| molding + placing | CrowdsJJJJ |

| | |
|--|------------|
| molding + handling | WormsHHH1 |
| molding + handling + portrayal | WormsAAAAA |
| molding + handling + inconclusive | LeavesJJJJ |
| molding/handling + molding + handling | LeavesVVVV |
| molding + drawing | WormsJJJJ |
| handling + portrayal + personification | WormsTTTT |

The most striking result to emerge from the data is the correlation between the number of gestures and a specific semantic area. For example, multiple realizations clustered around manipulability or plurality considerably exceeded in number the realizations depicting spatiality. This is in line with Ortega and Özyürek (2016), who found that manipulable objects are mainly represented by multiple silent gestures. It also partially agrees with Ortega and Özyürek's finding (2019b), suggesting that manipulable and non-manipulable objects are represented by a combination of drawing (drawing and molding collapsed) and acting. Indeed, in this study, molding was frequently selected in combination not only with handling but also other techniques (e.g., portrayal).

Furthermore, it has been suggested that with high-affordance objects, the action of the object is depicted in one gesture, whereas with low-affordance objects sequential gestures are produced that stand for different salient characteristics of the object (Masson-Carro et al., 2016). However, this does not appear to be the case in this study. Such highly manipulable referents as the Screw or Lightsabers were represented by multiple gestures not only depicting handling but also portraying the item or highlighting its shape. The spatiality referents such as the path or coffee pot were mainly represented by molding and elicited a small number of multiple realizations. A likely explanation is that the spatiality referents in this project were less complex than those used in Masson-Carro et al. (2016) (e.g., a shelf rack). As a result, they did not offer as many opportunities to describe different shapes or indicate various relations between referent elements.

Finally, the multiple gesture combinations were identified in the three populations, revealing their universal character. The universality of multiple gesture patterning was also found in Ortega and Özyürek (2019b) for silent gesture. Despite the existence of multiple gesture examples in the three groups, a group-specific tendency was also detected: the multiple gestures depicting plurality were clearly favored by the Australian participants.

4.4 Simultaneous realizations

Simultaneous realizations refer to gestures that depict (1) the same referent with an analogous form on both hands, (2) the same referent with more than one form and/or different strategies on two hands, (3) two referents on two hands and (4) the same referent with more than one strategy on one hand. Unlike multiple realizations, these creations are generated within the same realization.

The following overview comprises several categories built upon the theoretical background introduced in the Literature Review section on simultaneity (Section 2.6.2). These include mirroring gestures, doubling gestures, gesture fragments and various gesture blends involving combinations of the same or different strategy or iconic and non-iconic gestures.

Mirroring gestures

Several realizations were produced in an analogous fashion to the examples of mirroring signs (Nilsson, 2007) and combined various depiction strategies. The examples are presented in Table 4.9.

Table 4.9
Examples of mirroring gestures

| Realization | Strategy on dominant hand | Shared parameters | Height of dominant hand |
|--------------|---------------------------|-----------------------------|-------------------------|
| ScrewAAAAA | handling | 1-5 crooked
PL rotation | higher |
| ScrewQQQ(1) | molding st | 1+2 bent
PVTC
Missing | higher |
| ScrewQQQ(2) | portrayal | 2 stretched
TC
Circle | higher |
| ScrewQQQ1(2) | portrayal | 2 stretched
Circle | higher |
| WormsJJJJ(2) | drawing | 2 stretched
PV | higher |
| SharkCCC | placing | spread flat hand
AB | higher |
| SharkWWW(1) | placing + portrayal | 1-5 spread bent | higher |
| SharkWWW(2) | placing + portrayal | 1-5 spread bent | higher |

Note: Color coding for the three groups:

Yellow: Australian realizations

Green: Irish realizations

Red: Polish realizations

For instance, ScrewAAAAA (AP) employed handling with two hands 1-5c crooked engaged in an alternating repeated rotation of the wrist. ScrewQQQ(2) (PP) used portrayal with two hands taking

on the 2 stretched handshape, the right one in PDTC slightly higher than the left in PVTC. Both hands were engaged in a repeated alternating circular motion (see Figure 4.33).

Figure 4.33

Examples of mirroring gestures: 1) ScrewAAAAA (AP) and 2) ScrewQQQ(2) (PP)



- 1) you can see the head of the screw you know
|~~~~~*****|
- 2) metal screw screwed
metalowy wkręt wkręcany
|~*~*~*~*|

Interestingly, the same speaker applied the same strategy and handshape and movement parameters in ScrewQQQ1(2) when she was recorded in English. Accordingly, it seems possible that some mental representations or their parts are resistant to linguistic influence during speech and gesture production. Another alternative is the gestural conceptualization produced by the speaker is more fundamental than the linguistic stream and embodiment got a role to play here.

Two more realizations involved the same participant: ScrewQQQ1(3) (PP) depicting portrayal with 2 stretched but with movement missing on the non-dominant hand and ScrewQQQ(1) (PP) employing molding static with 1+2 bent and palm vertical towards center (PVTC) on both hands and the dominant hand positioned higher in gesture space. A further unexpected aspect involving this participant was the fact that she alternated left and right hand as the dominant one (the participant was self-assessed as left-handed in the study questionnaire). Further research should be undertaken to determine if there is a tendency amongst speakers to shift hand dominance. The last example illustrated the drawing strategy. In WormsJJJJ(2) (AP), the participant applied 2 stretched on both hands and slightly different orientations. The dominant hand in palm vertical away body (PVAB) was engaged in a repeated arced movement, whereas the non-dominant in palm vertical towards center (PVTC) remained *in situ* at a lower gesture space.

Doubling gestures

Doubling (Nilsson, 2007) can occur in signs that are one-handed in citation form but which might be articulated with both hands engaged in the same movement at the same height. In such examples the non-dominant hand adds contents to the discourse, emphasizing what has been said. This study shows that doubling occurs in co-speech gesture too (Table 4.10).

Table 4.10

Examples of doubling gestures

| Realization | Strategy on dominant hand | Shared parameters | Height of hands |
|--------------------|---------------------------|---|-----------------------|
| WormsAAAAAA(1) | handling | 1-3 connected
PLTC
repeated up-down | same |
| WormsAAAAAA(3) | molding dyn | crooked (1+2; 1-3)
arced | same |
| WormsAAAAAA(4) | portrayal | 1-5 crooked
PLTC
irr fingers | comparable |
| LightsabersRRRR(3) | molding st | 1+2 bent
PUTC | comparable: periphery |
| ScrewLLLL(5) | molding st | 1+2 bent
PDTC
missing | same |

Note: Color coding for the three groups:

Yellow: Australian realizations

Green: Irish realizations

Red: Polish realizations

For instance, in WormsAAAAAA(1) (AP) made by an Australian speaker that depicted handling, the participant used the 1-3 connected handshape, palm lateral towards center (PLTC) and a simultaneous repeated up-down movement on two articulators kept at the same height (Figure 4.34). It could also be argued that the example displays beat qualities and will be mentioned again in the discussion on simultaneity in combinations of iconic and non-iconic gestures.

Figure 4.34

Examples of doubling gestures: 1) WormsAAAAA(1) (AP) and 2) LightsabersRRRR(3) (AP)



- 1) and these dried out brown things
|~~~~~|
- 2) very bright
|~~~~*/|

—

In WormsAAAAA(3) (AP), the same participant resorted to the molding dynamic and described the shape on both hands with 1+2 crooked and 1-3 crooked, palm lateral towards center (PLTC) and palm down away body (PDAB), and a synchronous arced movement left for the left hand and right for the right hand. In WormsAAAAA(4) (AP), the same speaker used the same handshape: 1-5 crooked, orientation: PLTC and movement: irregular movement of fingers to depict worms in portrayal. In the next two examples employing molding static, the movement parameter was missing. In LightsabersRRRR(3) (AP) (Figure 4.31), two articulators applied 1+2 bent, palm up towards center (PUTC) and the peripheral position. It is also worth mentioning that the speaker generated the same one-handed gesture in a preceding realization, using the same two parameters 1+2 bent, PUTC on both hands. Further analysis is needed to determine if one handed gestures are followed by their two-handed alternatives.

Gesture fragments

In the analysed data, several realizations are compatible with the definition of sign fragments, as in (Liddell, 2003), Miller (1994) and Nilsson (2007) discussed in the Literature Review (Section 4.6.2). This section gives an account of such gestures. Figure 4.35 presents two examples of this type of simultaneity that are subsequently discussed below.

Figure 4.35

Examples of gesture fragments: 1) CoffeepotCCC(1) (PP) and 2) CoffeepotBBBBBB1c (PP)



- 1) a jug in the middle
dzbanek na środku
|*****|*****|
- 2) I don't remember the name (-)
|*****|*****|

CoffeepotCCC(1) (PP) shows a combination of molding and placing. Initially, two hands participated in creating the coffee pot. Subsequently, the dominant hand moved forward to place the referent in the middle while the non-dominant hand maintained the 1-5 spread bent shape. Another example is CoffeepotBBBBBB1c, combining molding static and dynamic. In this gesture, two hands molded the referent using the 1-5 spread bent, and the dominant hand then moved on depict the height of the pot in a repeated up-down movement. The discussed examples, as well as more fragments-like gestures, are presented in Table 4.11.

Table 4.11

More examples of gesture fragments

| Realization | Strategy on both hands | Subsequent strategy on a dominant hand | Action in the subsequent strategy |
|---|------------------------|--|-----------------------------------|
| CoffeepotCCC1 | molding
st | placing | placing in the middle |
| CoffeepotBBBBBB1c | molding
st | molding
dyn | exploring the side vertically |
| CoffeepotP(2) | handling | placing | putting it down |
| CoffeepotAAAAAA1c (2)
and
CoffeepotAAAAAA1c (3) | molding
st | handling | putting a lid down |

| | | | |
|----------------------------|----------|----------|------------------------|
| ScrewP(2) and
ScrewP(3) | handling | handling | pushing the
screw |
| | handling | handling | down and
turning it |

Note: Color coding for the three groups:

Yellow: Australian realizations

Green: Irish realizations

Red: Polish realizations

The common denominator in these instantiations seems to be selecting the molding static or handling strategy on both hands, with the movement missing parameter, and the subsequent execution of another strategy, including motion, on the dominant hand. In addition, the first strategy handshape was preserved in the subsequent strategy in all but the last example ScrewP(3). In this realization, the non-dominant hand maintained “1-5 touching” employed by two hands in the preceding example ScrewP(2), whereas “1+2 stretched” digits on the dominant hand engaged in a rotating movement. It is possible that the simulation of turning the screw realized in this overt rotation enforced the change in the handshape parameter.

Gesture blends

The term “gesture blends” has been inspired by mental space theory (Fauconnier, 1995) and conceptual blending (Fauconnier & Turner, 2008).¹⁵ As conceptual blends combine various mental spaces, these gestures comprise several categories that have emerged from recurrent combinatorial patterns. Gesture blends are treated separately from the previously discussed simultaneously categories, as they do not merely mirror, double or maintain the form of the dominant hand. Conversely, they blend different form parameters/strategies on one or both hands within the same realization and thus contribute to creating new meaning. The categories can be listed as follows:

1) Same strategy but different handshapes on two articulators

In these gestures, the non-dominant hand was backgrounded, and the dominant hand was foregrounded by featuring movement and being produced in an elevated position (see Table 4.12). This is also in line with Talmy’s (1996) windowing of attention and how the principles of foregrounding/backgrounding have been found to hold in sign languages. This category seems to be

¹⁵ Fauconnier’s (1995) mental space theory acknowledges the existence of mental spaces that speakers/signers create when they communicate. The spaces include information about entities or items that are being discussed. They are not a faithful representation of reality but rather conceptualizations of speakers/signers’ experience. Conceptual blending (Fauconnier & Turner, 2008) is a further extension of mental space theory. Accordingly, communicators utilize mental spaces to generate and develop new analogical variants. These are often composite blends of mental spaces.

the closest to the previously discussed fragment gestures in which the weak articulator perseveres when the dominant hand is engaged in movement execution. The handshapes, however, differed on both hands. ScrewHHH(1) (PP) was the only realization in which the dominant hand was maintained at the same height as the non-dominant hand.

Table 4.12

Gesture blends: same strategy but different handshapes

| Realization | Strategy | Handshape on non-dominant hand | Handshape on dominant hand | Movement on dominant hand |
|--------------|----------|--------------------------------|----------------------------|---------------------------------------|
| ScrewHHH(1) | handling | 1+2 bent | 1+2 touching | other:1 towards-away body 1 rubbing 2 |
| ScrewHHH(2) | handling | 1+2 bent | 1-3 connected | down |
| ScrewQQQ1(1) | handling | 1-5 connected | 1+2 crooked | down |
| ScrewDDDD | handling | 1+2 crooked | 1+2 connected | down |

Note: Color coding for the three groups:

Yellow: Australian realizations

Green: Irish realizations

Red: Polish realizations

2) Two different strategies on two articulators

Another type of simultaneity was observed when two different strategies were applied on two hands to highlight different referent features.

Table 4.13

Gesture blends: two different strategies on two articulators

| Realization | Strategy on dominant hand | Strategy on non-dominant hand |
|-------------------|---------------------------|-------------------------------|
| WormsRRRR | portrayal | molding st |
| WormsAAAAA(2) | molding dyn | molding st |
| WormsVVVV | molding dyn | molding st |
| WormsHHH1 (1) | handling | molding st |
| WormsHHH1 (2) | molding dyn | molding st |
| ScrewP(1) | molding st | handling |
| PathP | molding dyn | molding st |
| LeavesAAAAAA1c(1) | molding dyn | molding st |

Note: Color coding for the three groups:

Yellow: Australian realizations

Green: Irish realizations

Red: Polish realizations

It is likely that the strategy displaying no inherent movement is backgrounded in realizations employing two different strategies simultaneously. In the examples above, the strategy selected by a dominant articulator generally contained movement, whereas the other one was static and persevered during the execution of the dynamic hand. Consequently, molding static and depicting the shape or length of an object was found to have been executed on a non-dominant hand in most of the Table 4.13 examples. In some realizations, however, participants selected a strategy displaying no movement characteristics on both hands. For instance, in ScrewP(1) (IP), molding static was implemented on a dominant hand, whereas handling was realized on a non-dominant hand. As a result, it could be stated that the dominant articulator was positioned much higher than the other one. Overall, there is a strong possibility that the selection of a higher position in gesture space is another way of foregrounding information in simultaneous realizations.

3) Two different referents on two articulators

Several realizations depicted two different referents on both hands. These results are summarized in Table 4.14.

Table 4.14

Gesture blends: two different referents on two articulators

| Realization | Strategy on dominant hand | Implied image/action | Strategy on non-dominant hand | Implied image/Action |
|---------------------|---------------------------|----------------------------|-------------------------------|----------------------|
| Leaves/TreesVVVV(3) | handling | pulling leaves | handling/portrayal | holding a tree/tree |
| PathAAAAA | portrayal | legs | molding st | path |
| ScrewI | handling | manipulating a screw | portrayal | surface |
| ScrewO(1) | handling | manipulating a screwdriver | handling | holding a screw |
| ScrewR(1) | inconclusive: handling? | manipulating a screw | portrayal | surface |
| ScrewR(2) | handling | manipulating a screw | portrayal | surface |
| ScrewP(4) | portrayal | screw | portrayal | surface |
| ScrewDD | portrayal | screw | portrayal | surface |
| ScrewJJJJ(1) | Poptrayal | screw | portrayal | surface |
| ScrewTTT1(1) | portrayal | screw | portrayal | surface |

| | | | | |
|--------------|------------------|-------------------------------------|-----------|---------------------|
| ScrewTTT1(2) | portrayal | screw | portrayal | surface |
| WormsYYYY | handling/drawing | manipulating
or drawing
worms | portrayal | surface
(tomato) |
| WormsZZZZ | portrayal | worms | portrayal | surface |
| SharkTTTT(1) | placing | swimmer | placing | shark |
| SharkTTTT(2) | placing | swimmer | placing | shark |
| SharkEEE | placing | swimmer | placing | shark |

Note: Color coding for the three groups:

Yellow: Australian realizations

Green: Irish realizations

Red: Polish realizations

As can be seen from Table 4.14, handling, portrayal and placing were the three most frequently adopted strategies. The combination of handling/portrayal and portrayal was often selected when one referent displayed a movement quality (e.g., the screw) and the other was static (e.g., the flat surface). In contexts when two referents were movable (e.g., the shark and the swimmer), placing the referents and thus giving information about their locations seemed to be favored. This result is also consistent with the findings for the shark single realizations in which placing or placing combined with portrayal were frequently adopted. Finally, this result is also in line with Leeson and Saeed (2012), who state that iconicity and thus the actual locations of entities in reality determines the topographic arrangement in gesture space.

4) Two strategies on the same hand

The findings presented in this section suggest that a small number of realizations executed with the same articulator could incorporate characteristics of more than one depiction strategy. Table 4.15 illustrates how elements belonging to different strategies were combined within one realization.

Table 4.15

Gesture blends: two strategies on the same hand

| Realization | Strategies 1 and 2 | Elements of strategy 1 | Elements of Strategy 2 |
|---------------|--------------------------|--------------------------------------|-------------------------------|
| CrowdsDDDD(1) | molding st and portrayal | 1-5 spread bent | irregular movement of fingers |
| SharkOOO(1) | placing and drawing | peri upper space: participant's face | repeated, circle, PVTB |
| SharkQQQ1(3) | molding st and/or | PLTC | 1-5 spread bent |

| | portrayal | | |
|--------------|---------------------------|--------------------------|-------------------------------|
| WormsAAAAAAc | molding dyn and portrayal | circular movement | irregular movement of fingers |
| WormsRRRR(4) | molding dyn and portrayal | circular movement | irregular movement of fingers |
| WormsYYYY | handling and/or drawing | 1+2 connected | repeated arced |
| WormsWWWW | handling and/or drawing | 1+2connected-
1-5bent | repeated arced |

Note: Color coding for the three groups:

Yellow: Australian realizations

Green: Irish realizations

Red: Polish realizations

For example, CrowdsDDDD(1) used the 1-5 spread bent handshape that occurred frequently with the molding static strategy to sculpt a roundish shape (Figure 4.36).

Figure 4.36

Example of gesture blends: two strategies on the same hand in CrowdsDDDD(1)



or a densely populated village
|***/*****|

This was selected for numerous crowds and coffee pot realizations. Irregular movement of the fingers was often employed to depict the worms referent. This was classified as portrayal denoting either (1) plurality and moving worms or (2) insect legs in motion. SharkOOO(1) (PP) combined placing and drawing elements when the participant brought her hand close to her mouth and drew a circular shape to characterize sharks' teeth. Another example, SharkQQQ1(3) (PP), is likely to have integrated portrayal and molding static. Indeed, numerous realizations depicting the shark featured the 1-5 spread bent handshape on one or both hands representing a shark's jaw(s). Surprisingly, this

participant opted for palm lateral towards center (PLTC) that could imply profiling a shape. As the gesture coincided with “those big jaws,” it is also possible that the image of the shark was overridden by the participant’s mental representation of “big,” as in BIG metaphor.¹⁶

Finally, several realizations displayed the same combination of strategies and parameters. WormsAAAAAAc (PP) and WormsRRRR(4) (AP) employed a molding dynamic and portrayal. Their dominant hands were simultaneously engaged in haptic exploration of a circular shape and irregular movement of fingers. WormsYYYY (AP) (dominant hand) and WormsWWWW (AP) (both hands) used the 1+2 connected handshape typically associated with handling small objects and repeated arced movements as if they were drawing thin and curved items. The fact that the same combinations of strategies were used either within the same community or across different communities shows that certain ways of integrating two or more strategies to create simultaneous realizations are universal.

5) Iconic and non-iconic gestures

Certain realizations contained features of iconic gestures and non-iconic components, such as beats (McNeill, 1992), whose function is to highlight words in discourse or interactive gestures (Bavelas, Chovil, Lawrie, & Wade, 1992) which are intended for the interlocutor. A detailed overview of examples is presented in Table 4.16.

Table 4.16

Gesture blends: iconic and non-iconic gestures

| Realization | Depiction strategy | Depiction Strategy Handshape | Non-iconic function | Non-iconic gesture movement |
|--------------------|--------------------|------------------------------|---------------------|-----------------------------|
| WormsXXXX (2) | molding st | 1+2 bent | presenting | up |
| LightsabersRRRR(4) | molding st | 1+2 bent | presenting | away |
| ScrewLLLL(6) | molding st | 1+2 bent | presenting | up |
| ScrewTTTT(4) | molding st | 1+2 bent | presenting | away |
| ScrewP(1) | molding st | 1+2 connected | presenting | up |
| WormsAAAAA(1) | handling | 1-3 connected | beat-like | up-down 2h |
| CrowdsLLLL(1) | molding st | 1+2 crooked | inconclusive | away-towards 1h |
| CrowdsLLLL(2) | molding st | 1-5 spread bent | inconclusive | away-towards 2h |
| CrowdsP(2) | molding st | spread hand | flat presenting | presented away |

¹⁶ This example will be further discussed in Chapter 5, devoted to metaphor’s involvement in creating depiction strategies (Section 5.31).

| | | | | |
|--------------------|------------|-----------------------|--------------|------------------------|
| LightsabersLLLL(1) | portrayal | flat hands
crossed | inconclusive | away-towards
2h |
| LightsabersQ(2) | handling | fist | inconclusive | up-down
1h in pause |
| PathCCC | molding st | flat hand lax | beat-like | up-down 1h |

Note: Color coding for the three groups:

Yellow: Australian realizations

Green: Irish realizations

Red: Polish realizations

Regarding the iconic component, the majority of gestures were classified as molding static. In these examples, one handshape seemed to be most frequently selected: 1+2 bent. Other strategies included handling and portrayal. No preference for a particular orientation or position was detected. These gestures were profiled with the help of movement that could be comparable to that employed by certain interactive gestures (Bavelas et al., 1992) or beats (McNeill, 1992). For instance, WormsXXXX(2), ScrewLLLL(6) and ScrewP(1) realizations were created by raising the molding static handshape, as if presenting it to the conversation partner. In LightsabersRRRR(4), CrowdsP(2) and ScrewTTTT(4), the molding static hand was moved away from the gesturer's body towards the interlocutor. The realizations were classified as presenting, as the hand seemed to be on display or move closer to the addressee, in line with PUOH gestures (Müller, 2004) and the presenting gesture (Parrill, 2008). WormsAAAAA(1) and PathCCC assumed beat-like characteristics by moving repeatedly up and down and being integrated with speech. The movement function in several realizations has proven to be difficult to categorize. In CrowdsLLLL(1), CrowdsLLLL(2) and LightsabersLLLL(1), the hand(s) engaged in the repeated away-towards body movement that could be compared to the one displayed in beat gestures; however, these creations were not synchronized with speech. In a similar fashion, LightsabersQ(2) adopted the repeated up-down movement executed in a pause.

Discussion

Taken together, the results concerning simultaneous realizations can be summarized as follows:

- 1) Various groups of participants produced numerous realizations arranged around a specific type of simultaneous structure. Specific tendencies were detected. For instance, the majority of mirroring gestures were produced by the Polish participants, whereas the doubling gesturers were identified in the Australian population only. The Irish speakers produced the largest number of realizations for the two different referents on two different articulators in comparison to other simultaneity categories.
- 2) Finding the same combinations of strategies within one group and across the groups suggests that some representations of mental images are more universal than others (e.g., WormsAAAAAAc (PP) and WormsRRRR(4) (AP). In these two examples, the animacy

of the entity described could prompt the universality of response by employing irregular wiggly movements. Further research is needed to determine if selecting a particular simultaneous structure is an individual preference in gesturing or is more universal since it has been detected within and across the three groups.

- 3) In mirroring and doubling-like gestures, specific examples involved handshapes, orientations or positions that were not absolutely identical; e.g., a combination of 1+2 crooked and 1-3 crooked in WormsAAAAA(3) (AP). It must be remembered that these creations are fully spontaneous and not bound by any conventional method of articulation that decides on what is correct or not. In such instantiations, the fully synchronized movement or the same position contributed to perceiving each side of the realization as an equivalent image. Nevertheless, these creations seemed to highlight salient features of the referent in an analogous way. The next chapter (Section 5.3.1) will examine further instantiations of salience profiling in gesture.
- 4) Placing the realizations or strategies containing movement on a dominant hand is in line with certain studies investigating sign language. For instance, Leeson and Saeed (2012) investigated Irish Sign Language (ISL) and concluded that the dominant hand is selected to highlight the most animate element while the non-dominant hand depicts less active element.

Overall, this chapter has presented results to two research questions: the semantic and community impact on iconicity realised in various depiction strategies. The results of this investigation show that various semantic characteristics affect the selection and creation of depiction strategy. That is to say, different depiction strategies are favored by participants while describing referents from various semantic groups; for instance, molding is a prominent strategy in spatial depiction, particularly with respect to depicting shape and size. Handling is a preferred strategy when depicting manipulable objects, and portrayal and placing are favored strategies when it comes to depicting animated objects. Molding employing internal and external metonymy modes were both utilized to represent plurality. Regarding the community impact, while certain form aspects and parameters have been found to be universal for the three groups, underlying tendencies specific to individual communities have also been identified; for instance, selecting one referent's salient image over others, selecting a specific depiction strategy or designating different articulators to represent the target referent. It has also emerged that simultaneity in gesture is universal, although there appears to be a pattern of specific tendencies arising for each of the different groups considered in this study and manipulability has generated the most multiple constructions. The next chapter moves on to reveal the results of metaphor's involvement in the creation of depiction strategies.

Chapter 5: Metaphor in Depiction Strategies

A metaphor is not simply a linguistic expression, a word or a sentence with a colorful flourish. It is a cognitive process of human understanding. (Wilcox, 2000, p. 35)

Analysing metaphor is crucial in this type of study, as it has been suggested to be an indispensable component of gestural sign creation and the establishing of its meaning (Cienki & Müller, 2014). Various approaches to metaphor have been discussed in Chapter 2, including these theoretical foundations on metaphor that have been helpful in evaluating the results in Chapter 5. Chapter 5

consists of two parts. Section 5.1 offers a more concise look at metaphor adapted for the purpose of this study. Section 5.2 moves on to describe in greater detail metaphorical extensions of iconicity centered around a specific concept or action and thus attempts to answer the last research question:

What is the role of metaphor in creating depiction strategies?

5.1 Defining metaphor

Conceptual metaphor (Lakoff & Johnson, 1980) is a point of departure for analysing metaphor and gesture in this project. Accordingly, metaphor is seen not as a mere linguistic expression but a conceptual tool actively participating in human thinking and responsible for bringing abstract concepts into existence, physically materialized in gesture. Furthermore, “the essence of metaphor is understanding and experiencing one kind of thing in terms of another” (Lakoff & Johnson, 1980, p. 5). This understanding and experiencing of one thing in terms of another is facilitated by the use of metaphorical mappings that are defined as systematic correspondences across conceptual domains. Thus, metaphor allows “for the use of source domain inference patterns to reason about the target domain” (Lakoff & Johnson, 1980, p. 252). For example, in the metaphor TIME IS SPACE, the target domain – time is here conceptualized with regard to the source domain – is space. Others include

talking about fights as wars, love as a journey, theories as buildings and organizations as plants. In short, concrete experience serves as scaffolding for denoting abstract ideas.

5.2 Overview of realizations

This section attempts to present metaphorical extensions of iconicity that have been identified in the data and analyse their plausible functions. The extensions are analysed as pairings of source and target conceptual domains (Taub, 2001). These metaphors have been grouped around the specific abstract concepts they represent. Some of these are realized on a vertical and horizontal scale, as in orientational metaphors (Lakoff & Johnson, 1980); others are organized around a unifying semantic core combining various geometrical configurations and actions. Section 5.2.1 presents size metaphors, Section 5.2.2 displays examples of amount metaphors, Section 5.2.3 reviews knowing and not knowing instantiations, Section 5.2.4 discusses gestures centered around the concept of autumn and Section 5.2.5 offers a review of metaphorical examples gathered around various actions.

5.2.1 Size metaphors

Size is typically represented as a delimited distance in gesture space. Brennan (1990, p. 113), for instance, offers a comprehensive overview of how size is expressed in BSL:

“Size” is typically expressed in BSL by means of relative distance between the two hands, relative distance between the hand(s) and some implied reference point (e.g., the ground, the signer's body, or a reference point represented by the other hand) or relative distance between the thumb and index finger or thumb and all fingers together.

Her analysis of size representation is relevant to this study as analogous size realizations have been identified. Furthermore, drawing on Taub (2001), Nyst (2016a) presents a model of size and shape iconicity used to convey such abstract concepts as distance for size in space, or delimited stretch of the arm is size in Adamorobe Sign Language.¹⁷ Certain results found by Nyst (2016a) are compatible with findings presented in this work (Section 5.2.1). Referring to the metaphor research in sign language is vital for co-speech gesture studies, as similarities and differences in employing metaphor by these two communication systems have been revealed (Cardona, 2008).

The following is a brief description of gestures clustered around the depiction of various size dimensions extracted from the data. These gestures mostly pertain to two referents, path and coffee pot, as these generated most size-oriented realizations. Individual realizations describing other referents that highlight interesting size-related findings will also be mentioned. Regarding the path

¹⁷ Adamorobe Sign Language is a sign language used in Ghana.

picture, the results suggest that various groups recognized different size dimensions as prominent and foregrounded them in gesture (e.g., width, length, height or depth). Table 5.1 has been inspired by Taub (2001) and her interpretation of double mappings for various metaphorical concepts.

Table 5.1

Overview of double mappings for size dimensions in path gestures

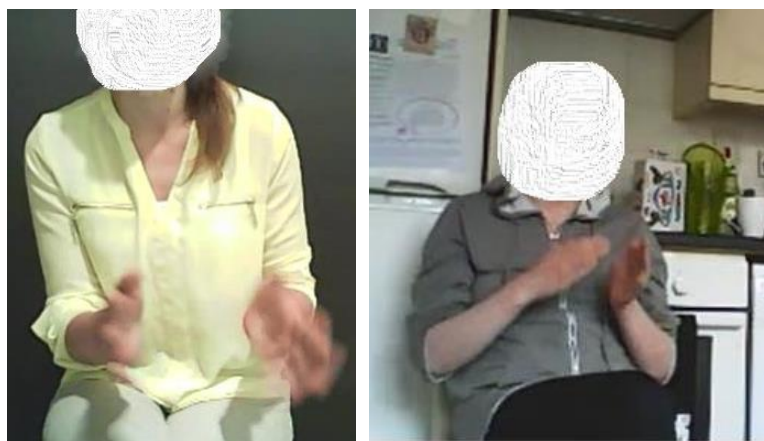
Double mappings for size dimensions in path gestures

| iconic mapping | metaphorical mapping | |
|---|--|------------------------|
| Articulators | source | target |
| orientation: PLTC | distance between hands | size: width |
| orientation: PLTC, PVTC-PLTC
movement direction: away | distance between hands and movement away | size: width and length |
| movement direction: vertical | vertical movement | size: height |
| orientation: PVTC
movement direction: vertical | distance between hands and vertical movement | size: width and height |
| orientation: PDAB | movement away | size: length |
| handshape: 1-5 bent, 1+2 bent
movement direction: away | distance between fingers and movement away | size: width and length |
| handshape: 1-5 spread bent, 1-5 bent, 1+2 bent | distance between fingers | size: depth |

Profiling width. The width of the path was foregrounded by the three groups with the help of molding static and depicting distance between two hands (see Figure 5.1).

Figure 5.1

Profiling width in path gestures: 1) PathRRR (PP), 2) PathS (IP)



1) road
droga
|****|

2) bridge
|****|

The examples included PathCCC, PathRRR, PathIII and PathMMM1(1) in the Polish group, PathIIIII and PathKKKKK in the Australian group and only one realization, PathS, in the Irish group. Some realizations seemed to be reduced variations where one hand was used to sculpt only one side of the path: PathIIIII (AP). Such a method of depiction is also analogous to shape-for-shape iconicity (Taub, 2001) where the shape of the gesture represents the shape of the referent.

Profiling width and length. Molding dynamic strategy was used when two articulators outlined distance and additionally moved away from the body. Figure 5.2 displays its example realizations.

Figure 5.2

Profiling width and length: 1) PathAAAAAA1c (PP), 2) PathLLLL (AP)



- 1) there is a long straight way
|~~~~~****/****|
- 2) road
|***|

It is possible such realizations could profile width and length at the same time. Differences in number and handshape across groups were detected. The majority of such realizations were generated by the Polish participants, PathAAAAAAc, PathAAAAAA1c, PathQQQ, PathWWWWW1c, PathHHH, PathXXX, PathSSS and PathQQQ, followed by the Australian speakers, PathLLLL(1), PathLLLL(2), PathRRRRR and PathJJJJJ(2). These gestures were articulated with flat hand handshapes. In contrast, in the Irish group, PathV(1) and PathV(2) IP employed a different handshape 1-5 bent and 1+2 bent and movement away. As in the case of previously discussed examples profiling width, several realizations depicting width and length were one-handed; e.g., PathAAAAAAc (PP), PathHHH (PP) and PathQQQ1 (PP). These creations seem to be comparable with path-for-shape iconicity (Taub, 2001).

Profiling height (and width). Surprisingly, several Polish participants depicted the referent with a movement on a vertical axis, even though the stimulus was positioned horizontally, not vertically (see Figure 5.3).

Figure 5.3

Path example depicted on a vertical axis (PathOOO) (PP)



house which is attached to a jib
dom który jest na jakimś wysięgniku
|~~~~~*****|

The examples included PathOOO and PathPPP with the movement up and PathMMM1(2) drawing the path with a two-handed downward motion. It is possible that the mental representation of height superseded the iconic arrangement of the stimulus. At the same time, these three realizations depicted width by employing two hands to mark two boundaries (PathOOO and PathMMM1(2)) or applied a relevant handshape on one hand (PathPPP executed with 1-5 spread bent).

Profiling length. A further significant difference was the inclination in Irish speakers to depict the path by emphasizing its length (see Figure 5.4).

Figure 5.4

Example of path gestures profiling length: PathEEEE (IP)



something stuck out at the end of metal girder
|~~~~~***|

These realizations involved the molding dynamic: one hand placed away body, generally in PDAB and movement away. The examples included PathP, PathEEEE, PathI and PathN. The same combination of parameters occurred in the Australian group, PathWWWW and PathVVVV, but not in the Polish population. One handed were also gestures drawing the length of one side of the path horizontally. Such gestures were captured exclusively in the Australian population: PathAAA and PathYY. It is possible that drawing involves more schematization and does not require the use of both hands. In this way, the length parameter is preserved and the width parameter is dropped.

Profiling depth. A small number of realizations seemed to profile depth combined with another dimension (Figure 5.5).

Figure 5.5

Example of profiling depth and width: PathKKKKK (AP)



with a (-) with a long path
|~*~*~|

For example, Australian PathKKKKK employed 1-5 spread bent and palm lateral toward center (PLTC) on both hands that could accentuate width with the distance between two articulators and depth with the spread fingers. Combinations of profiling depth and length could be seen in PathJJ (IP) that employed palm vertical diagonal away body (PVdiAB) and 1-5 bent for depth, and movement away for length. PathQ (IP) used 1+2 bent, palm down towards center/away body (PDTC/AB) and movement away, and finally PathJJJJ(1) AP applied 1+2 bent, PVTC and movement away.

Profiling roundness (with other dimensions). It is likely that roundness is not perceived as a primary characteristic and is depicted with other dimensions described above. Figure 5.6 displays an example realization, and the subsequent analysis of gestures depicting roundness is presented below.

Figure 5.6

Roundness feature foregrounded with width: CoffeepotQ (IP)



it could be a coffee pot because teapots are generally (-) I think smaller
|~*|

For instance, in the coffeepot realizations, the molding static foregrounded the width in the PLTC orientation (e.g., CoffeepotCCCCC(1) (AP), CoffeepotQ (IP) and CoffeepotAAAAAA1c(1) (PP)) and possibly height in PVTC (e.g., CoffeepotJJJJ (AP), CoffeepotP(1) (IP) and CoffeepotCCC(1) (PP)). Additionally, variations of the spread hand emphasized the roundness of the item. This iconic device was used in the three groups, with the Australian participants producing the most realizations and the Irish the fewest. Similarly, the molding dynamic type was selected to depict different dimensions and the rounded shape of the coffee pot. Roundness was generally depicted with an appropriate handshape (e.g., 1-5 spread bent or spread hand) equipped with a specific movement type (e.g., an arced downward movement or a wrist rotation). It also highlighted the referent's width (e.g., CoffeepotAAAAA (AP), CoffeepotS (IP) and CoffeepotAAAAAA1c(2) (PP)) or its height (e.g., CoffeepotCCCCC(2) (AP), CoffeepotCCC(2) (PP), CoffeepotTTT1 (PP), CoffeepotQQQ (PP) and CoffeepotBBBBBB1c (PP)).

Profiling height. Surprisingly, several Australian realizations favored profiling the height of the coffee pot, employing a different combination of orientations than the other two groups. This was manifested via the selection palm up (PU) and palm down (PD) orientations on both hands respectively and sculpting the top and the bottom of the referent with or without depicting the roundness (see Figure 5.7). CoffeepotWWWW, CoffeepotDDDD(1) and CoffeepotDDDD(2) that employed the flat hand handshape could profile the height only; CoffeepotLLLL(1) and possibly one handed CoffeepotRRRR seemed to profile the height and roundness by additionally exploiting the 1-5 spread bent handshape. Such realizations demarcating the bottom and the top of the referent were

not detected in the Irish or Polish group except for one one-handed Polish example: CoffeepotHHH. Accordingly, it is possible that this way of profiling height for this particular referent is not as universal as depicting other dimensions and is favored by the Australian community.

Figure 5.7

Example of profiling hight: CoffeepotDDDD(1) (AP)



teapot but (-) too tall
|~**|

Articulator type related to the referent size/shape. Different articulators were observed for the depiction of smaller and bigger referents. For instance, the length of the screw or worms was depicted with combinations of fingers, usually 1+2 bent. The size of bigger objects such as the path, coffee pot or shark’s jaws was mainly pictured with the hand(s). There was also a correlation between the handshape selection and the referent’s shape: spread, spread bent or crooked fingers were employed for round objects and flat hands for flat surfaces. Table 5.2 illustrates the major metaphorical mappings for size depiction found in the analysed data.

Table 5.2

Metaphorical mappings for size dimensions/features

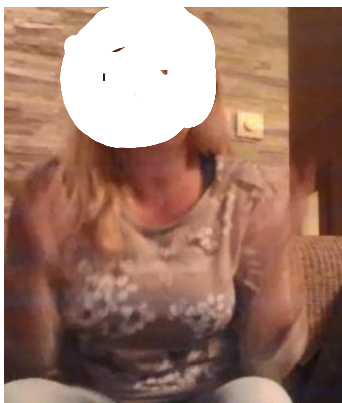
| Metaphorical mappings for size dimensions/features | |
|--|--------------------------------------|
| Source | Target |
| distance between | size: width, length, height or depth |
| movement away body | size: length |
| movement on a vertical axis | size: height |
| movement on a horizontal axis | size: width |

| | |
|----------------------------------|----------------|
| palm vertical orientation | size: height |
| palm lateral orientation | size: width |
| smaller distance | smaller size |
| bigger distance | bigger size |
| smaller articulator | smaller object |
| bigger articulator | bigger object |
| bent or spread fingers handshape | round shape |
| flat handshape | flat shape |

A final point for consideration in our discussion of size metaphors relates to a very interesting example of how metaphor overrides iconicity (Figure 5.8).

Figure 5.8

Example of metaphor overriding iconicity: SharkQQQ1(3)



uhm those big jaws

|*****|

In SharkQQQ1(2) and SharkQQQ1(3) (PP), the participant first depicted the jaws using the portrayal technique where two hands mirrored the open jaws vertically and subsequently moved hands to the PLTC orientation, preserving the shape of the jaws horizontally. This co-occurred with “uhm those [big jaws].” Accordingly, it could be argued that the metaphorical representation of BIG is executed on a horizontal axis and the BIG metaphor affected the iconic vertical representation of the jaws (a horizontal representation of BIG was also found in Nyst (2016a)).

Overall, molding static and molding dynamic strategies were employed to foreground various abstract dimensions of objects or entities. Some of these dimensions or features are highlighted more universally than others (e.g., length in the path or roundness in the coffee pot). Some are profiled in various ways by different groups (e.g., length in Irish and Polish path realizations), and some are selected by a specific group of speakers (e.g., height in Australian coffee pot gestures). In addition, some dimensions are maintained at the expense of others (e.g., Australian drawing path realizations). Finally, conceptual metaphor representations can override an iconic arrangement of the stimulus. This is exemplified by foregrounding height in vertical path examples generated by the Polish participants or accentuating BIG while portraying jaws in SharkQQQ1(2) and SharkQQQ1(3) (PP).

5.2.2 Amount metaphors

The realizations metaphorically alluding to amount existed on both vertical and horizontal scales and comprised several variants clustered around presenting amount as a physical entity. The crowds referent elicited the largest proportion of such gestures (twenty four realizations), followed by other plurality-oriented referents: leaves (six realizations) and worms (four realizations). What follows is an account of amount metaphorical extensions arranged according to their source and target domains.

AMOUNT IS THE HEIGHT OF A PILE. The first group to be discussed is realizations created in line with MORE IS UP (Lakoff & Johnson, 1980) and AMOUNT IS THE HEIGHT OF A PILE (Taub, 2001), where higher locations represent larger amounts and lower locations represent smaller amounts. Such examples were found in the Australian and Polish group.

Table 5.3

Metaphorical mapping for AMOUNT IS THE HEIGHT OF A PILE

| Metaphorical mapping for AMOUNT IS THE HEIGHT OF A PILE | |
|---|----------------------------------|
| Source | Target |
| pile of material | quantity to be measured |
| material to be added or taken away | amount to be added or taken away |
| material being added to the pile | amount being increased |
| material being removed from the pile | amount being decreased |
| top of pile rising | amount increasing |
| top of pile falling | amount decreasing |

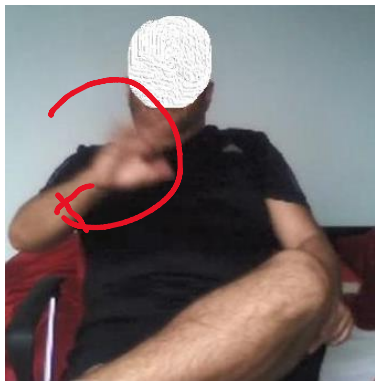
| | |
|-----------------|------------------|
| new top of pile | new total amount |
| | |

Note: Adapted from Taub (2001)

The Polish speakers tended to depict crowds in a pile with variations of the spread hand and an arced motion (Figure 5.9). The examples included CrowdsAAAAAAc, CrowdsOOO and CrowdsDDD1 (PP). Similar piles were created by other Polish participants for other referents; for instance, in LeavesQQQ and WormsHHH1(2). Another way of creating an imaginary pile was exploring its top with molding static hands. This was observed in Australian realizations; for instance, in CrowdsAAAAA, CrowdsDDDD(1) and CrowdsCCCCC(2); and in one Polish example: LeavesAAAAAA1c(2).

Figure 5.9

Example of depicting the crowds referent as a pile: CrowdsAAAAAAc



the whole picture is filled with people
cafe ujęcie pełne ludzi
|~~~~*****|

AMOUNT IS THE EXTENT ON A FLAT SURFACE. Amount was also depicted as AMOUNT IS THE EXTENT ON A FLAT SURFACE where hands engaged in haptic investigation of a flat area. Such realizations were created on a vertical and horizontal axis and were identified in the Australian group only. The vertical example was CrowdsJJJJ(2) where the participant marked the extent with synchronous, repeated left-right movements of spread flat hands in the PVAB orientation (Figure 5.10). Horizontal examples included CrowdsVVVV and LeavesVVVV(2), where the extent of an area covered by leaves was indicated by a repeated left-right movement of both hands. In CrowdsTTTT and LeavesJJJJ(4), the amount of people and leaves was shown by the spread flat PDAB hand.

Figure 5.10

Example of depicting AMOUNT IS THE EXTENT ON A FLAT SURFACE in CrowdsJJJJ(2) (AP)



there were just people
|*****|

AMOUNT IS THE DIAMETER OF A CIRCLE. Several realizations presented plural referents as a round 2D collection of items that could be summarized as AMOUNT IS THE DIAMETER OF A CIRCLE. Accordingly, the larger the diameter of a circle, the bigger the collection. Such examples occurred in the three groups; e.g., WormsRRRR(4) (AP), LeavesR (IP), CrowdsP(1) (IP), WormsAAAAAAc (PP) and LeavesAAAAAA1c(1) (PP). They generally occurred on the horizontal scale. The “flatness” of the collection was emphasized by selecting flat-hand handshapes; e.g., CrowdsP(1) (IP), LeavesR (IP) and LeavesAAAAAA1c(1) (PP). Other realizations selected bent or crooked alternatives. Such examples could also attempt to convey the image of the set as a 3D round shape in line with AMOUNT IS THE HEIGHT OF A PILE (e.g., WormsRRRR(4) (AP), WormsAAAAAAc (IP)).

Figure 5.11

Example of AMOUNT IS THE DIAMETER OF A CIRCLE in WormsRRRR(4)

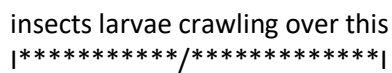


Figure 5.12

- 1) so many people on the beach you couldn't see the sand (-)
|~*~*~*~*~*|
- 2) swarms of people
|~*~*~*~*~*|

These form properties are concordant with Lapaire (2016) and the “globe gesture,” where an invisible globe is sculpted with hands that represents an imaginary object and McNeill (1992, p. 145) when a “bounded physical entity” stands for “the image of a concept.” Such globe configurations are used with a great variety of referents that confirm their metaphoricity: “a generic pattern is used that transcends and neutralizes individual word meanings” (Lapaire, 2016, p. 32). The main globe gesture characteristics are (1) it generally depicts an object that is rather nominal than verbal, phrasal than clausal, abstract than concrete; (2) the majority of NP heads co-existing with the gesture are singular nouns referring to abstract entities; (3) plural nouns are scarce and the reference made to plural concrete nouns is usually “general” and “vague”; and (4) it serves a unifying function, grouping all items together as a cohesive whole. Returning to the realizations depicting a sphere in this study, it can be stated that their properties matched the characteristics presented above. They depicted a large amount of people (one example referred to worms) presented as a roundish bounded collection without including any of their features. They also grouped individuals as a unified whole. Finally, the fact that the same configuration was used for crowds and worms to describe “plenty” shows that the individual meaning was neutralized.

LARGER AMOUNT CAN BE SQUEEZED INTO SMALLER AMOUNT. Another metaphoric extension could be formulated as LARGER AMOUNT CAN BE SQUEEZED INTO SMALLER AMOUNT. In these realizations two hands squeezed an imaginary object into an object of a smaller size (Figure 5.13).

Figure 5.13

Example of LARGER AMOUNT CAN BE SQUEEZED INTO SMALLER AMOUNT: CrowdsDDD (PP)



like ants
jak mrówki
|*****|

The examples comprise realizations alluding to plurality: CrowdsDDD PP; CrowdsTTT(1) PP; CrowdsTTT(2) PP; CrowdsR IP; and LeavesQQQ1 PP (classified as handling suggesting gathering leaves). In a similar fashion, Lapaire (2016, p. 35) notes that “once the globe has been fashioned, it either dissolves or evolves” and the evolving alternatives create “a gestural blend”. Such creations are rather synchronous than sequential: the speaker does not switch from one form to another but combines movement on the other hand with the globe gesture. In the realizations extracted from the study, the movement is also synchronous; however, it is executed on both hands simultaneously engaged in an action of squeezing or packing. What is preserved is the 1-5 spread bent or spread flat handshapes holding a mentally conceived sphere.

COMPLETE AMOUNT IS ROUND.

Finally, it could be speculated that COMPLETE AMOUNT IS ROUND. The evidence for this assumption comes from other studies on metaphor and gesture. For instance, Teranishi (2003) notes that COMPLETENESS is ROUNDNESS stems from examples such as “He was roundly defeated” in English. In addition, in Japanese, “maru” (circle) denotes “a whole” as a noun and “full” and “whole” when used as a prefix. Similarly, Antas (2013, p. 151), analysing gestures referring to such concepts as entirety, whole and all, speculates:

[...] ale sądzę jednak, że rzeczywisty schemat wyobrażeniowy kryjący się za tym pojęciem to wyobrażenie pewnego idealnie skończonego, pełnego zbioru, jaki w wyobrażeniu ludzkim reprezentuje KULA, a (potem już tylko jej geometryczna schematyzacja w postaci koła).
 [I believe that the real image schema hiding behind this concept is the image of a certain perfectly finite complete set, represented by the human mind as the SPHERE (a circle is its geometrically schematized variant)].

Overall, most metaphorical extensions alluding to amount display a spherical or circular shape (see overview in Table 5.4). Accordingly, it could be hypothesized that amount is conceptualized as a round shape. Gestures depicting the sphere could be the least schematized variants, whereas the circular or semi-circular realizations could be the most schematized.

Table 5.4
Overview of amount metaphors

| |
|--|
| AMOUNT metaphors |
| AMOUNT IS THE HEIGHT OF A PILE |
| AMOUNT IS THE EXTENT ON A FLAT SURFACE |
| AMOUNT IS THE DIAMETER OF A CIRCLE |

AMOUNT IS THE DIAMETER OF A SPHERE

LARGER AMOUNT CAN BE SQUEEZED INTO SMALLER AMOUNT

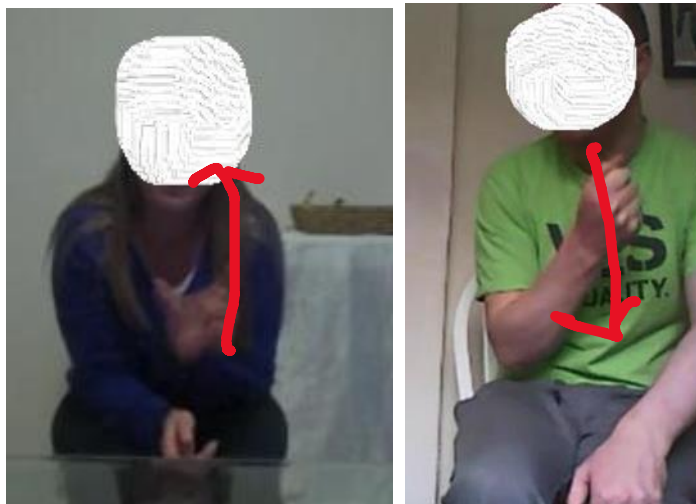
COMPLETE AMOUNT IS ROUND

5.2.3 Knowing and not knowing metaphors

A number of realizations was clustered on a vertical axis that could convey UNKNOWN IS UP and KNOWN IS DOWN metaphors (Lakoff & Johnson, 1980). In these examples, the participants moved the imaginary referent up when they were uncertain how to label it or down when they were confident about its identification. Inspecting the accompanying speech proved to be vital as it provided information about how participants felt during the referent description. Figure 5.14 presents two examples of such gestures that are discussed below.

Figure 5.14

Examples of knowing and not knowing: WormsXXXX(2) (AP) and LightsabersQ(4) (IP)



- 1) I'm not sure these are witchetty grubs either they are very long
|*****|
- 2) he's carrying a blue one
|~~~ _____ *****|

One such realization is WormsXXXX(2) (AP). While describing the worms referent, the speaker lifted the dominant hand with 1+2 spread bent fingers that depicted the length of the creatures. At the same time, she commented: "I'm not sure these are witchetty grubs either they are very long." An analogous movement up was detected in ScrewLLLL(6) (AP). This realization might display two metaphors: (NOT) KNOWING IS (NOT) SEEING and consequently UNKNOWN IS UP. The participant

described the screw simultaneously on both hands with 1+2 bent and lifted the right hand up. The gesture coincided with “you can’t see the top.” In a similar vein, the hand moved up just before ScrewP(2) IP was executed that co-existed with “you can’t see.” An opposing movement down was observed in SabersQ(4) (IP). In this particular example, the participant declared, “he’s carrying a blue one” and the dominant hand, clenched into a fist, moved down.

Overall, these results indicate that metaphor may enrich iconic realizations by adding supplementary information about how much speakers know about a given object or entity they represent in gesture. They can lift an imaginary item up to portray their doubt or uncertainty or position it down to illustrate their confidence.

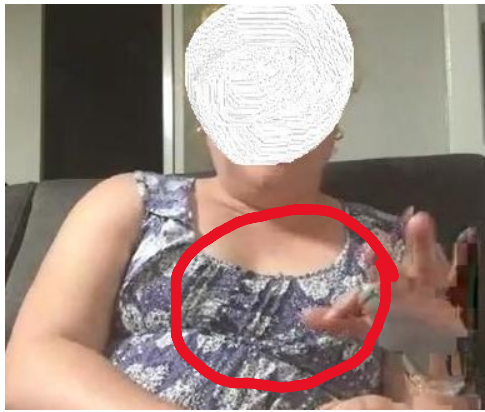
5.2.4 AUTUMN metaphor

The AUTUMN metaphor is an example when an abstract semantic concept is depicted as a physical item or an action associated with manipulating the item. Several such realizations were detected, mainly among the Australian participants. One example was made by the Irish speaker, and none were identified in the Polish group. All these realizations exploited analogous depiction strategies that were used in iconic renderings of leaves. They also coincided with “autumn” in speech. What follows is an account of specific metaphorical extensions and their iconic equivalents.

AUTUMN IS A PILE OF LEAVES. To begin with, AutumnV was the only Irish example. The participant employed 1-5 spread bent and PDdiAB and sculpted a shape that mirrored molding static Leaves realizations (e.g., LeavesAAAAAA1c(2) (PP) and LeavesJJJJ(4) (AP)). Regarding the Australian group, identical form parameters were also observed in AutumnJJJJ (AP). Using the same iconic framework to create a metaphorical extension by participants in different groups suggests that some of the ways we use to conceptualize abstract notions are universal. The fact that static AMOUNT IS THE HEIGHT OF THE PILE realizations for a different referent were structured in an analogous fashion (e.g., CrowdsAAAAA (AP), CrowdsDDDD(1) (AP) and CrowdsCCCCC(2) (AP)) contributes to the metaphorical universality. Interestingly, the realizations were sourced from the Australian group only. Accordingly, it can be suggested that AUTUMN IS A PILE OF LEAVES (Figure 5.15).

Figure 5.15

Examples presenting AUTUMN IS A PILE OF LEAVES in 1) AutumnV (IP) and leaves in 2) LeavesAAAAAA1c(2) (PP)



uhm autumn
|~~~~*****|

AUTUMN IS LEAVES ON TREES. The last two Autumn examples were generated with the help of the molding dynamic. In AutumnAAAAA(1) (AP), lax flat hands explored the upper part of the imaginary surface with PVAB hands moving in opposite directions horizontally, and in AutumnAAAAA(3) (AP) the 1-5 spread crooked configuration investigated the same surface with an opposite zigzag movement on both hands. It could be also hypothesized that the crooked handshape and zigzag motion depicted the uneven top of the imaginary structure. Additionally, these two AUTUMN realizations preserved the iconic arrangement of the stimulus (i.e., some leaves were positioned on trees at the top of the picture) and therefore could represent AUTUMN IS LEAVES ON TREES. None of the iconic Leaves depictions matched exactly these two vertical AUTUMN representations; however, the CrowdsJJJJ(2) example, related to AMOUNT IS THE EXTENT ON A FLAT SURFACE, bears a striking similarity. Accordingly, these gestural renditions of AUTUMN could be seen as a further convincing argument for metaphor as generalizing semantic contents (Lapaire, 2016).

Figure 5.17

Example of AUTUMN IS LEAVES ON TREES in AutumnAAAAA(1) (AP)



autumn
|*****|

5.2.5 Action metaphors

Numerous metaphorical extensions have been identified that are clustered around an underlining action. This section has been inspired by the research undertaken by Bressemer and Müller (2014a) and their repertoire of German recurrent gestures centered around a semantic core. In the next sections, a more detailed account of such creations is given. Section 5.2.5.1 explores the actions of quivering and fluctuating, Section 5.2.5.2 presents the actions of emanating and absorbing, and Section 5.2.5.3 explores giving and receiving.

5.2.5.1 Quivering and fluctuating

This group comprises metaphoric extensions built upon actions of rapid irregular movements as if exploiting quivering and fluctuating.

PHYSICAL QUIVERING IS EMITTING LIGHT. Quivering, for instance, might be perceived as PHYSICAL QUIVERING IS EMITTING LIGHT. This has been inspired by Brennan (1990) and her BSL examples, such as GLITTER, SPARKLY, REFLECTION and SHIMMER. The underlying metaphor is physical quivering that conveys the image of tremulous light (e.g., in SHIMMER, the spread fingers are engaged in a repeated wriggly motion). The motion can be accompanied with short, repeated twisting movements of articulators in the 5-shape generated from the wrists. In the following two examples, the participants attempted to imitate the wavering light of the lightsabers. In LightsabersLLLL (AP), two crossed hands shook with a slight rapid motion. At first sight, it could be speculated that the two imaginary swords were fighting, but the movement was too subtle and recurred at too regular intervals; it rather resembled shaking or vibrating light. LightsabersPPP1 (PP) is in line with Brennan's examples above: two spread articulators engaged in a repeated movement of irregular fingers. Additionally, the co-occurring speech provided the lightsabers' attributes: "shiny" and "glittering."

Figure 5.18

Example of PHYSICAL QUIVERING IS EMITTING LIGHT in LightsabersLLLL (AP)



with the swords (-) looking like they are both illuminated

|~~~~~*****|**|

Another example, LightsabersPPP1 (PP), is also analogous in form to Brennan's examples (1990) cited above: two spread articulators engaged in a repeated movement of irregular fingers. Additionally, the co-occurring speech provided the lightsabers' attributes: 'shiny' and 'glittering'.

PHYSICAL FLUCTUATION IS MENTAL FLUCTUATION. PHYSICAL FLUCTUATION IS MENTAL FLUCTUATION, as coined by Brennan (1990, p. 122), relates to a set of indefinite metaphors (Brennan, 1990) that convey indefiniteness, typically affiliated with meanings such as uncertainty or doubt. An example would be BSL DOUBT, in which two flat palms up (B shape) move in an alternating up-down movement. In a similar vein, Brennan (1990) claims that this metaphor can be communicated by some uses of the word "oscillate" in English, and it is used by the spatial metaphor to convey the meaning of mental oscillation. Numerous English words can be converted into BSL signs in which this metaphor is conveyed even more explicitly through fluctuating hands (e.g., irresolution, vacillation or uncertainty). Other BSL examples include MAYBE (produced with a short up and down twisting motion), PERHAPS (generated with a short side to side twisting motion) or AMBIVALENT (employing an alternating to and fro twisting movement). Similarly, Kimmel (2013) finds examples of UNCERTAINTY IS WAVERING in his research on metaphorical gestures.

In an analogous fashion, certain realizations were enriched with metaphorical content alluding to expressing uncertainty and doubt by applying a quivering oscillating motion. For instance, in CrowdsLLLL(1) (AP) (Figure 5.19) and CrowdsLLLL(2) (AP), the speaker attempted to describe crowds, first by resorting to depicting an individual in a crowd with 1+2 bent and then the entire "composition" with two 1-5 spread bent hands, both accompanied by a quivering motion.

Figure 5.19

Example of PHYSICAL FLUCTUATION IS MENTAL FLUCTUATION in CrowdsLLLL(1) (AP)



I couldn't really pick out any anyone or a single object
|~~~~~|

A feeling of uncertainty was additionally conveyed by co-occurring phrases: “[I just couldn't really pick out any] anyone or the single object” and “[I don't know quite what] the whole that composition...” In SharkCCC (PP), the participant tried to locate the shark in gesture space with a series of short, repeated left-right movements. The accompanying speech also expressed uncertainty about its location: “gdzieś tam ten rekin był” (the shark was there somewhere). In LightsabersRRRR(1) AP, the dominant hand held an imaginary sword and was engaged in short, repeated away-towards body motions. At the same time, the speaker voiced “I don't remember the name of them.” Similarly, in CoffeepotAAAAA (AP), the speaker expressed doubt about the type of material the coffee pot was made of that was gesturally reinforced by repeated, simultaneous left-right movement on both hands. In CoffeepotCCC(2) (PP), the participant depicted deciding between “teapot” and “coffee pot” and moved both hands in a repeated alternating away-towards body manner. It is possible that this example also reflected the DIFFERENT IS APART/OPPOSED metaphor by clearly highlighting two distant locations in gesture space (Figure 5.20).

Figure 5.20

Doubt expressed by simultaneous left-right movement on both hands in CoffeepotAAAAA (AP)



it was white and porcelain or not (-)
|~~~~~*****|

5.2.5.2 Emanating and absorbing

A set of BSL signs could be grouped under the umbrella of EMANATE (Brennan, 1990). Their typical manifestation would be the opening of a closed hand. “This action of the opening and spreading of the hand and fingers realises a visual metaphor which expresses meanings linked with the idea of 'emanating'; 'sending forth' (Brennan, 1990, p. 97). The BSL examples include SUN, LIGHT(S), SEND and MAGIC. The EMANATE metaphor is also present in other sign languages. Leeson and Saeed (2012, p. 136), for instance, present a plethora of ISL examples, such as SUN-SHINING, LIGHT(S), TRANSMIT, MAGIC, SPEND, BOMB, DISCHARGE, EMIT, SHOUT, FLOW and MICROWAVE. Other signs in ISL which also make use of the EMANATE/EMIT form include DISTRIBUTE, SPREAD, FLASHLIGHT, HEADLAMPS, CAR-EXHAUST, STREETLIGHTS, FLASHING DOORBELL, POLICE-SIREN, AIRPORT-LANDING LIGHTS, OVERHEAD-PROJECTOR and SHOWER. This section provides examples of realizations that fit into this pattern.

The idea of “sending forth” could be identified in ScrewTTTT(3) (AP), where the participant described a screw coming out of a piece of timber (Figure 5.21).

Figure 5.21

Action of emanating in ScrewTTTT(3) (AP)



coming out of a piece of timber
|~~~~ ***/**|

—

The realization was classified as portrayal; however, it diverges from a typical screw portrayal presentation in the data. Instead of representing the screw with 2 stretched, the handshape foregrounded opening of fingers and alternated from 1-5 spread crooked to 1-5 spread bent. It was also equipped with the movement up. Overall, it resembles light moving outward from a source. The motif of emanating light might also be seen in *LightsabersQQQ* (PP), where portraying/presenting lightsabers with spread flat hand or lax flat hand handshapes could represent the weapons flashing light (Figure 5.22).

Figure 5.22

Action of emanating in LightsabersQQQ (PP)



lightsabers moving
miecze świetlne (-) w ruchu
|**|

In contrast to the previously discussed examples, the actions of absorbing explored the motif of taking in or soaking up. The ABSORB metaphor, for instance, is realized with the open hand closing (e.g., BSL LEARN or HEAR) (Brennan, 1990). Analogously, BSL DISAPPEAR could be understood as being swallowed up by or absorbed by something, e.g., mist (Brennan, 1990). This is evident in the case of *TreesH(2)* (IP), where the participant described trees as “obscured” and closed her dominant hand into a fist at the same time (Figure 5.23).

Figure 5.23

Action of absorbing/disappearing in TreesH(2) (IP)



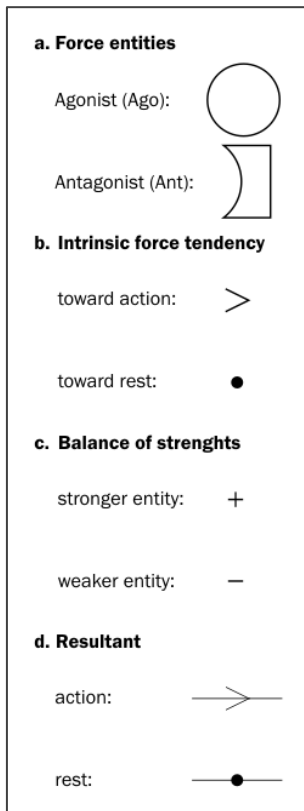
trees somehow obscured
|~~~~*****/**|

—

Several screw realizations metaphorically alluded to emitting or absorbing force. These depicted a screw on one hand and the surface on the other. The handshape representing the surface occasionally changed in relation to the screw's impact, even in the examples where the screw did not come into immediate contact with the surface. It seems possible that such realizations depicted (1) the force of the screw penetrating the surface and (2) the force of the surface opposing the force of the screw. Consequently, it could be proposed that the forces described here are analogous to Talmy's (2000, pp. 413-415) system of *force dynamics* and his concept of two entities: the *Agonist* (Ago) and the *Antagonist* (Ant). The Ago can be defined as a focal force entity that possesses an intrinsic force tendency toward action or rest, and the Ant is the force entity opposing the Ago (Figure 5.24).

Figure 5.24

Talmy's forces

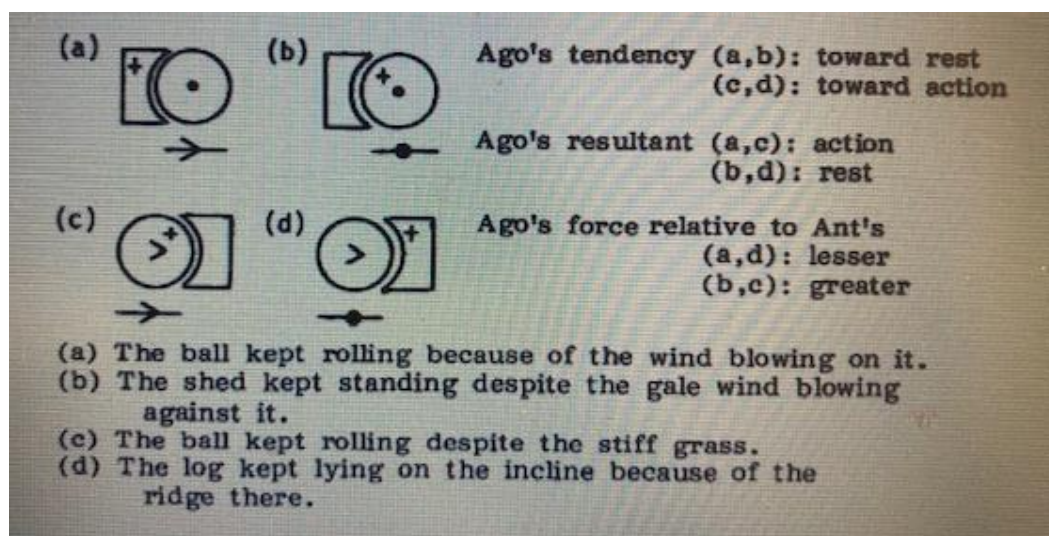


Note: Adapted from [http://en.wikipedia.org/wiki/Force Dynamics](http://en.wikipedia.org/wiki/Force_Dynamics)

The intrinsic force tendency is based on the principle of distinction: toward action or toward rest. Similarly, the strengths are contrasted as a stronger and weaker entity. These distinctions are critical for identifying the basic steady-state patterns. Talmy (2000, pp. 415-417) distinguishes four of them: *Causative*, *Weak Despite*, *Strong Despite* and *Causative Hindrance* (Figure 5.25).

Fig. 5.25

Representation of steady-state patterns



Note: The steady-state patterns have been adapted from Talmy (1985).

In the Causative pattern (a), a weaker Ago shows a tendency toward rest but is confronted by a stronger Ant that forces an Ago to move. In the Weak Despite pattern (b), a stronger Ago also shows a tendency toward rest; however, it is stronger than an Ant and manages to remain immobile. In the Strong Despite pattern (c), a stronger Ago shows a tendency toward motion and is opposed by a weaker Ant. This results in the Ant's failure to block the Ago and in the Ago's subsequent movement. Finally, in the Causative Hindrance pattern (d), a weaker Ago shows a tendency toward motion; however, it is blocked by a stronger Ant and is forced to remain *in situ*.

Talmy's theory is relevant to several realizations investigated in this study. For example, ScrewP(4) (IP) could be an instance of the causative pattern when a weaker Ago (surface) is confronted by a stronger Ant (screw) and so opens up when the screw approaches (Figure 5.26).

Figure 5.26

Example of the causative pattern in ScrewP(4) (IP)



but it's just going through the wood
|~~~*****|

In this way, the screw's force permeates the surface and subsequently emanates from the surface, which is reflected in the hand opening. In a similar vein, in ScrewDD (IP), a weaker Ago (surface) is affected by a stronger Ant (screw), but this time the hand representing the surface closes as if absorbing the force of the screw. Screw TTT1(2) depicts the Ant (screw) as engaged in a repeated circular movement and the Ago (vertical surface) absorbing the Ant's force and quivering. Interestingly, the gesture co-exists with "[I don't know the] name of this." Such fluctuating and quivering movements (as in UNCERTAINTY IS WAVERING (Kimmel, 2013)) have been linked to the expression of feelings of doubt. Therefore, it is difficult to determine which function is used here: experiencing the Ant's force, expressing uncertainty or both. The next two realizations, ScrewJJJJ(1) (AP) and ScrewTTT1(1) (PP), seem to be in line with the Weak Despite pattern, where a stronger inactive Ago (surface) manages to remain in place (Figure 4.27).

Figure 4.27

Example of weak despite pattern in ScrewTTT1(1) (PP)



something on the (-) is there is (-) through the wall
|~~~~~*****|

In ScrewJJJJ(1) (AP), in a series of three strokes, the hand portraying the surface becomes tense when the imaginary screw approaches and the spread flat hand conveys the impression of emitting its own force. Towards the end of the last stroke, the finger portraying the screw loses its rigidity whereas the other articulator stays tense. Finally, in ScrewI (IP), the dominant hand uses the handling strategy and with 1+2 touching turns the screw (Ant) when the non-dominant hand adopts the flat hand lax handshape for the surface (Ago). The fact that the surface is portrayed with no tension could imply that the Ago is weaker. However, it manages to remain in its position unaffected by the

Ant, which could also mean that the Ago is a stronger force and resists the impact. Accordingly, it is impossible to determine fully which steady-state pattern this realization depicts.

Overall, these realizations are likely to portray Talmy's system of force dynamics. Interestingly, Oakley (2005) remarks that Talmy never uses the phrase "image schemas"; however, his definition of the phenomena is consistent with Johnson's (1987) definition of image schemas. Though image schemas are not the subject of this thesis per se, their involvement in gestural sign creation cannot be ignored (see the Literature Review on image schema types and definitions). First, gestures can be manifestations of image schemas (Cienki, 2005). Second, metaphor research has shown that image schemas structure the source domain for several conceptual metaphors (Gibbs, 2005), which is particularly relevant in this section.

5.2.5.3 Giving and receiving

The actions of giving and receiving created another grouping of realizations. The "giving" category included realizations that, instead of employing one of the depiction strategies, utilized the Palm Up Open Hand (PUOP) (Kendon, 2004; Müller, 2004) when participants were describing a referent. These realizations are in line with Müller (2004), who documents functional uses of PUOH collected around the theme of presenting an abstract object as an obvious one to the addressee or offering an abstract object for inspection.

It is likely that the "receiving" action gestures display a different underlying motivation, which could be interpreted as RECEIVING IS NOT KNOWING. In such realizations, both hands open to Palm Up Open Hand (PUOH) as if awaiting the receipt of an imaginary item. This metaphorical extension is in line with Efron (1941/1972) and his research on the gestures of Italian and Eastern European immigrants in America. The Italians used the gesture as a standardized means of requesting something, whereas the Eastern European Jews did so as a way of expressing "I don't know." In a similar vein, Müller (2004) specifies that one of the uses of PUOH gestures is to express the fact of not knowing. The fact that these gestures have been observed in different populations might indicate their universal character.

GIVING IS KNOWING. In these examples, participants also presented referents as obvious ones, though these were not abstract but concrete, and the action could be summarized as GIVING IS KNOWING. This metaphorical extension is exemplified in LightsabersDDD (PP) (Figure 5.28) and LightsabersFFF (PP), where participants presented lightsabers on PUOH that co-existed with "miecze świetlne" (lightsabers) in speech or in LightsabersQ(3) (IP) where the participant depicted "shaft" with two PUOH hands. In SharkKKKKK(1) (AP), the speaker presented "giant shark" on PUOH and a series of repeated up-down movements. Some of the "giving" examples included a combination of a depiction strategy and a movement away, presumably directed at the interlocutor. This is

transparent in LightsabersRRRR(4) (AP), where the participant molded the width of the swords on both hands, moved the dominant hand away and articulated “the swords.” Similarly, in ScrewTTTT(4) (AP), the 1+2 bent handshape molding the screw was moved away from the gesturer’s body and the speech provided the information about its location, “[so it’s just kind of] sitting there.”

Figure 5.28

Example of giving is knowing in LightsabersDDD (PP)



lightsabers
miecze świetlne
|*****|

RECEIVING IS NOT KNOWING. It is likely that the “receiving” action gestures display a different underlying motivation, which could be interpreted as RECEIVING IS NOT KNOWING. In such realizations, both hands open to PUOH as if awaiting receipt of an imaginary item. This is evident in the case of LightsabersQQQ1(3) (PP) (Figure 5.29), where the speaker expressed doubt (“light swords I don’t know how to call [all these]”) and simultaneously maintained the PUOH configuration. A further example is SharkZZZZ(1) (AP) where the participant uttered “shark” with rising intonation and two hands opened to PUOH. In a similar vein, Müller (2004) specifies that one of the uses of PUOH gestures is to express the fact of not knowing. The fact that these gestures have been observed in different populations might indicate their universal character.

Figure 5.29

Example of RECEIVING IS NOT KNOWING in LightsabersQQQ1(3) (PP)



light swords I don't know how to call these
|*****|

Discussion

A general conclusion that could be drawn from these findings is that even iconic gestures are equipped with elements of metaphoricity. Metaphor is employed to convey conceptual information that goes beyond physical characteristics of the referents. Molding strategies are used to foreground various abstract dimensions such as the length, width, height and depth of concrete objects. Some dimensions are more readily selected than others, while some might also be profiled in a different way by various groups (e.g., profiling the height of the coffee pot by the Australian speakers). In the same vein, amount can be gesturally presented by taking on various geometric configurations. A round shape seems to be the most readily selected, with the sphere being the least schematized, and the arced motion occurring in pile depictions the most schematized variant.

It is also possible that one metaphor can combine the use of geometrical configurations and actions united around one semantic core to convey a specific concept. This is exemplified by AUTUMN where the same target domain, AUTUMN, is linked with various source domains: LEAVES that could be picked and tactically explored on a flat vertical surface or as a pile. The fact that these realizations were mainly sourced from the Australian group might indicate their less universal character.

An underlying physical action can lead to creating various metaphoric extensions; for instance, quivering could be associated with emitting light. The light motif was also adopted in emanate/emit and absorb/disappear metaphors, where a specific entity or force could be spread out or absorbed the way light is. These examples agree with Talmy's forces of dynamics (2000), Cienki's (2005) perspective on image schemas and the theory that image schemas establish the conceptual metaphor source domain (Gibbs, 2005). Irregular fluctuating motions also conveyed the speaker's uncertainty regarding the depicted referent in line with PHYSICAL FLUCTUATION IS MENTAL FLUCTUATION (see more sign language examples in Brennan (1990)). In these realizations, the hand

or hands were moving in a quivering or swaying motion, attempting to decide between different locations or struggling to label a referent. Knowing and not knowing could also be conveyed by the basic actions of giving and receiving. In these realizations, the participants presented a referent in line with GIVING IS KNOWING on the PUOH configuration and moved it closer toward the addressee. Not knowing was also depicted by PUOH and/or a slight movement apart. This time, however, the motivation was different, and the gesturer placed their open hands apart as if waiting to receive something from the interlocutor concordant with RECEIVING IS NOT KNOWING.

Metaphor can also enrich the iconic representation with the gesturer's epistemic stance. Metaphor portrayed KNOWING IS DOWN (Lakoff & Johnson, 1980) in realizations when participants felt confident about the described referent and NOT KNOWING IS UP (Lakoff & Johnson, 1980) when they were dubious about the item. In this way, iconic realizations were additionally provided with the gesturer's epistemic stance towards a given referent. Accordingly, this is a perfect example of gestural multifunctionality and provides further evidence for approaching gestures as dimensions rather than separate categories (McNeill, 2006).

Finally, it could be speculated that metaphor can alternate iconic representations. In fact, some metaphorical creations are so powerful that they can override an iconic arrangement of the stimulus (e.g., BIG metaphor in SharkQQQ1(3) PP or RECEIVING IS NOT KNOWING in SharkZZZZ(1) AP). In addition, it is likely that certain metaphorical extensions feed on iconic representation of concrete objects and neutralize semantic meaning (Lapaire, 2016); e.g., analogous universal AMOUNT portrayals with different referents across different groups. Though this chapter has only touched the surface of metaphoricity in depiction strategies, and although metaphoric gestures were not the subject of this investigation per se, it has been shown that metaphorical processes actively participate in creating iconic gestures and cannot be ignored.

Chapter 6: General Conclusions

Thus far, we have looked at iconicity and metaphor's role in creating depiction strategies in representational gesture. In this chapter, we turn to consider our main results and present some final comments.

In Chapter 1, we laid out the general foundations of this thesis, namely, we presented various attempts of defining and classifying gesture and the chief theories of gesture creation. We also provided the study's specific perspective on gesture and explained why iconicity and metaphor are the subject of this investigation with a brief overview of methodological design and the study's significance. We also identified three key research questions:

1. How do different semantic characteristics affect depiction strategy selection and creation?
2. How do different communities affect depiction strategy selection and creation?
3. What is the role of metaphor in creating depiction strategies?

In Chapter 2, we turned to review the literature. We analysed various gesture production models and, in particular, the gesture-as-simulated-action approach (Hostetter & Alibali, 2008) influenced our thinking vis-à-vis the data concerned. We also presented cognitive-semiotic principles as gestural sign ingredients and various depiction strategy types identified in sign and gesture.

In Chapter 3, we laid out the methodology adopted in this thesis. We re-stated the research questions and signposted these questions to the relevant sections in the Literature Review. We also introduced the design of the study as well as the analysis and coding steps.

In Chapters 4 and 5, we turned to answer the research questions posed. Here, we take the opportunity to summarize the key results that have emerged, contextualizing them in the field of gesture studies more broadly and considering how this positions us for follow-on research work.

6.1 Re-stating the research questions and main results

The three research questions related to iconicity and metaphor's involvement in selecting and creating depiction strategies in co-speech representational gesture sourced from three cultural-linguistic communities: Australia, Ireland and Poland. They intended to explore whether it is possible to detect consistent patterns in referent depiction within each community and across communities. Question 1 investigated the impact of various semantic characteristics (spatiality, animatedness, manipulability and plurality) on iconicity in depiction strategies. Question 2 explored the community impact (Australia, Ireland and Poland) on iconicity in depiction strategies. Question 3 analysed the

involvement of metaphor in creating these strategies. What follows is a summary of the main results grouped around the relevant question.

1. How do different semantic characteristics affect depiction strategy selection and creation?

We found that following certain iconic patterns unified around a semantic characteristic have emerged. For example, we found that molding is a prominent strategy in spatial depiction, particularly with respect to depicting shape and size. The motivation behind the favoring of the molding static strategy over the molding dynamic and consequently sculpting the shape of an object with hands or applying the movement parameter to trace the contour of an item is unknown. A possible explanation for the selection of this strategy is the fact that smaller objects (e.g., a ball or a boulder) can be sculpted with both hands, whereas larger or longer items (e.g., a path or a house) could elicit movement as in the path-for-shape iconicity (Brennan, 1990). Furthermore, a relationship between handedness and a specific orientation emerged as prominent in molding. When the palm lateral towards center (PLTC) orientation was employed, the majority of the realizations were two-handed (e.g., coffee pot realizations and Australian and Polish path examples). In contrast, the Irish participants opted for the palm down away body (PDAB) orientation to present the path and generated one-handed realizations. Palm vertical towards center (PVTC) and palm lateral towards center (PLTC) orientations applied by both hands were also selected to describe round items such as the boulder.

We also found that portrayal and the extraction of an image embodying a specific entity was the most frequently selected strategy to depict animated referents, viz, the excavator and the shark. These images were schematized to various degrees, becoming more or less adequate copies of the original shape. A further profiled feature was a specific action and imitation of the way the referent moved. Selecting an action as an image to be recreated in gesture could be motivated by the animated/animate inherent qualities.

Placing (on its own or combined with portrayal) was found to be the second dominant strategy in animated object depiction. The fact that it related to one stimulus only, the photograph presenting the relation between the shark and the swimmer, raises a question about the qualities exhibited by these two entities. One alternative would be that placing is an iconic way of recreating the referent(s) location when (1) the referent is represented by the dominant hand depicting the shark and the gesturer's body becomes an invisible witness or (2) two hands become two entities, the shark and the swimmer (see also body partitioning (Dudis, 2004)), and dual viewpoint gestures (Parrill, 2009). Another option would be exhibiting qualities of an animate/animated entity intrinsically equipped with a particular movement. In other words, if a referent is animate/animated,

it naturally displays the propensity for a certain action and is likely to move and change its location. Thus, moving and placing the shark (e.g., with the away movement) could be explained by its natural characteristic of chasing its prey.

We also noted that handling is a preferred strategy when depicting manipulable objects across all three groups, followed by portrayal as the second preferred strategy. The manipulability-oriented referents also generated the highest number of realizations. This result is concordant with other studies that found that manipulability is a significant predictor of creating iconic gesture (Hostetter, 2014). Handling employed a diverse array of handshapes for the screw (Table 4.1) and one handshape for the lightsabres: fist. The opposite trend was witnessed in portrayal, where the screw predominantly used the 2 stretched configuration, whereas the lightsabres utilized plural hands and plural fingers. Further research is needed to investigate a diversified system of handshapes in various strategies.

Internal and external metonymy modes were both utilized to represent plurality referents. Internal metonymy, also known as synecdoche, is based on a contiguity relation in which a part stands for another part, a part for the whole, or a whole for the part (Mittelberg & Waugh, 2014). External metonymy comprises an array of outer contiguity relations such as contact, containment, manipulation and exploration (Mittelberg & Waugh, 2014). Internal metonymy was singled out to represent one representative of the whole collection, whereas external metonymy employed an external contiguity relation in which the hand(s) explored an entire set of referents. In this way, (1) molding static and dynamic strategies with internal metonymy were favored to depict a singular representative of the plural animate referent (worms) and (2) the molding static and dynamic with external metonymy were applied across all plural referents: worms, leaves and crowds. Further research is needed to determine if animate plural referents show a marked bias towards selecting the internal metonymy mode.

Portrayal was selected as the second dominant strategy to depict animate plural entities, viz, worms. As this strategy was not favored by other plural referents, it is possible that animacy exhibited by this referent imposed its presence through portrayal and the irregular wriggly movement of fingers. Apart from identifying the iconic patterns presented above, other chief results directly related to the depiction strategies have emerged:

We found that the same underlying action can be profiled in different strategies (e.g., the straight movement down in handling a screw and the analogous movement of a screw going down in portrayal, or the circular action of revolving fingers in handling a screw compared to the index finger travelling around a circle in screw portrayal realizations). These examples refer to the same referent, the screw, and the manipulable objects category. It remains to be verified if this trend could be extended to other referents and different semantic characteristics.

We also found that referent affordances determine the selection of the depiction strategy and relevant cognitive-semiotic mode. We have already seen that handling was readily selected to depict manipulable objects. This strategy was also employed with other referent types that afforded manipulation; for instance, certain plurality referents, worms and leaves, but not crowds. The first two are considered small items that can be easily handled and manipulated. Crowds, in contrast, could be associated with representing a human body, far too big to be lifted or manipulated by hands. In such crowds realizations, molding was adopted instead. A further example, the feature of animacy occurring in plural worms, was robust enough to impose molding with internal metonymy or portrayal. Therefore, it could be stated that specific referent affordances determine the depiction strategy selection as well as the cognitive-semiotic mode.

Additionally, we noted that manipulability has generated the most multiple constructions, and a correlation between the number of multiple gestures and a specific semantic area has emerged. For instance, multiple realizations clustered around manipulability considerably exceeded in number the realizations depicting spatiality. Molding was frequently selected in combination with handling but also other techniques (e.g., portrayal). The fact that these gestures were identified in the three groups proves their universal character. Nevertheless, a marked bias towards a specific semantic characteristic was also observed across different groups (Australian speakers favoring multiple combinations to convey plurality).

We also found that simultaneity in gesture is universal, although there appears to be a pattern of specific tendencies arising for each of the different groups considered in this study. For instance, the majority of mirroring gestures recorded were produced by the Polish participants, whereas the doubling gesturers were identified in the Australian population only. The Irish participants produced the largest number of realizations for the two different referents on two different articulators in comparison to other simultaneity categories. Nevertheless, combinations of the same strategies across different groups were also found that might suggest their ubiquitous nature traversing different populations.

2. How do different communities affect depiction strategy selection and creation?

While certain form aspects and parameters have been found to be universal for the three groups, underlying tendencies specific to individual communities have also been identified. We noted that participants seem to select one referent's salient image that maps onto a given referent over others. For example, the excavator stimulus generated gestural realizations highlighting the three images, claw, boulder, and caterpillar track, each employing a different depiction strategy. The claw referent elicited the most portrayal examples, the boulder produced molding realizations, and the caterpillar track generated drawing gestures. The caterpillar track examples were elicited in only one Irish

participant and five Australian speakers. No such gestures were identified among the Polish participants.

We noted that across all groups, there was a preference for a specific depiction strategy for several referents. For instance, in the worms depictions, the Irish participants only used handling to represent the referent. The Polish participants favored portrayal, and therefore it could be speculated that they found animacy a prominent feature for this referent. The Australian participants showed a clear preference for molding static with internal metonymy. In these realizations, the thumb and index finger depicted the size of one representative of the entire collection. A further example is coffee pot gestures, with molding static being favored by the Australian speakers, shark realizations eliciting the largest number of placing in the Australian group and placing and portrayal favored among the Polish participants.

Across the groups, we noted a tendency to designate different articulators to represent the target referent. For example, the Irish speakers showed a preference for the single hand and plural fingers to describe the shape in path realizations, whereas the Polish participants favored depicting the path with two hands. A further example could be lightsabers, with some Australian participants portraying the referent with plural fingers and the 2 stretched handshape, whereas other realizations, including those of the Australian, Irish and Polish speakers, opted to employ hands instead of fingers.

Different orientations were selected to depict the same referent's feature across the three communities. For instance, PD and PU orientations respectively were adopted in certain molding Australian coffee pot depictions, while the rest of the Australian, Irish and Polish coffee pot realizations maintained the PLTC and PVTC orientations. This trend seemed to traverse both molding strategies, with the PU/PD orientations for both hands also identified in molding dynamic Australian instances. A further example is certain path realizations, where the Polish speakers opted for PLTC, whereas the Irish participants consistently employed PDAB and the Australian speakers a mix of both.

The motion direction parameter associated with a specific referent was another form aspect that revealed variety across the three groups. This is exemplified by the horizontal Polish claw gestures and vertical up, down and up-down repeated claw Australian, Irish and Polish examples. A further unexpected finding was two molding dynamic path realizations accompanied by a vertical, upward motion, PathOOO and PathPPP, produced by the Polish speakers, while the remaining realizations in the three groups were produced on a horizontal axis.

3. What is the role of metaphor in creating depiction strategies?

The main goal of the third research question was to investigate metaphor's involvement in creating the depiction strategies that emerged above.

The study has identified that (1) certain dimensions have been more readily selected than others for specific referents by all the groups (e.g., length in path, roundness in coffee pot realizations), (2) certain dimensions are profiled in various ways by different groups (e.g., length in Irish and Polish path realizations) and (3) certain groups deem other features salient (e.g., height in Australian coffee pot gestures). Further research is needed to determine which dimensions require the least effort to be conveyed in gesture and if there are any preferential patterns in dimension depiction among different groups of participants.

Metaphor has been involved in representing abstract concepts through various geometrical representations. For instance, AMOUNT was commonly portrayed by a roundish shape. The sphere seemed to be the least schematized variant, followed by the arced motion employed in pile depictions and the sculpted semi-circle representations as the most schematized alternative. Other renderings involved presenting amount on a flat surface.

We also note that metaphor can combine the use of various geometrical configurations and actions united around one semantic core to represent the same metaphorical concept. For example, AUTUMN can be linked with the LEAVES source domain, allowing the LEAVES to be picked, manipulated and tactically explored on a flat vertical surface or as a pile. In this way, a concept of autumn is given a physical presence through various iconic renderings of leaves. The fact that these gestures were identified mainly in the Australian group might point to their less universal nature. Indeed, further delving into what may or may not be community-specific metaphoric underpinnings of gesture needs to be explored.

An underlying physical action can lead to the creation of various metaphoric extensions; for instance, an act of physical quivering, as in emitting light. The light motif was adopted in emanate/emit and absorb/disappear metaphors, where a specific entity or force could be spread out or absorbed in the manner of light. Irregular fluctuating motions also conveyed the speaker's uncertainty regarding the depicted referent when PHYSICAL FLUCTUATION IS MENTAL FLUCTUATION (Brennan, 1990).

Metaphor can enrich the iconic representation with the gesturer's epistemic stance or attitude. In several realizations, further information was provided by gesturers not related to the iconic representation of the referent but rather to the speaker's epistemic stance or attitude (Mittelberg & Waugh, 2014). For instance, the participants expressed how they felt about a particular referent (e.g., deciding between two alternatives in CoffeepotCCC(2) (PP)), whether they identified an object/entity well, had a limited knowledge of this particular item (e.g., KNOWING IS UP or NOT

KNOWING IS DOWN (Lakoff & Johnson, 1980)) or finally offered an object for inspection to an addressee¹⁸ (e.g., LightsabersFFF (PP)).

Certain metaphorical extensions seem to feed on iconic representation of concrete objects and neutralize semantic meaning (Lapaire, 2016). This theory has been exemplified in AMOUNT realizations where various plurality referents (e.g., crowds, leaves and worms) generated analogous in form realizations depicting a roundish entity.

Metaphor can override the iconic arrangement of the stimulus. It is possible that certain prototypical mental representations override the iconic arrangement of the stimulus and serve as metaphor source domains that are subsequently realized in gesture (e.g., BIG in SharkQQQ1(3) (PP) or vertical path examples in the Polish group). This metaphor's role is indirectly confirmed by analogous metaphorical representations for different referents found in the literature (e.g., BIG in Nyst (2016a)) and the prototype theory (Rosch, 1977), in which prototypes serve as cultural models in both sign creation and interpretation.

Regarding the cross-community comparison, several metaphor's functions proved universal and transparent in the three populations (e.g., conceptualizing amount as a round shape), whereas some related to a specific population (e.g., depicting AUTUMN as LEAVES in Australian realizations), it is possible that different metaphors are, in Müller's (2008) sense, sleeping and waking in the investigated communities. That is, further research is needed to determine their universal and specific activation.

6.2 Final comments

The study set out to analyse depiction strategies affected by the exposure to stimuli representing various semantic characteristics across three different communities. Furthermore, it was also designed to determine the role of metaphor in creating these depiction techniques. Overall, it has been shown that gesturers use the same array of strategies to create patterns indicating different semantic characteristics. On the semantic level, certain internal relations between strategies have been identified. For instance, portrayal and handling utilized the same physical actions (a downward straight movement or a circular motion in the screw realizations). A likely explanation is that action simulations (Hostetter & Alibali, 2008) evoked by the referent resulted in gestures in two different depiction techniques. Another example would be the semantic features of animate and animated bringing various strategies together. Again, the action characteristic seems to be an intrinsic factor and transcends the strategies by depicting referents the way they move (e.g., molding and portrayal combinations of worms, portrayal depicting worms, personification depicting worms, certain

¹⁸ Offering an imaginary object for inspection has been analysed in detail in Müller (2004) with presentations of other uses of the Palm Up Open Hand (PUOH).

excavator and shark portrayal examples). Furthermore, recreating the referent's location, as in topographic (semantic) space (Napoli & Leeson, 2020) has been noted across strategies. It was particularly noticeable in placing and combinations of placing and portrayal (shark realizations) but also present in molding examples (molding the shape of the coffee pot and placing it in the center center position to show its location). The spatiality characteristic predominately employed molding static and dynamic with sparse drawing examples (coffee pot, boulder, path gestures). A likely explanation for a clear preference for molding over drawing might be the way these referents are schematized; preserving a 3D rather than 2D shape. Finally, representing an indefinite amount as a bounded space (Talmy, 2000) has been found with plurality and animatedness characteristics and molding static and dynamic strategies were used in depictions of crowds, leaves and worms. To sum up, these results accord with Masson-Carro et al. (2016), who state that high affordance objects (Gibson, 1979), are mainly expressed through object use and gripping gestures, whereas low affordance variants are depicted with molding employing haptic perception (Lederman & Klatzky, 1987). Also, following Masson-Carro et al. (2016), it is likely that molding stems from a different type of simulated action involving haptic touch. Accordingly, this study confirms a close relation formed between object affordances and semantic characteristics with manipulability predominately linked with handling, spatiality and plurality with molding and animatedness with portrayal.

On the semiotic level, patterned iconicity (Padden et al., 2015; Padden et al., 2013) has emerged allocating depiction strategies across realizations with different semantic characteristics. Iconicity often interacts with metonymy, to a significant extent, and selecting an image to represent a concept occurs by means of metonymy. The results of this study show discrepancies in opting for internal or external metonymy across the depiction strategies. For instance, in molding static and dynamic realizations, internal metonymy was adopted to depict a shape of one representative standing for the entire collection (worms, crowds). In portrayal, personification or drawing examples, a prominent feature was foregrounded and used to represent the entire object/entity (jaws for the shark, legs the insect and the claw or the belt for the excavator). In a small number of drawing examples, gesturers produced basic lines to convey the meaning of the referent (e.g., the coffee pot in CoffeepotZZZZ (AP) or the path in PathMMM1(2) (PP). These gestural instantiations of internal metonymy are in line with Mittelberg and Waugh (2014) who state that this principle might be responsible for emphasizing prototypical or locally salient features of an object, action or event. External metonymy used its outer contiguity relations such as adjacency, contact or cause/effect (Jakobson & Pomorska, 1983) in which hands touched imaginary objects and surfaces or handled imaginary tools. In this way, molding techniques employing outer metonymic modes represented the shape of a referent (coffee pot, boulder, path) or depicted the referents as an entire set (worms, leaves and crowds). In handling, hands held an invisible tool (screw, lightsabers). With presenting gestures, hands positioned in the Palm Up Open Hand (Müller, 2004) offered the referent for

inspection to the addressee. Examples of pointing (e.g., BeltOOOO (AP), CoffeepotAAAAAAc (PP), SharkKKKKK(2) (AP), characterized by a highly indexical Ground ((Mittelberg, 2013), pointed to imaginary targets in gesture space.

Regarding metaphor, the evidence from this study suggests that metaphor actively cooperates with other principles in gestural sign creation. It has been shown that realizations with metaphorical component are built upon two mappings: iconic and metaphorical (also see Taub (2001)). Thus, an iconic depiction of a physical object, action or entity can give rise to an abstract concept. Metonymy is not omitted in this process. In fact, it facilitates constructing metaphorical meaning since “a metonymic mapping between hand (source) and imaginary object (target) is a prerequisite for the metaphorical mapping between that very object (source) and the abstract idea (target) it represents” (Mittelberg & Waugh, 2009, p. 329). In this way, leaves were used to create autumn in AUTUMN IS A PILE OF LEAVES and a physical action of fluctuating and wavering induced mental uncertainty in PHYSICAL FLUCTUATION IS MENTAL FLACTUATION. Lastly, the results of this research support the idea that image schemas and force dynamics can be detected in gestural creations. Admittedly, certain recurrent combinations of the handshapes or recurrent movement patterns seem to be reminiscent of image schemas presented in the literature review sections. For instance, the internal and external metonymic principles echo PART-WHOLE, CONTACT, ADJACENCY schemas. Pointing realizations could reflect the SOURCE-PATH-GOAL schema with the path leading to the implied object/entity at the end of the path and profiling the amount between two hands in amount realizations agrees with the schema of CONTAINMENT. Finally, several screw realizations metaphorically alluded to emanating and absorbing force as in Talmy’s (2000, pp. 413-415) system of force dynamics (see Section 5.2.52 for details).

The insights gained from this project may also be of assistance in verifying various theories referring to the origins and production of gesture and sign. Accordingly, examples of broader implications of the project are discussed first in Section 6.2.1, followed by the project’s possible limitations (Section 6.2.2) and the alternatives of further research (Section 6.2.3).

6.2.1 Broader implications of the project

The study makes a significant contribution to the following areas of research:

Placement of the identified iconic patterns within the framework of manual modality research

The iconic patterns that have been identified in this project could be further compared with other studies investigating co-speech gesture, silent gesture and sign language. Recurrency in the implementation of specific depiction strategies with certain semantic categories has already been documented in the literature (see Chapter 2 on systematicity in depiction strategy selection in sign

language, silent gesture and co-speech gesture), and the current results could assist in unraveling further similarities and discrepancies in sign creation in the manual modality. Specifically, there is little published data on the impact of object characteristics on depiction strategy in co-speech gesture (Masson-Carro et al., 2016).

Investigation of referential origins of recurrent gestures

Recurrent variants serving a referential function could shed light on the semiotic etymology of a given recurrent gesture (Ladewig, 2014c). Gestures serving a referential role are the closest to a common action from which they arise. In contrast, in their variants used with a pragmatic function, which have undergone a process of conventionalization, the link with the action is not as clear; for example, the cyclic gesture portraying continuous actions in its referential role and the cycling gesture in requests fulfilling a performative task (Ladewig, 2014c). Despite the considerable significance of referential gestures, there is a scarcity of studies presenting examples of them, as most of the investigations pay particular attention to their variants with a pragmatic function (Ladewig, 2014c). Consequently, potential candidates for future investigation could include recurrent variants depicting continuity (e.g., repeated up-down movement in certain claws realizations and repeated circular movement in the belt examples) or animacy (e.g., irregular wriggly movements of fingers portraying worms).

Contribution to gesture and speech production theories

The study extends our knowledge of the processes involved in gesture production and offers support for certain gesture and speech production models and hypotheses. The results are consistent with a broader definition of gesture, as advocated by Kendon (2004, 2014) and Müller (2018). Kendon (2014) refers to 'gesture' as 'utterance visible action.' This work, however, preserves the term 'gesture' in line with Müller (2018). The accumulated data show numerous gestural examples that do not fully conform to clean-cut definitions of depiction strategies. Instead, these realizations present themselves as combinations of different strategies with two different strategies employed on two hands, or in more extreme examples, with elements of different depiction techniques generated on one hand. At times, realizations could fulfil different functions simultaneously, for instance, gesturers could depict a referent employing a referential function and present it to the interlocutor using a pragmatic one. These hybrid examples stand in sharp contrast to a much narrower understanding of gesture by McNeill (1992) and Goldin-Meadow and Brentari (2017) and do not meet their gesture definition.

The emergence of iconic patterns in referent depiction across different semantic characteristics and different communities is also consistent with that of Kendon's (2004, p.309) theory of form reduction and how repeated form elements become selected for a recurrent use and provide a label for various concepts. These elements are further schematized so the visible connection with their iconic base becomes obscure and, gradually, they might evolve into an abstract system of symbols. Similarly, in this study, the emergent iconic patterns have originated from a specific action utilized by a singular gesture and evolved to repeated schematized variants across different semantic characteristics and communities. Such an evolution does not happen in a vacuum. The patterns could have been motivated by the participants' embodied experiences available to all humans and by the embodied experiences typical of a particular community (Taub, 2001). This would explain the study's universal and community-specific examples. Furthermore, the results seem to be consistent with Langacker's (2008) understanding of embodiment and how meaning making relies on interactions with the physical world through sensory and motor activities. In this way, bodily experience facilitates the creation of mental structures whose connection with the immediate surroundings is more distant. These are often built upon our previous experiences, using the process of abstraction. Consequently, features that recur are reinforced and the constructed structure is a more general version of a particular bodily experience. Finally, the involvement of schematization and abstraction processes participating in meaning creation is echoed in Talmy (2000, 2011). Although Talmy's (2011) understanding of embodiment does not fully agree with that of Lakoff and Johnson (1999) that is adopted in this study, Talmy's (2000) theories seem to be relevant to this work, for instance, his conceptual system of force dynamics (Section 5.2.5.2), state of boundedness (Section 5.2.2) or figure/ground organization (Section 4.2.2). All in all, it is possible that all these recurring patterns manifest, to some extent, conceptual structures that we have acquired during our daily interactions with the surrounding world. Consequently, this work supports the theory of the embodied mind (Mittelberg, 2013) rather than the concept of disembodied cognition (Chatterjee, 2010).

The emergence of regular patterns in co-speech gesture is contrary to that of Goldin-Meadow and Brentari's (2017) and their proposal of the 'cataclysmic break' (Singleton et al., 1995) between gesture and sign. This categorical division is justified by the presence of 'silent gestures' (Goldin-Meadow, 2015), recently labeled 'spontaneous signs' (Goldin-Meadow & Brentari, 2017). These creations are said to be instantaneously acquiring language-like properties once speech is forbidden. However, by focusing on their understanding of 'gesture' at one end of the division and 'spontaneous sign' and 'sign' at the other, the researchers seem to miss the vital area in between where the processes of schematization and abstraction take place and gesture is created in a

particular cultural and linguistic context, either as a reduced version of a physical action or embodying an existing structure.

In addition, the data obtained support the principles of the GSA framework (Hostetter & Alibali, 2008), suggesting that high-affordance objects trigger action simulations realized in overt representational gestures. In fact, the largest number of realizations was detected in the manipulability criterion, with handling as a predominant mode, thus showing a connection between object characteristics and a depiction strategy. Nevertheless, it needs to be highlighted that portrayal also elicited high numbers (second after handling) in the manipulability category, and analogies were detected between handling and portrayal employing the same movement type. This, in turn, carries implications for the same action simulation potentially being used in handling and portrayal and the common origins of these two strategies.

Furthermore, the findings may prove to be useful in uncovering how two modalities, gesture and speech, are coordinated with each other. Even though the aim of this study was not to investigate the gesture-speech relationship, its findings have significant implications for understanding the nature of this cooperation. For instance, in molding realizations, the oral modality provided a label and gesture informed about the referent's shape (e.g., coffee pot, path and boulder). These instances are concordant with Ortega & Özyürek's (2019a) hypothesis that the molding strategy (drawing and molding collapsed) is a perfect candidate to collaborate with speech when speech labels the referent and the co-existing gesture offers information about its shape. This study extends their theory to other depiction strategies: (1) speech labels the referent in portrayal or personification (e.g., worms) and gesture provides the information about the way it moves; (2) speech labels the referent (e.g., screw) in handling and gesture depicts the way it can be manipulated; and (3) speech labels the referent (e.g., screw) in portrayal and gesture gives it a visible form. A possible explanation is that speech mainly provides a label and gesture, depending on the strategy selected, depicts other characteristics such as shape/size, the way the referent moves or can be handled.

Finally, the data also contribute to the investigation of various constraints influencing gesture production (e.g., retelling a story to an old addressee (Galati & Brennan, 2014)). For example, an interaction of molding strategies employing different movement parameters was identified across two languages, where two native speakers of Polish used molding dynamic "squeezing" gestures and molding static sculpting gestures to profile a round shape in crowds in the first recording and performed molding dynamic arced movements to trace the shape in the second recording. Interestingly the order of the languages, English and Polish, was counterbalanced. Therefore, it is possible that other constraints played an active role in the selection of a depiction strategy, such as

describing the visual twice to the same addressee. Though this is a rather surprising result, these data must be interpreted with caution since no other parallel examples have been found.

6.2.2 Limitations of the study

This research has revealed certain limitations. First, some of the realizations were impossible to categorize within one of the depiction strategy types or were classified as a blend of two or more strategies. A small number of realizations were also categorized as “inconclusive,” with their meaning obscure and not clarified by the co-occurring speech. This results from the conception that gestures should be perceived as dimensions rather than separate representatives of a given category (McNeill, 2005). In addition, as these gestures are totally spontaneous creations in which “a core idea is brought into concrete existence and becomes part of the speaker’s existence at that moment” (McNeill, 2015, p. 17), their meaning might not be as obvious to an observer witnessing the moment from the outside, even though the “moment” is recorded on video camera and can be repeatedly watched in future replays. Second, the quality of certain Skype recordings was not always as high as that of the clips produced with the participants physically present during the recording session (e.g., because of an interrupted Internet connection or inadequate distance to the recorder). Nevertheless, an extensive amount of reliable Skype data has been collected and the problematic clips were excluded from further analysis.

6.2.3 Possible avenues of further research

The alternatives provided below offer several ways of expanding and verifying the current findings in further research. Considerably more comparative work could be done to verify the current data with studies investigating other input modalities, run across different communities or adopting various constraints influencing gesture production.

Presentation of referents through other input modalities

Presenting the referents through other input modalities (e.g., videos and written format) could shed light on depiction strategies selected under these conditions and differences existing among picture, video and words conditions. Several studies have investigated the effects of different input modalities on gestures; e.g., Masson-Carro et al. (2017). It has been reported that the inclusion of videos of objects and objects presented in pictures might affect the gestural strategy (Padden et al., 2015); that is to say, the number of portraying gestures elicited through pictures was greater than using movies. However, a preference for handling was maintained in both conditions. This result would suggest that replicating the study using videos should elicit a smaller number of gestures

employing portrayal. Furthermore, the inclusion of the stimuli of the objects presented in this study in a written format (e.g., using pictures and words simultaneously) might result in producing gestures employing two different strategies. Pictures are likely to elicit gestures that attend to referent perceptual aspects such as shape or size, whereas words might trigger gestures depicting function (Masson-Carro et al., 2017).

Replication of the study with different groups of participants

Replicating the study with different groups of participants could offer a deeper insight into the selection and production of depiction strategies. One alternative would be selecting various age groups. For example, Masson-Carro, Goudbeek, and Krahmer (2015) measured the pantomimes and co-speech gestures of adults and children ($m=9$) and found that the pantomimes were produced in a similar way for both groups. In contrast, the co-speech gestures revealed discrepancies between adults and children. First, children gestured less than adults. Second, in regard to representation techniques, children tended to produce more action gestures, both object use and enactment, than adults, who produced more molding gestures. The results indicate that children might find action-based gestures less demanding in the presence of speech when speech is a dominant modality. The authors explained the children's lesser dependence on gesture by the changing relationship between gesture and speech until it reaches its integration around the period of adolescence.

Another alternative would be reproducing the project's aims with adult participants from different communities. For instance, Ortega and Özyürek (2019b) investigated silent gesture in Dutch and Mexican groups. Silent gesture shows a great degree of systematicity, being naturally immune to spoken language impact (Ortega & Özyürek, 2019a). Its co-speech alternative, however, poses a greater challenge, being subjected to the specific constraints of a given linguistic community (Kita & Özyürek, 2003). Nevertheless, studies investigating depiction strategies in co-speech gesture have been documented; e.g., (Masson-Carro et al., 2016) and (Masson-Carro et al., 2017). This study has already shown cross-community differences in selecting different referent images across the groups, selecting different strategies across the groups or selecting different form parameters across groups. More projects should be set up to verify the selection and creation of depiction strategies across various communities for this mode of communication.

Replication of the study including various constraints

Finally, conducting project designs featuring specific constraints could extend our knowledge of depiction strategy patterning. For instance, Holler and Wilkin (2011) measured speakers' gestures before and after addressees' feedback. The results of their study show a major change in gestural form after feedback: gestures were larger, more precise or more visually prominent. Another example would be the introduction of studies researching depiction modes under the conditions of

increasing and decreasing cognitive load. It has also been suggested that speakers gesture more when a task is more demanding (Hostetter et al., 2007) in a way that also corroborates the Information Packaging Hypothesis (Kita & Özyürek, 2003) and the fact that representational gestures are generated when the information conveyed by speech requires a lot of effort to be parsed into separate units (Hostetter et al., 2007). Much uncertainty, persists, however, concerning the distribution of depiction strategies in conditions requiring substantial or marginal cognitive effort.

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Appendices

Appendix I: Pictures for the memory task



coffee pot



path



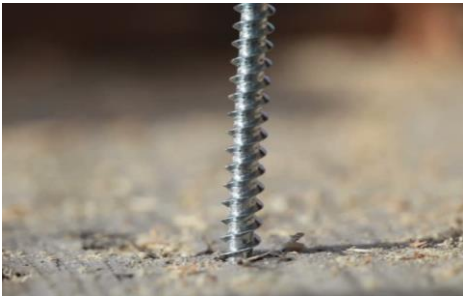
excavator



shark



lightsabers



screw



leaves



crowds



worms

TRINITY COLLEGE DUBLIN
SCHOOL OF LINGUISTIC SPEECH AND COMMUNICATION SCIENCES

Consent Form

Learning to communicate in a second language

Learning to communicate in a second language
The School of Linguistic, Speech and Communication Sciences

I am invited to participate in this research project which is being carried out by Edyta English under the supervision of Dr. Gessica De Angelis. My participation is voluntary. Even if I agree to participate now, I can withdraw at any time without any consequences of any kind.

The study is designed to investigate how individuals remember things.

If I agree to participate, this will involve me answering questions about my language background, looking at a picture for five seconds, then trying to describe it from memory, giving as many details as I can and telling the researcher if I have ever been in this situation or used the object presented in the picture. There are twenty-five pictures in total. It will take place at my college/school or at my home if it is more convenient for me. The researcher will visit me once. The visit will take approximately fifteen - twenty minutes.

I will not benefit directly from participating in this study.
This research may benefit the second language acquisition area.

Any information or data which is obtained from me during this study which can be identified with me will be treated confidentially. This will be done by using a letter code instead of using my name, and then this code will be used in all subsequent stored data records. The researcher will be the only person who has the key that links the code with my identity. The data will be kept in her password-protected computer and only she can access it. The key will be stored separately on a USB key that will be locked in the researcher's study.

I will be provided with a copy of the recording if I wish to receive it and will have the opportunity to delete any part of the recording I think might identify me. Also, my face will be blurred out in the recording.

Written transcriptions may be made for teaching purposes or for linguistic analysis. Data from this research project may be published in future. The original recording and all copies will be available only to the present investigator and her supervisor.

If I have any questions about this research I can ask Edyta English, eenglis@tcd.ie, +353851017959. I am also free, however, to contact any of the other people involved in the research to seek further clarification and information: Dr Gessica De Angelis, Assistant Professor in Applied Linguistics, Centre for Language and Communication Studies, Trinity College Dublin, gessica.deangelis@tcd.ie, +35318961106.

Signature of research participant

I agree to participate in the study. I understand what is involved in this research. I have been given a copy of the Participant Information Leaflet and a copy of this consent form to keep.

Signature of participant

Date

Signature of researcher

I believe the participant is giving informed consent to participate in this study

Signature of researcher

Date

TRINITY COLLEGE DUBLIN
SCHOOL OF LINGUISTIC SPEECH AND COMMUNICATION SCIENCES
Participant Information Leaflet

Learning to communicate in a second language

Learning to communicate in a second language
The School of Linguistic, Speech and Communication Sciences

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The study is designed to investigate how individuals remember things.

If you agree to participate, this will involve you answering questions about your language background, looking at a picture for five seconds, then trying to describe it from memory, giving as many details as you can and telling the researcher if you have ever been in this situation or used the object presented in the picture. There are twenty five pictures in total. It will take place at your college/school or I can visit you in your home if it is more convenient for you. I will visit you once. The visit will take approximately fifteen- twenty minutes.

You will not benefit directly from participating in this study.
My research may benefit the second language acquisition area.

Any information or data which I obtain from you during this research which can be identified with you will be treated confidentially. I will do this by using a letter code instead of using your name, and then this code will be used in all subsequent stored data records. I will be the only person who has the key that links the code with your identity. The data will be kept in my password-protected computer and only I can access it. The key will be stored separately on a USB key that will be locked in my study.

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Appendix IV: Questions on language background

Letter code:

Gender:

1. Are you left-handed or right-handed?

2. How old are you?

3. What is your (future) job/profession?

4. Do you speak other languages?

5. What other languages do you speak?

.....

6. How long have you been learning those languages?

.....

7. Where do/did you learn those languages?

.....

8. What is your level of proficiency in other languages? Please, choose from A1 to C2 for Listening, Reading, Speaking (Spoken Interaction, Spoken Production) and Writing.

.....

.....

.....

.....

9. How often/how many hours a day do you speak other languages? Where?

.....

.....

10. Have you ever lived abroad?

.....

.....

Further comments

.....

Appendix V: The CEFR Assessment Grid

| | | A1 | A2 | B1 | B2 | C1 | C2 |
|---|---------------------------|---|---|---|---|--|--|
| U
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A
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D

I
N
G | Listening | I can recognise familiar words and very basic phrases concerning myself, my family and immediate concrete surroundings when people speak slowly and clearly. | I can understand phrases and the highest frequency vocabulary related to areas of most immediate personal relevance (e.g. very basic personal and family information, shopping, local area, employment). I can catch the main point in short, clear, simple messages and announcements. | I can understand the main points of clear standard speech on familiar matters regularly encountered in work, school, leisure, etc. I can understand the main point of many radio or TV programmes on current affairs or topics of personal or professional interest when the delivery is relatively slow and clear. | I can understand extended speech and lectures and follow even complex lines of argument provided the topic is reasonably familiar. I can understand most TV news and current affairs programmes. I can understand the majority of films in standard dialect. | I can understand extended speech even when it is not clearly structured and when relationships are only implied and not signalled explicitly. I can understand television programmes and films without too much effort. | I have no difficulty in understanding any kind of spoken language, whether live or broadcast, even when delivered at fast native speed, provided I have some time to get familiar with the accent. |
| | Reading | I can understand familiar names, words and very simple sentences, for example on notices and posters or in catalogues. | I can read very short, simple texts. I can find specific, predictable information in simple everyday material such as advertisements, prospectuses, menus and timetables and I can understand short simple personal letters. | I can understand texts that consist mainly of high frequency everyday or job-related language. I can understand the description of events, feelings and wishes in personal letters. | I can read articles and reports concerned with contemporary problems in which the writers adopt particular attitudes or viewpoints. I can understand contemporary literary prose. | I can understand long and complex factual and literary texts, appreciating distinctions of style. I can understand specialised articles and longer technical instructions, even when they do not relate to my field. | I can read with ease virtually all forms of the written language, including abstract, structurally or linguistically complex texts such as manuals, specialised articles and literary works. |
| | Spoken Interaction | I can interact in a simple way provided the other person is prepared to repeat or rephrase things at a slower rate of speech and help me formulate what I'm trying to say. I can ask and answer simple questions in areas of immediate need or on very familiar topics. | I can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar topics and activities. I can handle very short social exchanges, even though I can't usually understand enough to keep the conversation going myself. | I can deal with most situations likely to arise whilst travelling in an area where the language is spoken. I can enter unprepared into conversation on topics that are familiar, of personal interest or pertinent to everyday life (e.g. family, hobbies, work, travel and current events). | I can interact with a degree of fluency and spontaneity that makes regular interaction with native speakers quite possible. I can take an active part in discussion in familiar contexts, accounting for and sustaining my views. | I can express myself fluently and spontaneously without much obvious searching for expressions. I can use language flexibly and effectively for social and professional purposes. I can formulate ideas and opinions with precision and relate my contribution skilfully to those of other speakers. | I can take part effortlessly in any conversation or discussion and have a good familiarity with idiomatic expressions and colloquialisms. I can express myself fluently and convey finer shades of meaning precisely. If I do have a problem I can backtrack and restructure around the difficulty so smoothly that other people are hardly aware of it. |
| | Spoken Production | I can use simple phrases and sentences to describe where I live and people I know. | I can use a series of phrases and sentences to describe in simple terms my family and other people, living conditions, my educational background and my present or most recent job. | I can connect phrases in a simple way in order to describe experiences and events, my dreams, hopes and ambitions. I can briefly give reasons and explanations for opinions and plans. I can narrate a story or relate the plot of a book or film and describe my reactions. | I can present clear, detailed descriptions on a wide range of subjects related to my field of interest. I can explain a viewpoint on a topical issue giving the advantages and disadvantages of various options. | I can present clear, detailed descriptions of complex subjects integrating sub-themes, developing particular points and rounding off with an appropriate conclusion. | I can present a clear, smoothly-flowing description or argument in a style appropriate to the context and with an effective logical structure which helps the recipient to notice and remember significant points. |
| W
R
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I
N
G | Writing | I can write a short, simple postcard, for example sending holiday greetings. I can fill in forms with personal details, for example entering my name, nationality and address on a hotel registration form. | I can write short, simple notes and messages relating to matters in areas of immediate needs. I can write a very simple personal letter, for example thanking someone for something. | I can write simple connected text on topics which are familiar or of personal interest. I can write personal letters describing experiences and impressions. | I can write clear, detailed text on a wide range of subjects related to my interests. I can write an essay or report, passing on information or giving reasons in support of or against a particular point of view. I can write letters highlighting the personal significance of events and experiences. | I can express myself in clear, well-structured text, expressing points of view at some length. I can write about complex subjects in a letter, an essay or a report, underlining what I consider to be the salient issues. I can select style appropriate to the reader in mind. | I can write clear, smoothly-flowing text in an appropriate style. I can write complex letters, reports or articles which present a case with an effective logical structure which helps the recipient to notice and remember significant points. I can write summaries and reviews of professional or literary works. |

Appendix VI: Original Research Ethics Committee response

| | | |
|---|---|---|
|  | COLÁISTE NA TRÍONÓIDE, BAILE ÁTHA CLIATH
Ollscoil Átha Cliath | TRINITY COLLEGE DUBLIN
The University of Dublin |
| 30/07/2015 | | |
| Application TT 57 Academic Year 2014/15 | | |
| Applicant: Edyta English | | |
| Title of Research: Learning to communicate in a second language | | |
| Supervisor: Dr Gessica De Angelis | | |
| Dear Edyta, | | |
| Your submission for ethics approval for the research project above was considered by the Research Ethics Committee, School of Linguistic, Speech and Communication Sciences, Trinity College Dublin, on Thursday, 30 July 2015, and has been approved in full. We wish you the very best in your research activities. | | |
| Best wishes, | | |
|  | | |

Appendix VII: Research Ethic Committee response: amendment



Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

Application: Academic Year 2019/20
Application Code: MT 4 TT57-2014/2016
Applicant /Supervisor Name: Edyta English/Gessica De Angelis

Title of Research: Learning to communicate in a second language

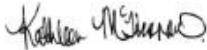
Date of this letter: 24-04-20

Dear Edyta,
Your submission for the amendment of your research project (MT4, TT57-2014-2015) was considered by the Research Ethics Committee on the 24th of April 2020 and has been approved in full.

Please note

- (i) that on completion of research projects, applicants should complete the *End of Project Report Form* (which can be found at: <https://www.tcd.ie/slscs/research/ethics/>) and submit one signed hard copy to the School Office (Room 4091, Arts Building) as well as an electronic copy (to slscs@tcd.ie)
- (ii) the REC requests that you attend, in particular, to your commitments as regards the storage and destruction of data arising from this research, in keeping with REC policy and General Data Protection Regulation (GDPR) guidelines.

We wish you every luck with your research,
Best wishes,



Professor Kathleen McTiernan
Chair, Research Ethics Committee

Appendix VIII: Overview of the most Important GAT 2 transcription conventions adapted for the project

Main speech transcript conventions:

| | |
|------------------------|---|
| [] | speech outside of the stroke phase |
| [] | speech outside the intonation unit |
| (-) | pause |
| no words | gesture produced with no accompanying speech |
| and_uh | cliticizations within units |
| uh, uhm, etc. | hesitation markers, so-called "filled pauses" |
| haha, hehe, hihi | syllabic laughter |
| <laughing>, <crying> | description of laughter and crying
laughter particles accompanying
speech |
| <coughing> | other non-verbal vocal actions and events
such as coughing |
| hm, yes, no, yeah | monosyllabic tokens |
| hm_hm, ye_es, | bi-syllabic tokens |
| no_o | |
| ?hm?hm | with glottal closure, often negating |
| (unintelligible) | unintelligible passage |
| (may I?) | assumed wording |
| (may I say/let us say) | possible alternatives |
| (translation) | English translation of Polish
in an Excel document |

Appendix IX: Transcription conventions for speech and gestural action adapted from Kendon (2008)

| | |
|--------|--|
| | gesture phrase boundaries |
| ~~~~~ | preparation |
| ~*~*~ | where preparation and stroke cannot be sharply distinguished |
| **** | stroke |
| ***/** | different phases of stroke action |
| _____ | hold |
| **** | post-stroke hold |
| _____ | |

Appendix X: Example of grouping realizations per referent for the screw stimulus

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N |
|----|----|----------------------|---------------|--------------|-------------|--|---------------------------|--------------------|------------------------|-------------|---|--------------|------------------------|---|
| 1 | | | | Dominant | | | | | Non-dominant | | | | | |
| 2 | | Gestural Realization | Dominant hand | Hand Shape | Orientation | Movement | Position | Depiction Strategy | Hand Shape | Orientation | Movement | Position | Depiction Strategy | Speech |
| 3 | 1 | ScrewAAAAAc | r | 2stretched | PVTC | down, spiral | extr upper r-peri upper r | portrayal | NA | | | | | wkret wchodzacy [a screw going [mechaniczne cos] urzadz[enie] [something mechanical]] |
| 4 | 2 | ScrewODD | both | fist | PLTC | missing | center l | handling | fist | PLTC | missing | center r | handling | wkret[ktory jest jakby czesciowo wkrecony] screw [which is somehow partially screwed in] jest jakby cz[esciowo wkrecony] is somehow p[artially screwed] |
| 5 | 3 | ScrewHHH(1) | r | 1+2touching | PLTC | reduced, away b towards b, other (1moving) | peri lower | handling | 1+2 bent backgrounded? | | | | | [swider wblajacy] sie [w ziemie] [a drill boring] itself [into the [me]talowy [wkret] [me]tal [screw]] |
| 6 | 4 | ScrewHHH(2) | r | 1+3connected | PDAB | reduced, down, straight | peri lower | handling | 1+2 bent backgrounded? | | | | | wkreca ten srub[okret] turning or twisting this |
| 7 | 5 | ScrewODD | r | 2stretched | PDAB | down, straight | center c-peri low | portrayal | NA | | | | | [stee] screw no words [coming into] [screw that has been partially screwed in]to |
| 8 | 6 | ScrewQQQ(1) | both | 1+2 bent | PVTC | missing alternate, repeated circle, clockwise | peri lower | molding st | 1+2bent | PVTC | missing alternate, repeated circle, clockwise | center r | molding st | |
| 9 | 7 | ScrewQQQ(2) | both | 2stretched | PVTC | | peri lower | portrayal | 2stretched | POTC | | center c | portrayal | |
| 10 | 8 | ScrewRRR | r | 1+2crooked | PLTC-PDAB | repeated, rotation w, clockwise enlarged, down straight revolving f, clockwise ? | center lower | handling | NA | | | | | |
| 11 | 9 | ScrewAAAAA(1)c | l | 1+2crooked | PVAB-PDdiAB | | extr upper-center l | handling | NA | | | | | |
| 12 | 10 | ScrewAAAAA(1)c | l | 1+2stretched | PDdiAB | | center l | handling | NA | | | | | |
| 13 | 11 | ScrewHHH1 | r | 1+2touching | PLTC | missing | center r | handling | NA | | | | | |
| 14 | 12 | ScrewQQQ(1) | r | 1+2crooked | PLTC | down, straight simultaneous opp dir, | center c | handling | 1-5 connected? | PUTC | missing simultaneous opp dir, | center lower | inconclusive handling? | screw |

