DEGREES OF METAPHORICITY:
A QUANTITATIVE GESTURE ANALYSIS

by

GREG ALEXANDER WOODIN

A thesis submitted to the University of Birmingham for the degree of MASTER OF ARTS BY RESEARCH

Department of English Language and Linguistics
School of English, Drama, American and Canadian Studies
College of Arts and Law
University of Birmingham
September 2018

ABSTRACT

When a speaker uses a linguistic metaphor, how do we know that they are thinking metaphorically? One answer is by looking at their gestures (e.g., Müller, 2008).

In this thesis, I propose three criteria for identifying whether a speaker is thinking metaphorically: gesture co-occurrence, gestural fit and gestural effort (see Hostetter & Alibali, 2008). I also appeal to Müller's (2008) conception of metaphoricity as a gradable phenomenon. Using these three criteria, I conduct a large-scale, quantitative analysis of gestures in the TV News Archive, focusing on linguistic metaphors of emotional valence ('low standards, 'high standards', 'lower the standards', 'raise the standards'). I also look at factors that may affect the metaphoric activation of these linguistic metaphors, and whether speakers gesture in line with other conceptual metaphors of emotional valence (e.g., Casasanto, 2009). Finally, I look at whether articulatory plurality, a widely-reported feature of sign languages (e.g., Börstell et al., 2016c), can be found in co-speech gestures.

Amongst other results, I find high levels of gesture co-occurrence (85.3%), gestural fit (61.5%) and gestural effort (70.8%) for all four linguistic metaphors. I also find that metaphorical verbs ('lower', 'raise') are more likely to be understood metaphorically than metaphorical adjectives ('low', 'high').

CONTENTS

FIGURES AND TABLES

1. INTRODUCTION

Lakoff and Johnson's (1980) Conceptual Metaphor Theory (CMT) has long been beset by criticisms of its circular logic (e.g., Murphy, 1996, 1997; see also Gibbs & Colston, 1995). The central claim of CMT is that linguistic metaphors, which describe one thing in terms of another, are surface-level manifestations of conceptual metaphors that shape the way we think. For instance, the expression 'I'm looking forward to it' describes a future event as if it were in front of the speaker in physical space. Using the terminology of CMT, this linguistic metaphor describes the target domain TIME metaphorically in terms of the source domain SPACE. Proponents of CMT would argue that this way of talking about time reflects the conceptual metaphor TIME IS SPACE. If asked, 'How do we know that we structure our understanding of time in terms of space?', a traditional CMT response might be, 'Because we talk about it this way'.

It is this line of reasoning that has been criticised for its circularity, and which has since put pressure on proponents of CMT to prove that linguistic metaphors are in fact 'active' at the conceptual level. After all, linguistic metaphors are often so entrenched in language that speakers may view them simply as "just the way to say it" (Cameron 2003: 100). Spatial terms such as 'high' and 'low', for instance, are practically the only way to talk about pitch (e.g., Pratt, 1930; Zbikowski, 1998; Rusconi et al., 2005; Clark et al., 2013). Even in cases where there are alternative, non-metaphorical terms available to language users, linguistic metaphors may be so conventionalised that their metaphorical meanings hardly occur to those who use them (e.g., Black, 1993; Murphy, 1996, 1997; Müller, 2008). With this in mind, how do we 'know' when a linguistic metaphor is active in the mind of a speaker? One answer is by looking at their gestures.

In this thesis, I use Hostetter and Alibali's (2008) Gesture as Simulated Action framework to propose three criteria for identifying whether a linguistic metaphor a speaker uses is active at the conceptual level: gesture co-occurrence, gestural fit and gestural effort. Using these criteria, I conduct a large-scale, quantitative analysis of gestures in a corpus of videos assembled from the TV News Archive, an online database that, at the time of writing, contains over 1.6 million news broadcasts. I focus on gestures produced by speakers using linguistic metaphors pertaining to emotional valence, a term that refers to the good-ness or bad-ness of a concept (Frijda, 1989: 207). Speakers often describe emotional valence in terms of vertical space; for instance, someone at a 'low point' in their life might be described as 'hitting rock bottom', or a sportsman or woman in 'top form' might be described as being at the 'peak' of their career. Using the criteria of gesture co-occurrence, gestural fit and gestural effort, I assess whether the vertical BAD IS DOWN and GOOD IS UP associations expressed in linguistic metaphors such as these are conceptually active. In doing so, I appeal to Müller's (2008) notion of 'sleeping' and 'waking' linguistic metaphors, which suggests that conceptual activation is not a binary yes/no decision; rather, there are degrees of metaphoricity. Following this, I compare linguistic metaphors that express the same valence-space association but in different ways to see if these different modes of linguistic expression affect whether a given linguistic metaphor is conceptually active, and to what degree. I also explore whether other conceptual metaphors not expressed linguistically, such as Casasanto's (2009) body-specificity hypothesis, are active in the minds of speakers who use vertical linguistic metaphors of emotional valence. Finally, I assess whether the concept of articulatory plurality reported in sign languages (Börstell et al., 2016c; Lepic et al., 2016; Östling et al., 2018) extends to co-speech gestures.

In section 2, I explore the literature on mental imagery and mental simulation, as well as Müller's (2008) conception of sleeping and waking linguistic metaphors, to lay the groundworks for the main proposal that drives the entire study: that we can infer whether or not linguistic metaphors are conceptually active, and to what degree, by looking at how speakers gesture when they use these linguistic metaphors. I expound this premise fully in section 3, where I give an overview of co-speech gestures, describe the proposals of Hostetter and Alibali's (2008) Gesture as Simulated Action framework, and develop the criteria of gesture co-occurrence, gestural fit and gestural effort used for assessing conceptual activation. In section 4, I explicate the linguistic metaphors that are the focus of the study ('low standards', 'high standards', 'lower the standards', 'raise the standards'), which describe emotional valence in terms of vertical space. I also suggest ways of identifying whether or not conceptual metaphors other than the BAD IS DOWN and GOOD IS UP associations expressed linguistically might be active in the minds of speakers who use these linguistic metaphors. In section 5, I look at four different factors that might affect the conceptual activation of a linguistic metaphor (emotional valence, word class, agency, animacy), and suggest how we might investigate the effects of these different factors using the criteria of gesture co-occurrence, gestural effort and gestural fit. In section 6, I explicate articulatory plurality and put forward a method of determining whether this widely-reported feature of sign languages extends to co-speech gestures. The next five sections detail the main study itself, beginning with its methodology in section 7, a contextualisation of the data with some qualitative examples and analyses in section 8, and the main quantitative results in section 9. I summarise and comment upon the main findings of the paper with a general discussion in section 10, and come to some general conclusions in section 11.

To foreshadow the main results found herein, the criteria of gesture co-occurrence, gestural fit and gestural effort suggested that the linguistic metaphors investigated in this study ('low standards', 'high standards', 'lower the standards', 'raise the standards') were highly conceptually active overall. These three criteria also indicated that linguistic metaphors of emotional valence where verticality was expressed using a verb ('lower', 'raise') were more conceptually active than those where verticality was expressed using an adjective ('low' 'high'). Emotional valence, agency and animacy seemed to have no effect on conceptual activation. No evidence was found for conceptual metaphors other than the BAD IS DOWN and GOOD IS UP associations expressed linguistically being active in speakers' minds, nor was evidence found for articulatory plurality in co-speech gestures.

All of these conclusions are inferences drawn from speakers' gestures. To understand how we might infer a speaker's thoughts from their gestures, the next section gives an overview of the literature on mental imagery and mental simulation. This body of literature suggests that understanding metaphorical language involves mental simulation. This then informs a proposal based on Müller's (2008) conception of sleeping and waking linguistic metaphors, which positions gestures as a "window into the mind" (De Ruiter, 2007: 21), allowing us to quantify whether or not a given linguistic metaphor is conceptually active, and to what degree.

2. DEGREES OF METAPHORICITY

2.1. Mental imagery and mental simulation

Being able to interact with the world is essential for the survival of any human. This fact has led theorists to speculate that perception itself evolved from the need to act (Sperry, 1952; Gibson, 1979), which includes finding food, escaping from predators and pursuing mates.

There is abundant evidence for the existence of a direct link between perception and action. For instance, in a study conducted by Kilner et al. (2003), participants made arm movements while observing a person making either the same or a different type of arm movement. When there was a mismatch between the action performed by the participant and the action they observed, participants' arm movements were more varied, suggesting that perceiving incongruent actions has an interference effect on the performance of actions (see also Stanley et al., 2007). Likewise, research conducted by Wohlschläger (2000) showed that action can also influence perception. In this study, participants rotated a knob either clockwise or counter-clockwise before observing a circular visual display that rotated clockwise, frame by frame rather than continuously. Participants then had to judge in which direction the circular formation had rotated. Crucially, non-continuous clockwise motion can also be interpreted as counter-clockwise motion, so the rotation direction of this visual display was ambiguous. Results showed that participants who rotated the knob clockwise were more likely to report that the visual display had rotated clockwise, whereas participants who rotated the knob counter-clockwise were more likely to report that the visual display had rotated counter-clockwise (see also Miall et al., 2006).

This direct link between perception and action allows people to make advance action plans in response to perceived stimuli in their environment (e.g., Adolph, 1997).

These action plans are thought to take the form of ‘mental imagery’: analogue representations of perceptions and actions (e.g., Kosslyn, 1980, 1994; Kosslyn et al., 2006). Analogue representations stand in contrast to verbal representations (natural language descriptions) and propositional representations (amodal, abstract symbols) (e.g., Barsalou, 1999; Hostetter & Alibali, 2008), and are theorised to be constructed from “perceptual, motor and introspective states acquired during experience with the world, body and mind” (Barsalou, 2008: 618). Using mental imagery, a person can consciously and deliberately imagine interacting with a stimulus to plan how to best to respond to it. This type of mental imagery, which involves imagining our own bodies in action, is known as motor imagery (Jeannerod, 1994, 1995).

Behavioural research suggests that motor imagery relies on mental processes overlapping with those involved in the actual performance of actions (see Barsalou, 1999; Glenberg & Kaschak, 2002; Gallese & Lakoff, 2005). For instance, Decety et al. (1989) reported a strong correlation between the time taken for participants to walk to a target location in one condition, and to imagine walking to the same location in a second condition. Moreover, Decety and Jeannerod (1995) showed that the time taken for participants to imagine walking to a target gate increased when the gate was narrower and therefore more difficult to navigate to. These studies suggest that factors known to affect the time taken to perform real-life actions (i.e., distance, difficulty) affect motor imagery in a parallel way. Additional evidence for overlapping mental processes for real and imagined actions comes from neuropsychological studies, which have shown that brain areas involved in movement, such as the supplementary motor areas, cerebellum and basal ganglia, are also active when participants imagine moving (see Jeannerod, 2001 for a review). In addition, Jacobson (1931) reported increased electromyography (EMG) activity (a measure of muscle activity) and

micromovements in the limbs of participants who were asked to imagine moving their limbs without physically moving them. Other research has shown that EMG activity increases proportionally to the amount of effort that an imagined action requires (Shaw, 1940), and that frequency characteristics of EMG activity during imagined actions are similar to those recorded during real actions (Wehner et al., 1984; also see Jeannerod, 1994 for a review). The muscular activity reported in these studies seems to be related specifically to the premotor planning stages of an action, distinct from the action itself, which is mostly inhibited (Jeannerod, 1994; Smith & Kosslyn, 2007).

Related to mental imagery is ‘mental simulation’. Both mental imagery and mental simulation consist of analogue representations, but whereas mental imagery is conscious and deliberate, mental simulation is less conscious and less deliberate (e.g., Bergen, 2012; Connell & Lynott, 2016). A study conducted by Tucker and Ellis (1998) exemplifies mental simulation, showing that participants were quicker to respond to an image depicting a teapot with a handle on its left side when they made this judgment using their left hand. The authors propose that viewing the image prompted participants to involuntarily mentally simulate interacting with the teapot using their left hand. Because this mental simulation activated mental processes overlapping with those that would have been activated if participants actually performed this action, it took less activation and therefore less time for a participants to respond with their left hand. Similar results were reported by Ellis and Tucker (2001), who found that participants were quicker to respond to a visually-presented object (e.g., a grape vs. a hammer) when the grip they were asked to respond with was congruent with the grip they would use to physically grasp the object (e.g., precision grip vs. power grip). This effect has been shown to persist when participants

are asked to respond 700ms after the object has been removed from view (Derbyshire et al., 2006).

Evidence suggests that language can control our mental simulations: comprehending words may trigger automatic mental simulations based on the content of these words (e.g., Barsalou, 1999; Glenberg & Kaschak, 2002). Evidence for this perspective comes from the action-sentence compatibility effect (ACE), which was first reported by Glenberg and Kaschak (2002). In this study, participants judged whether or not sentences were sensible by responding with a movement either away from or towards their body. Some of these sentences implied movement away from the body (e.g., '<u>close</u> the drawer'), whereas others implied movement towards the body (e.g., '<u>open</u> the drawer'). If the movement participants were asked to respond with was in the opposite direction of the movement implied by the sentence, they were slower to correctly judge whether the sentence was sensible, evidencing an interference effect (see also Zwaan & Taylor, 2006). Similarly, Klatzky et al. (1989) showed that semantic judgments about action-based phrases (e.g., 'aim a dart') were quicker when participants performed an appropriate bodily action (e.g., touching together thumb and fingers in a dart-aiming hand gesture). In another study conducted by Stanfield and Zwaan (2001), participants read sentences about objects and then had to decide whether a pictured object was referred to in the sentence they had just read. Results showed that participants were quicker to make this decision correctly when the orientation of the pictured object matched the orientation of the object implied by the sentence (e.g., 'Put the pencil in the cup' implies that the pencil is vertically-oriented) (also see Perlman & Gibbs, 2013 for a review). More evidence for the tight coupling of language and mental simulation comes from a neuroimaging study conducted by Hauk et al. (2004). By comparing fMRI scans of participants who moved their tongue, fingers

and feet with scans of participants who read words such as ‘lick’, ‘pick’ and ‘kick’, the authors were able to observe similar patterns of motor cortex activity for physical movements and their corresponding words (see also Pulvermüller, 2005).

Mental simulation is also hypothesised to be involved in the processing of metaphorical language (e.g., Gibbs & Matlock, 2008). For instance, the ACE has been shown to extend to metaphorical action phrases such as ‘grasp the concept’, (Wilson & Gibbs, 2007), and to sentences implying metaphorical motion such as ‘She told me this story’, where information is described metaphorically as moving towards the speaker’s body (Glenberg & Kaschak, 2002). Other evidence comes from research conducted into the comprehension of fictive motion sentences, such as ‘The road goes through the desert’, in which metaphorical motion is implied, despite the sentence literally referring to a static entity. Using eye-tracking technology, Richardson and Matlock (2007) found that participants spent longer scanning a pictured road after reading a fictive motion sentence where the road’s terrain was described as being difficult to navigate (‘The desert is hilly’) compared to easy (‘The desert is flat’). This result suggests that the comprehension of sentences describing metaphorical motion involves the mental simulation of actual motion. Because mental simulations of actions recruit similar mental processes to those recruited during the performance of physical actions, this has a physical effect on participants’ eye movements (see also Matlock et al., 2005).

We might infer from this research that we tend to comprehend linguistic metaphors by mentally simulating their source domains, which we then use to understand their target domains. For instance, upon hearing the linguistic metaphor ‘grasp the concept’ (Wilson & Gibbs, 2007), we mentally simulate performing the physical action of GRASPING (source domain), which is used to understand the more

abstract, introspective state of UNDERSTANDING (target domain). However, in some cases, language comprehenders might understand the linguistic metaphor ‘grasp the concept’ by simulating the target domain UNDERSTANDING, without simulating the source domain GRASPING, skipping the metaphorical link from source to target. Here, ‘grasp the concept’ would cease to be understood metaphorically at all. This loss of metaphoricity is the issue I explore in the next section, where I explicate Müller’s (2008) conception of sleeping and waking linguistic metaphors, and her notion that linguistic metaphors can be understood more or less metaphorically than one another: ‘degrees of metaphoricity’.

2.2. Sleeping and waking metaphors

To understand Müller’s (2008) ideas, we must first examine the historical distinction between ‘dead’ and ‘alive’ linguistic metaphors (e.g., Black, 1993). This distinction is often conceptualised in terms of whether or not a linguistic metaphor is understood metaphorically by language users; in other words, whether a metaphorical association expressed by a linguistic metaphor is active at the conceptual level. For example, metaphorical comprehension of the linguistic metaphor ‘grasp the concept’ would involve understanding the target domain UNDERSTANDING in terms of the source domain GRASPING. This linguistic metaphor would thus be called ‘alive’. In contrast, non-metaphorical comprehension of this linguistic metaphor would involve the target domain UNDERSTANDING directly, without the metaphorical link from the source domain GRASPING. This linguistic metaphor would thus be called ‘dead’. Hereafter, I will refer to this dead-alive distinction in terms of ‘conceptual activation’, where dead linguistic metaphors are conceptually inactive, and alive linguistic metaphors are conceptually active. While Müller (2008) does not use these terms, I believe they are useful because

they allow the possibility of linguistic metaphors being more or less conceptually active, which is central to her non-categorical, gradable conception of ‘sleeping’ and ‘waking’ linguistic metaphors.

Some linguistic metaphors may be dead, or conceptually inactive, for several reasons. First, the linguistic metaphor may be opaque: it may have metaphorical origins, but language change has obscured these over time to the point that the linguistic metaphor is no longer conceptually active for most language users. For instance, Müller (2008: 179) points out that the German word *Kummer*, meaning ‘sorrow’ or ‘grief’, has its origin in the Indo-Germanic root *bher* (carry) and the Gallo-Latin *comboros* (what is collected), which combine to metaphorically describe sadness as the physical carrying of an emotional load. Because the vast majority of German speakers are presumably unaware of this word’s metaphorical etymology, *Kummer* may be deemed conceptually inactive. In contrast, transparent linguistic metaphors are linguistic metaphors whose metaphorical meanings can be detected without any additional etymological knowledge, such as ‘falling in love’. Because it is transparent, this type of linguistic metaphor has the potential to be alive, or conceptually active. However, even transparent linguistic metaphors such as this can be used so frequently that they become conventionalised, which may lead speakers to think of these linguistic metaphors as literally expressing the concepts they represent, rendering them conceptually inactive (e.g., Brinkmann, 1878; Black, 1993; Hanks, 2006). The power of conventionalisation to ‘kill’ linguistic metaphors may be especially strong where there is no literal alternative to express a concept, such as with the spatial terms ‘low’ and ‘high’ used to talk about musical pitch (e.g., Pratt, 1930; Zbikowski, 1998; Rusconi et al., 2005; Clark et al., 2013).

Müller (2008) argues against this rigid dead-alive dichotomy, positing that it is more accurate to view linguistic metaphors on a cline from ‘sleeping’ to ‘waking’. According to Müller, all transparent linguistic metaphors are sleeping in that they have “metaphoric potential” (ibid: 196), which means that their metaphorical meaning is accessible to language users, like the ‘falling in love’ example discussed above. Waking linguistic metaphors, on the other hand, are sleeping linguistic metaphors whose metaphoric potential is realised during language production, and thus are ‘woken up’, that is, conceptually activated. Conceptual activation can be observed empirically through “activation indicators” (ibid: 197), which include co-speech gestures, metaphoric elaboration (where a conceptual metaphor is instantiated by multiple linguistic metaphors), and verbo-pictorial metaphors (where a linguistic metaphor is also expressed visually, common in advertisements; see Forceville, 1994). These activation indicators are claimed to be the outwards manifestations of conceptual activation. On a neurological level, Müller understands conceptual activation in terms of Cameron’s (1999: 19) notion of spreading activation through different pathways in the brain. Based on this, Müller (2008) postulates that because more or fewer pathways and links between these pathways can become activated, conceptual activation is by definition a gradable phenomenon. This means that a linguistic metaphor used by one speaker in one context can be more or less conceptually active than a linguistic metaphor used in another context (ibid: 197-198).

From this gradable definition of conceptual activation, Müller makes a prediction: the greater the number of activation indicators produced alongside a linguistic metaphor, the greater the conceptual activation of this linguistic metaphor (ibid: 198). For instance, if a linguistic metaphor is accompanied by gestures as well as metaphorical elaboration, this linguistic metaphor can be said to be more

conceptually active than a linguistic metaphor accompanied by gestures but not metaphorical elaboration. Müller makes explicit that conceptual activation can be either conscious or unconscious, in line with contemporary CMT accounts (e.g., Lakoff & Johnson, 1980; Gibbs, 1994; Kövecses, 2002). Müller (2008: 192) furthermore stresses that conceptual activation is analysable only at the level of language use, determined by examining the behaviour of a specific speaker in a specific context (see also Kyratzis, 2003).

Whereas Müller emphasises linguistic metaphors as the primary drivers of conceptual activation (2008: 207-8), the current study takes an approach akin to CMT in that it views conceptually active linguistic metaphors as the surface-level manifestations of conceptual metaphors (e.g., Lakoff & Johnson, 1980; Gibbs, 1994; Kövecses, 2002). From this perspective, it is usually conceptual activation that motivates a speaker to produce a linguistic metaphor and its associated activation indicators. In support of this position, there is an enormous body of research indicating the primacy of conceptual metaphors over linguistic metaphors. For instance, numerous studies have found evidence for conceptual metaphors in research paradigms that do not use linguistic metaphors as prompts (see Landau et al., 2010; Casasanto, 2010; Winter & Matlock, 2017). Moreover, conceptual associations with no corresponding linguistic representation have been shown to exist, such as the MORE IS RIGHT association reported for numbers (e.g., Dehaene et al., 1993; Wood et al., 2008; Chinello et al., 2012; Winter et al., 2015). Another source of evidence comes from studies investigating co-speech gestures, in which speakers have been reported to produce metaphorical gestures while not expressing these metaphors linguistically (e.g., Calbris, 1990; Cienki, 1998; Walker & Cooperrider, 2016). For example, a speaker might gesture backwards while saying ‘past’, in line with the spatial PAST IS

BEHIND conceptual metaphor, but without making any linguistic reference to space. Indeed, speakers systematically produce metaphoric gestures even where there is no linguistic equivalent, such as gesturing leftwards for ‘past’ and rightwards for ‘future’ (e.g., Casasanto & Jasmin, 2012; Cooperrider & Núñez, 2009; Walker & Cooperrider, 2016). Taking conceptual metaphors as the source of conceptually active linguistic metaphors and their associated activation indicators partly aligns with McNeill’s (1992, 2005) Growth Point Theory, where language and gesture are generated from the same “idea unit” (2005: 106), which is fundamentally conceptual (see also McNeill & Duncan, 2000).

Based on this, my proposal is as follows. A speaker has a thought that they want to communicate. This thought, at least in part, takes the form of mental imagery or a mental simulation, which the speaker then plans to communicate linguistically. If the thought is metaphoric, the speaker will be more likely to express it using a linguistic metaphor (see Gibbs, 2006; Gibbs & Matlock, 2008). Because a metaphorical conceptualisation motivates the production of the linguistic metaphor here, this linguistic metaphor can be called conceptually active. This is not just a one-way process: thought can influence language production, but language production can also influence thought (e.g., McNeill & Duncan, 2000), in line with Slobin’s (1987) ‘thinking-for-speaking’ hypothesis. For instance, a speaker may plan to use a linguistic metaphor simply because it ‘works’ to communicate a concept, and not necessarily because this linguistic metaphor accurately reflects the speaker’s metaphoric conceptualisation of said concept. In this case, however, the choice to use a linguistic metaphor may also trigger an automatic, metaphorical mental simulation in the mind of the speaker.

We have seen in this section that linguistic metaphors are unreliable markers of conceptual activation, because speakers are capable of reproducing conventionalised linguistic metaphors without being aware of their metaphorical meanings (e.g., Brinkmann, 1878; Black, 1993; Hanks, 2006). This begs the question: how do we determine whether or not a linguistic metaphor is conceptually active? For this purpose, many researchers have championed gestures, principally because they are usually produced unconsciously, and so are widely believed to be a "window into the mind" (De Ruiter, 2007: 21; see also McNeill, 1992; Goldin-Meadow et al., 1993; Beattie, 2003). Thus, if a speaker were to produce a metaphoric gesture alongside a linguistic metaphor, this would provide evidence that the linguistic metaphor is conceptually active. We have also seen that conceptual activation is a gradable phenomenon, and that we can infer the degree of a linguistic metaphor's conceptual activation from the number of activation indicators that accompany it (Müller, 2008: 198). This specific proposal would mean looking at activation indicators in addition to gesture, such as metaphorical elaboration. However, I propose that differences in the quality of a single activation indicator, such as gesture, can also reveal differences in conceptual activation. These differences might include the movement direction of a gesture, or whether the speaker's gesturing hands are open or closed. My proposal therefore affords the possibility of identifying differences in conceptual activation by examining gesture alone.

As such, the present study looks specifically at the presence or absence of gestures accompanying transparent linguistic metaphors ('low standards, 'high standards', 'lower the standards', 'raise the standards'), and the quality of these gestures. As mentioned previously, Müller (2008: 192) is keen to emphasise that conceptual activation is something that can only be observed empirically at the level

of the individual speaker in a given context, meaning that we should refrain from making blanket statements about all language users (see also Kyratzis, 2003). However, with a large enough sample of different speakers producing the same linguistic metaphor across different contexts, it is possible to infer empirically whether a particular linguistic metaphor tends to be conceptually active, and to what degree. This is the premise of the current study, which examines gestures produced by 268 unique speakers in a corpus assembled from the TV News Archive. By analysing these speakers' gestures, we should be able to quantify the conceptual activation of these linguistic metaphors.

* * *

In this section, I have explored the literature on mental imagery and mental simulation, which has informed an interpretation of Müller's (2008) conception of sleeping and waking linguistic metaphors. I have suggested that looking at how speakers gesture when they use linguistic metaphors can tell us whether these linguistic metaphors tend to be conceptually active, and to what degree. In the next section I expound this premise fully, detailing the key features of gestures, the different types of gestures, and exactly how gestures can be used to quantify conceptual activation. I do this by appealing to Hostetter and Alibali's (2008) Gesture as Simulated Action framework.

3. GESTURE

Although they often accompany speech, gestures are different from language in two key ways (McNeill, 1992; McNeill & Duncan, 2000). First, whereas the meaning of a sentence is primarily compositional, deriving from the sum of its constituent words, gestures express meaning non-compositionally. This means that a gesture's meaning is determined by its form as a whole, rather than by 'adding together' the elements that comprise it (e.g., hand shape, movement direction). Second, a single gesture can combine several meanings, whereas language often requires several words to do the same. For example, while saying, "She climbed up the ladder", a speaker might gesture by moving their hand upwards while wiggling their fingers, communicating three meanings (she + climbed + up) in a single symbol (example from Hostetter & Alibali, 2008: 501).

In these two ways, gestures are similar to images (e.g., Beattie and Shovelton, 2002), which makes gestures ideal for expressing the analogue representations of mental imagery and mental simulations directly, rather than communicating this imagery through propositional, linguistic forms. This is especially true for spatial and motor imagery (e.g., Alibali, 2005); for instance, it is more efficient to show a person how large a fish is with one's hands than to describe its size with words. Unsurprisingly, therefore, research has shown that gestures are more likely to occur with speech about spatial information than non-spatial information (Rauscher et al., 1996; Krauss, 1998; Alibali et al., 2001). Accumulating evidence also indicates that spatial gestures are at least partly motivated by spatial mental representations. For example, research shows that stroke patients with visuospatial deficits gesture less than age-matched controls (Hadar et al., 1998), and that individuals with weaker

visuospatial skills gesture less than those with stronger visuospatial skills (Hostetter & Alibali, 2007; see also Hostetter & Hopkins, 2002).

Many taxonomies have been suggested for the classification of gestures (see Kendon, 2004), but most useful for the purposes of the current study is McNeill's (2005: 38) distinction between 'beat gestures', 'deictic gestures', 'iconic gestures' and 'metaphoric gestures' (see also McNeill & Levy, 1982; McNeill, 1992). Beat gestures are normally used to emphasise certain lexical items in speech, typically consisting of short up-and-down movements (McNeill, 1992) coinciding with stressed syllables (Yasinnik et al., 2004; see also Wang & Chu, 2013). Deictic gestures involve simply pointing to a referent in the environment, which even toddlers have no trouble with ('I want that one'). Iconic gestures represent analogue representations directly, depicting referents using the shape and/or movement of the hands, exemplified by the fish example mentioned above ('It was this big'). Central to this paper, however, are metaphoric gestures. Metaphoric gestures are similar to iconic gestures in that they depict features of a referent directly (e.g., Müller, 1998). However, in metaphoric gestures, this depicted referent is used metaphorically to stand for something else. An example of a metaphoric gesture would be if a speaker moved their hands away from each other when saying 'This is a big opportunity'. This gesture would seem to depict the source domain SIZE, which is used metaphorically to represent the target domain IMPORTANCE (e.g., Grady, 1997; Yu et al., 2017).

Researchers (e.g., McNeill, 1992; Beattie, 2003; Goldin-Meadow et al., 1993) have championed gesture as a way to break the circular logic of CMT, where linguistic metaphors are simultaneously held as surface-level reflections of, and also evidence for, conceptual metaphors (e.g., Murphy, 1996, 1997; see also Gibbs & Colston, 1995). This argument assumes that gestures are a "window into the mind" (De Ruiter,

2007: 21), and thus can reveal out thoughts. However, the exact mechanisms by which gestures express thought were conceptually rather fuzzy until Hostetter and Alibali (2008) brought them into focus with their Gesture as Simulated Action framework (see also Kita et al., 2017). This framework directly motivates the methodology used in the present study.

3.1. Gesture as simulated action

Hostetter and Alibali's (2008) Gesture as Simulated Action (GSA) framework holds that gestures are the outwards manifestations of mental imagery and mental simulations. We have seen already that imagining perceptions and actions activates mental processes overlapping with those activated when actually perceiving and acting. Normally, this activation seems to occur in the premotor cortex (e.g., Rizzolatti et al., 1996; see also Jeannerod, 1994; Smith & Kosslyn, 2007), but under the GSA framework this activation may occasionally spread to the motor cortex. This spreading activation tends to manifest in overt action: typically, gestures.

What factors determine whether a given analogue representation will cause a speaker to produce a gesture? Hostetter and Alibali (2008: 503) suggest first that the strength of the activation dictates the likelihood that activation will spread from premotor to motor areas of the brain. This draws an immediate parallel with the idea that conceptual activation is gradable, because more or fewer pathways and links between these pathways can become activated (Cameron, 1999; Müller, 2008). Hostetter and Alibali (2008: 503) use the notion of gradability to characterise activation more generally, but conceptual activation can be viewed as a sub-category of activation that abides by the same rules. The authors are also keen to emphasise that while language production is often motivated by analogue representations, some

speakers may produce language derived from amodal, propositional codes. They argue that a speaker's propensity to generate language via analogue representations versus propositional codes may affect how likely they will be to produce gestures more generally (see Hostetter & Alibali, 2007). The topic that a given speaker is talking about may also influence whether or not they gesture; for instance, we have seen already that gestures are more likely to occur with speech about spatial information than non-spatial information (Rauscher et al., 1996; Krauss, 1998; Alibali et al., 2001).

A speaker's idiosyncratic analogue representations, which comprise their mental imagery and mental simulations, may also dictate how likely they will be to gesture. For example, Bergmann and Kopp (2009: 364) stress that humans can adopt different perspectives on an imagined scene at different scales or levels of detail, and that this can affect the quality of their gestures. In fact, Hostetter and Alibali (2008: 503) speculate that these kinds of details can dictate whether speakers gesture at all. A key distinction in this regard is whether an analogue representation is primarily visual or motoric. Motor representations necessarily involve imagined action, whereas visual representations may not. However, it is possible for a primarily visual representation to involve action, for example when a visual representation involves perceiving motion, perceiving an image that changes over time, or when a perceived image is closely tied to action. Visual representations may also trigger action-based representations when perception of an image depends on action (e.g., visual and tactile exploration). However, because of the lack of an explicit connection to action, Hostetter and Alibali predict that a speaker will be less likely to gesture based on primarily visual representations, compared to primarily motoric representations (ibid: 503-4).

The level of activation that an analogue representation generates must also be sufficient to surpass the speaker's personal 'gesture threshold', which is the limit

beyond which activation will manifest in action (ibid: 503). The speaker's gesture threshold may depend on neurological factors, such as the strength between premotor and motor areas of their brain, with greater connections between these areas making spreading activation more likely (ibid: 505). The speaker's gesture threshold may also be contextually determined. For instance, research has shown that speakers gesture more when a linguistic description is more difficult to produce (e.g., Chawla & Krauss, 1994; Morsella & Krauss, 2004; Melinger & Kita, 2007). In addition, research suggests that speakers can consciously exert a degree of control over their gesture production (e.g., Hostetter et al., 2006); specifically, speakers can lower their gesture threshold when they are communicating something challenging that they suspect their listener will find difficult to understand (e.g., Alibali & Nathan, 2007). Ultimately, other factors could affect a speaker's gesture threshold, such as whether they are an extrovert or an introvert; speculatively, we might expect extroverts to gesture more than introverts, which could be the result of extroverts generally having a lower gesture threshold. The fact that gesture thresholds differ from person to person and from context to context stresses the need to collect gesture data across speakers and across contexts if we wish to make any generalisable conclusions from these gestures about thought.

Hostetter and Alibali (2008: 504) suggest that speakers may rely more on propositional codes than analogue representations when talking about abstract concepts. This is relevant to linguistic metaphors because, often but not always, the target domains of these linguistic metaphors are abstract (e.g., Lakoff & Johnson, 1980). Because it is impossible to directly perceive or act upon an abstract concept, it seems less likely that a speaker will have a perceptual or motoric representation in mind when talking about this concept. Under the GSA framework, therefore, speakers should be less likely to gesture when using metaphorical language than when using

literal language. However, we must remember that linguistic metaphors tend to construe abstract concepts metaphorically in terms of concrete concepts (e.g., Lakoff & Johnson, 1980). This is true of the linguistic metaphors in the current study ('low standards', 'high standards', 'lower the standards', 'raise the standards'), which all describe the abstract concept EMOTIONAL VALENCE in terms of the concrete concept VERTICAL SPACE. Thus, speakers may still have an analogue representation in mind if the linguistic metaphor they are using is conceptually active (e.g., Lakoff & Johnson, 1980; Varela et al., 1993; Gibbs, 2005). This should make speakers more likely to gesture, bringing us back to characterisation of gestures as activation indicators (Müller, 2008).

3.2. Gesture as an activation indicator

Hostetter and Alibali's (2008) GSA framework suggests that 'gesture co-occurrence' can be used to assess the conceptual activation of a linguistic metaphor: if a linguistic metaphor is conceptually active, a speaker will be more likely to gesture when they use it. The greater the degree of this conceptual activation, the more likely it is that a speaker will gesture, because there is more chance of this activation surpassing the speaker's gesture threshold and spreading from premotor to motor areas of their brain. One caveat is that gesture co-occurrence can only be a reliable indicator of conceptual activation where the target domain of a linguistic metaphor is abstract. This is because, in the case of linguistic metaphors where both source and target domains are concrete (e.g., '<u>That man</u> is a <u>pig</u>'), the speaker's analogue representations may involve perception and/or action regardless of whether they are imagining the linguistic metaphor's source or target domain.

Gesture co-occurrence is a relatively non-specific criterion, however, in that it does not take into consideration the form of the gesture (e.g., hand shape, direction of movement). If a linguistic metaphor is conceptually active, we would expect the gesture's form to reflect the relevant aspect of the source domain used to metaphorically construe the target domain. One specific issue with gesture co-occurrence is that the presence of a gesture in and of itself may occur for reasons other than the linguistic metaphor being conceptually active. For instance, if beat gestures typically coincide with stressed syllables in speech, it may be that a certain linguistic metaphor contains words that tend to be stressed syntactically. To mitigate this problem, we can also decide whether or not a gesture aligns with the metaphorical meaning of a linguistic metaphor: what I call 'gestural fit'. How this is operationalised will depend on the source domain of the linguistic metaphor in question, which I explore further in section 4.1.

The gradability inherent in conceptual activation can also be deduced from the level of effort that a speaker uses to gesture: 'gestural effort'. We have seen already that imagining actions can result in muscular activity and micromovements (e.g., Jacobson, 1931; Shaw, 1940; Wehner et al., 1984), which could be viewed as evidencing activation that has spread to the motor cortex, but not quite enough to produce a noticeable action. At the other end of the scale, if a relatively high amount of activation spread from premotor to motor areas of the brain, we might expect this to result in a highly effortful gesture. One criterion by which effort can be quantified is whether a speaker gestures with one or both hands, with both-handed gestures corresponding to a higher amount of effort than one-handed gestures. This is the criterion of gestural effort used in the current study. Other criteria include the duration

of a gesture, the extent to which the gesturing hands move while gesturing, and potentially more.

* * *

In this section I have given an overview of co-speech gestures and their relationship with language, and I have described the proposals of Hostetter and Alibali's (2008) Gesture as Simulated Action framework. Using the GSA framework, I have suggested three ways of quantifying the conceptual activation of a linguistic metaphor:

1. *Gesture co-occurrence:* whether or not speakers gesture when using the linguistic metaphor
2. *Gestural fit:* whether or not speakers produce gestures that align with the meaning of the linguistic metaphor
3. *Gestural effort:* how effortful speakers' gestures are (e.g., gesturing with two hands tends to involve more effort than gesturing with one hand)

In the next section, I explicate the linguistic metaphors that are the focus of the current study and develop the criteria of gesture co-occurrence, gestural fit and gestural effort in relation to these linguistic metaphors. We have seen that, because gestures are similar to images, they are ideal for expressing spatial and imagistic information directly. Spatial information in particular is easy to express in gesture, with the most obvious signifier of spatial information being gesture direction. This makes linguistic metaphors with space as a source domain ideal for investigating conceptual activation using the criteria of gesture co-occurrence, gestural fit and gestural effort. One concept known to be construed metaphorically in terms of space is emotional valence, which is the focus of the current study. Emotional valence is doubly ideal

because it is an abstract concept, and therefore we would not expect a speaker to gesture when talking about it unless they conceptualised it metaphorically in terms of a concrete domain, such as vertical space.

4. METAPHORS OF EMOTIONAL VALENCE

Emotional valence is a term used predominantly in psychology that refers to the good-ness (positive) or bad-ness (negative) of a concept (Frijda, 1986: 207). For example, in a study where participants rated 13,915 English lemmas for emotional valence, the three most negative ratings were given to the words ‘pedophile’, ‘rapist’ and ‘AIDS’, whereas the three most positive ratings were given to the words ‘happiness’, ‘fantastic’ and ‘lovable’.

The current study focuses on vertical linguistic metaphors of emotional valence, where negative emotional valence (-valence) is described using words pertaining to lower space (BAD IS DOWN), and positive emotional valence (+valence) is described using words pertaining to upper space (GOOD IS UP). Specifically, the linguistic metaphors investigated here are: ‘low standards’, ‘high standards’, ‘lower the standards’ and ‘raise the standards’ (see section 5.2 for why these specific linguistic metaphors were chosen). ‘Low standards’ and ‘lower the standards’ express -valence in terms of lower space (‘low’, ‘lower’), whereas ‘high standards’ and ‘raise the standards’ express +valence in terms of upper space (‘high’, ‘raise’). Research suggests that people tend to think, as well as talk, about emotional valence in terms of vertical space, associating -valence with lower space and +valence with upper space (e.g., Meier & Robinson, 2004; Seno et al., 2009; Casasanto & Dijkstra, 2010). This indicates that, when a speaker uses one of these vertical linguistic metaphors to talk about emotional valence, this linguistic metaphor may be conceptually active.

Alternatively, a speaker might use one of these vertical linguistic metaphors and conceptualise emotional valence using a different conceptual metaphor. For instance, a speaker might associate the dominant side of their bodies with +valence, and the non-dominant side of their bodies with -valence, as suggested by Casasanto’s

(2009) ‘body-specificity hypothesis’. This can be described as a horizontal conceptual metaphor of emotional valence. Another possibility is that a speaker might associate space near to their bodies with +valence, and space further away from their bodies with -valence, as suggested by the ‘approach-avoidance effect’ (e.g., Solarz, 1960). This can be described as a sagittal conceptual metaphor of emotional valence.

One final possibility is that some speakers may conceptualise quantity rather than, or as well as, emotional valence when they use one of these vertical linguistic metaphors. This is suggested by the fact that increases in quantity (e.g., financial gains) are frequently correlated with improving ‘standards’, whereas decreases in quantities (e.g., financial losses) are frequently correlated with worsening ‘standards’ (e.g., Winter & Matlock, 2017). Research suggests that people tend to conceptualise quantity metaphorically in terms of physical size, where lesser quantities are conceptualised as smaller, and greater quantities are conceptualised as larger (e.g., Henik & Tzelgov, 1982). This can be described as a size-based conceptual metaphor of quantity.

In this section, I explore vertical, (section 4.1) horizontal (section 4.2) and sagittal (section 4.3) conceptual metaphors of emotional valence, all of which construe emotional valence in terms of space using different axes. I then turn my attention towards size-based conceptual metaphors of quantity (section 4.4). Across these four subsections, I cite research conducted in evidence of each conceptual metaphor and discuss suggestions as to their origins. I then suggest methods of determining whether or not these conceptual metaphors are active in the minds of speakers who use vertical linguistic metaphors of emotional valence. These methods involve analysing speakers’ gestures.

4.1. Vertical metaphors of emotional valence

In English and other languages, people often talk about emotional valence in terms of vertical space; for instance, people might encourage a friend who is feeling 'down in the dumps' to 'cheer up', they might look back on a 'low point' in their lives, or they might profess to feeling 'on a high' after a job promotion. The linguistic metaphors investigated in this study ('low standards', 'high standards', 'lower the standards', 'raise the standards') also express this vertical association. In each of these linguistic examples, -valence is described metaphorically as being low down in vertical space, whereas +valence is described metaphorically as being high up in vertical space. According to CMT, this way of talking reflects our tendency to mentally associate lower space with -valence and upper space with +valence (Lakoff & Johnson, 1980). To use the terminology of CMT, we structure our understanding of emotional valence in terms of GOOD IS UP and BAD IS DOWN conceptual metaphors.

What evidence is there that we tend to associate GOOD with UP and BAD with DOWN? Meier and Robinson (2004) showed that participants were faster to make semantic judgments about +valence words such as 'pride' when they appeared in a relatively high position on a computer screen, and -valence words such as 'liar' when these words appeared in a relatively low position. Studies have also shown that participants are more likely to recall positive memories when perceiving upwards motion (Seno et al., 2013), and when moving marbles upwards from a lower box to a higher box (Casasanto & Dijkstra, 2010), whereas downwards motion had the opposite effect in both these studies. Furthermore, Tversky et al. (1991) investigated representations of emotional valence by asking participants to place stickers anywhere on a piece of paper, which participants were told represented nonpreferred

(-valence) and preferred (+valence) foods and TV shows. The result from this study showed that participants were more likely to place the -valence stickers towards the bottom of the paper, and the +valence stickers towards the top (see also Woodin & Winter, under review). This vertical association has also been demonstrated cross-culturally (Marmolejo-Ramos et al., 2017), and in a study where three-dimensional responses were possible (Marmolejo-Ramos et al., 2018; see also Santiago et al., 2012; Marmolejo-Ramos set al., 2014).

From where do vertical conceptual metaphors of emotional valence originate? Researchers have proposed several mutually-inclusive answers to this question. For instance, we are more likely to assume a slumped body posture if we are feeling 'down' or lacking in confidence, whereas an upright posture connotes confidence and high self-esteem (Lakoff & Johnson, 1999; Casasanto, 2014; Winter & Matlock, 2017; Castaño et al., 2018). Moreover, being smaller than another person is generally to be in a physically inferior position to that person, whereas taller people tend to be stronger and therefore able to exert more control (Winter, 2014). Our embodied experience and observance of these correlations could lead us to associate GOOD with UP and BAD with DOWN. This vertical association may then come to be represented culturally in the form of linguistic metaphors, art and conventions such as the use of thumbs-up/thumbs-down gestures to indicate approval or disapproval (Casasanto, 2014), which become a new source of metaphorical associations (Kövecses, 2002; Winter, 2014; Winter & Matlock, 2017).

All this research indicates that people tend to associate GOOD with UP and BAD with DOWN, and that these associations are reflected in the linguistic metaphors we use to talk about emotional valence. However, none of this research necessarily shows that these associations are active when speakers use vertical linguistic

metaphors of emotional valence. We can investigate this issue by examining how speakers gesture when they use -valence linguistic metaphors (‘low standards’, ‘lower the standards’) and +valence linguistic metaphors (‘high standards’, ‘raise the standards’).

Gesture co-occurrence (gesture vs. no gesture) first tells us how likely it is that a speaker will gesture at all when using one of these linguistic metaphors. If a speaker gestures, this would suggest that the linguistic metaphor in question is conceptually active. This is because gestures are simulated actions (e.g., Hostetter & Alibali, 2008). Therefore, speakers should be unlikely to gesture when thinking about an abstract domain that cannot be perceived or acted upon (e.g., EMOTIONAL VALENCE), unless this abstract domain is conceptualised in terms of a concrete domain (e.g., VERTICAL SPACE). Gestural fit then tells us whether or not the speaker is thinking about the abstract domain EMOTIONAL VALENCE specifically in terms of the concrete domain VERTICAL SPACE. For instance, if a speaker gestures with an upwards movement when using a +valence linguistic metaphor, this gesture can be said to align with the GOOD IS UP association expressed by the linguistic metaphor. Similarly, if a speaker gestures with an downwards movement when using a -valence linguistic metaphor, this gesture can be said to align with the BAD IS DOWN association expressed by the linguistic metaphor. If a speaker produces an incompatible vertical movement (e.g., gesturing upwards when saying ‘low standards’) or does not gesture along the vertical axis at all, this gesture cannot be said to align with the meaning of the linguistic metaphor. Of those gestures that ‘fit’ the meaning of the linguistic metaphor, we can then use gestural effort to compare how many of these gestures are one-handed and how many are both-handed. Both-handed gestures point towards a higher level of conceptual activation than one-handed gestures.

4.2. Horizontal metaphors of emotional valence

Whereas vertical conceptual metaphors of emotional valence are often expressed through vertical linguistic metaphors, people may also structure thought about emotional valence in terms of horizontal conceptual metaphors, which do not tend to be expressed linguistically. Specifically, Casasanto's (2009) 'body-specificity hypothesis' predicts that right-handers will associate rightwards space with +valence and leftwards space with -valence, whereas left-handers will exhibit the opposite pattern. In evidence of this body-specific association, Casasanto found that right-handers tended to place items representing +valence concepts into a box on the right-hand side of a piece of paper, and -valence items into a box on the left, whereas left-handers preferred the reverse placements. This embodied left-right association has been reported in children as young as five years old (Casasanto & Henetz, 2012), and in Moroccan and Spanish right-handed participants (de la Fuente et al., 2014). It has also been demonstrated using various experimental paradigms, such as reaction time studies and memory performance tasks (Van Strien & Van Beek, 2000; Rodway et al., 2003; Bruny et al., 2012; de la Vega et al., 2012).

Casasanto (2009) argues that this horizontal association stems from the fact that we find it easier to interact with the world using the more dominant side of our bodies, and we therefore come to associate this side of space with +valence Conversely, we find it harder to interact with the world using the non-dominant side of our bodies, which may lead us to associate this side of space with -valence The idea that motor fluency can influence associations of emotional valence is supported by studies showing that expert typists tend to prefer letter pairs that are more easily typed, even when the task at hand does not involve typing (Van den Bergh et al., 1990; Beilock & Holt, 2007; for a review of the literature on fluency, see Oppenheimer, 2008).

Moreover, specific to handedness, Casasanto and Chrysikou (2011) showed that completing a manual task while wearing a bulky ski glove on one's preferred hand can reverse previously-held associations of emotional valence. The authors explain this finding in terms of their task impeding the motor fluency of one's preferred hand, making it relatively easier to interact with one's non-dominant hand.

Research suggests that speakers express body-specific associations of emotional valence through their gestures. In a study working with videos of speeches from presidential candidates, Casasanto and Jasmin (2010) found that right-handed candidates used more right-handed gestures during +valence clauses and more left-handed gestures during -valence clauses, whereas left-handed candidates tended to do the opposite. Conflicting results have been reported elsewhere, however. In a study conducted by Ćatak et al. (2018), Turkish participants used their dominant hands to gesture more often than their non-dominant hands, regardless of clause valence. The authors suggest that the difference between their results and those reported by Casasanto and Jasmin (2010) may be attributable to the fact that the politicians in the latter study were likely to have received speech and body language training, which could have affected their gestures. In contrast, the participants in Çatak et al.'s (2018) study were university students with a demographic profile similar to laypeople. The diverging results of these two studies make it difficult to determine whether body-specific effects extend to gestures.

The present study hopes to shed light on this issue by examining gestures accompanying -valence linguistic metaphors ('low standards', 'lower the standards') and +valence linguistic metaphors ('high standards', 'raise the standards'). By analysing the handedness of these gestures, it is possible to determine whether

speakers are more likely to gesture with their dominant hand when using +valence linguistic metaphors, and to gesture with their non-dominant hand when using -valence linguistic metaphors. Alternatively, speakers may simply be more likely to gesture with their dominant hand, irrespective of emotional valence, as was reported by Çatak et al. (2018). Moreover, although body-specificity is thought to derive primarily from handedness, this left-right association may extend to left-side and right-side space (e.g., Casasanto, 2009). If so, speakers may be more likely to gesture horizontally towards their preferred side of space when using a +valence linguistic metaphor, and towards their nonpreferred side of space when using a -valence linguistic metaphor.

Note that I do not use the term 'conceptual activation' when referring to horizontal conceptual metaphors of emotional valence, because I have reserved this term for describing whether or not a *linguistic metaphor* is active at the conceptual level. Because the linguistic metaphors investigated here have the source domain VERTICAL SPACE rather than HORIZONTAL SPACE, any body-specific effects expressed in speakers' gestures would seem to be unrelated to the linguistic metaphors themselves. The same is true of the sagittal metaphors discussed in section 4.3, and the size-based quantity metaphors discussed in section 4.4.

4.3. Sagittal metaphors of emotional valence

Other conceptual metaphors of emotional valence recruit the sagittal axis, where GOOD IS NEAR and BAD IS FAR. These sagittal associations are hypothesised to derive from the 'approach-avoidance effect', where +valence stimuli promote approach behaviour and -valence stimuli promote avoidance behaviour. A seminal study by Solarz (1960) demonstrating the approach-avoidance effect showed that participants were quicker

to pull cards with +valence meanings towards themselves (approach), and to push cards with -valence meanings away from themselves (avoid). In a more recent study conducted by Marmolejo-Ramos et al. (2017), participants were asked to place emotionally valenced words inside a three-dimensional cube. These participants tended to place +valence words near their body, and to place -valence words far away from their body. This basic effect has been replicated numerous times across many different experimental paradigms (e.g., Chen & Bargh, 1999; Centerbar & Clore, 2006; Saraiva et al., 2013).

Evolutionary theorists have suggested that people tend to exhibit approach-avoid behaviour because +valence acts a neural code for survival-enhancing stimuli, whereas -valence acts as a neural code for survival-threatening stimuli (e.g., Johnston, 2003; Phaf et al., 2014). By this logic, approaching +valence stimuli and avoiding -valence stimuli are behaviours that usually benefit survival. Supporting this interpretation, random computer simulations have shown that approach-avoidance tendencies emerge autonomously in people after several generations, indicating the survival value of these tendencies (den Dulk et al, 2003; Heerebout & Phaf, 2010a, 2010b).

By examining gestures accompanying -valence linguistic metaphors (‘low standards’, ‘lower the standards’) and +valence linguistic metaphors (‘high standards’, ‘raise the standards’), it is possible to determine whether a sagittal conceptualisation of emotional valence is active in the minds of speakers who use these linguistic metaphors. If speakers conceptualise emotional valence in terms of GOOD IS NEAR and BAD IS FAR conceptual metaphors, we would expect them to gesture sagittally towards their body when using a +valence linguistic metaphor, and sagittally away from their body when using a -valence linguistic metaphor. Alternatively, if a speaker gestures

with an incompatible sagittal movement (e.g., gesturing away from their body when saying ‘high standards’), we might assume that a sagittal conceptualisation of emotional valence is not active in their mind.

4.4. Size-based metaphors of quantity

One final possibility is that speakers who use the vertical linguistic metaphors ‘low standards’, ‘high standards’, ‘lower the standards’ and ‘raise the standards’, which seem to refer primarily to emotional valence, are also thinking about quantity. This is because increases in quantity are frequently correlated with improving emotional valence; and conversely, decreases in quantity are frequently correlated with worsening emotional valence. This correlation is best illustrated by TV news reports, where financial gains are often depicted using a green, upwards-pointing arrow, whereas financial losses are often depicted using a red, downwards-facing arrow (Winter and Matlock, 2017: 112; see also Gibbs, 2011). The vertical directionality of these arrows aligns with the conceptual metaphors MORE IS UP and LESS IS DOWN, where quantity is conceptualised metaphorically using the vertical axis (e.g., Hartmann et al., 2012; Winter & Matlock, 2013; see Winter et al., 2015 for a review). Furthermore, the presence of colour also lends the arrows an emotional valence component, with green signifying +valence and red signifying -valence (e.g., Moller et al., 2009). This correlation between quantity and emotional valence may trigger conceptualisations of quantity when speakers think about emotional valence, and vice versa.

Because vertical conceptual metaphors of quantity (MORE IS UP and LESS IS DOWN) are consistent with vertical conceptual metaphors of emotional valence (GOOD IS UP and BAD IS DOWN), it is impossible to distinguish between gestures that use the vertical axis to depict either QUANTITY or EMOTIONAL VALENCE. To investigate

conceptualisations of quantity, therefore, we can examine the conceptual metaphors LESS IS SMALL and MORE IS BIG, which construe QUANTITY in terms of PHYSICAL SIZE. This conceptual metaphor is often expressed through linguistic metaphors where numbers are described as being, for instance, ‘tiny’ or ‘huge’. Evidence for a size-based conceptualisation of quantity comes from Henik and Tzelgov (1982), who found that participants were quicker to make judgments about relatively large numbers when these numbers were presented in a large font, and vice versa for relatively small numbers. In another study conducted by Andres et al. (2004), participants had to judge whether numbers were odd or even using either hand-opening or hand-closing movements. The authors reasoned that if numbers are conceptualised as either large or small physical objects, the imagined size of these numbers should change how participants imagine interacting with them; specifically, participants should prefer open hand shapes for larger numbers, and closed hand shapes for smaller numbers. This reasoning was confirmed by the results of the study, which showed that participants who made hand-closing movements were quicker to make judgments about smaller numbers, whereas participants who made hand-opening movements were quicker to make judgments about larger numbers. Similarly, in a qualitative analysis of gestures using the TV News Archive, Winter et al. (2014) found that speakers were more likely to gesture with a closed hand configuration when talking about smaller numbers, and with an open hand configuration when talking about larger numbers.

In the current study, speakers using the -valence linguistic metaphors ‘low standards’ and ‘lower the standards’ might also be thinking about quantity, where LESS is conceptualised as SMALL. Furthermore, speakers using the +valence linguistic metaphors ‘high standards’ and ‘raise the standards’ might also be thinking about quantity, where MORE is conceptualised as BIG. If a size-based conceptualisation of

quantity is active in the mind of a speaker, we might expect them to gesture with a closed hand configuration when using the linguistic metaphors ‘low standards’ and ‘lower the standards’, and with an open hand configuration when using the linguistic metaphors ‘high standards’ and ‘raise the standards’. If the speaker does not, they may not be thinking of quantity in terms of size, or they may not be thinking about quantity at all. By investigating this question, we can assess whether the qualitative analyses of Winter et al. (2014) hold up under the scrutiny of a large-scale quantitative analysis.

* * *

In this section, I have discussed vertical linguistic metaphors of emotional valence (‘low standards’, ‘high standards’, ‘lower the standards’, ‘raise the standards’), and I have suggested a way of using gesture co-occurrence, gestural effort and gestural fit to determine whether these linguistic metaphors are conceptually active. Following this, I have explicated two other conceptual metaphors of emotional valence (horizontal, sagittal) and one size-based conceptual metaphor of quantity. I have then described methods of deciding whether these conceptual metaphors are active, broadly by looking at how speakers gesture. In the next section, I explore four factors that may or may not affect the conceptual activation of linguistic metaphors: emotional valence, word class, agency and animacy.

5. FACTORS AFFECTING CONCEPTUAL ACTIVATION

The four linguistic metaphors investigated in this study ('low standards', 'high standards', 'lower the standards', 'raise the standards') all express a metaphorical association between the target domain EMOTIONAL VALENCE and the source domain VERTICAL SPACE. Linguistically, however, they express this valence-space association in different ways. These linguistic differences may reflect conceptual differences (i.e., different mental imagery or mental simulations), and these conceptual differences may affect the likelihood of these linguistic metaphors being conceptually active (i.e., whether a metaphorical link is activated from VERTICAL SPACE to EMOTIONAL VALENCE). Furthermore, these linguistic metaphors are not usually produced in isolation; rather, they typically appear as constituent parts of whole clauses and sentences, which are strung together to express dynamic mental imagery or mental simulations taking place in speakers' minds. A single linguistic metaphor is therefore not likely to express a single thought, divorced from context, but is more likely to express one composite element of a larger, imagined scene, or one scene in a series of imagined scenes. This means that language expressed externally to these linguistic metaphors themselves may reflect conceptual differences, which in turn may affect the likelihood of these linguistic metaphors being conceptually active.

One difference between the linguistic metaphors examined in this thesis is that 'low standards' and 'lower the standards' represent the association BAD IS DOWN (-valence), whereas 'high standards' and 'raise the standards' represent the association GOOD IS UP (+valence). Another difference between these linguistic metaphors is that 'low standards' and 'high standards' describe vertical space using adjectives ('low', 'high'), whereas 'lower the standards' and 'raise the standards' describe vertical space using verbs ('lower', 'raise'). In addition, when a speaker uses a metaphorical verb

('lower', 'raise'), they may or may not describe themselves as performing this action; in other words, they may or may not be the agent of this verb. Agency may be expressed externally to these linguistic metaphors, for instance with pronouns indicating that the speaker is the agent of the verb (e.g., 'I', 'we'), or pronouns indicating that the speaker is not the agent of the verb (e.g., 'you', 'she', 'he'). If the speaker is not the agent of the verb, the implied agent of the verb may either be animate (e.g., "They are almost lowering the standard") or inanimate (e.g., "This bill raises the standard"). This animate-inanimate distinction refers to whether or not the agent described is alive, conscious and therefore capable of performing the action described.

Over the next four subsections, I describe these four factors (emotional valence, word class, agency, animacy) in more detail, and suggest how they might affect the conceptual activation of a linguistic metaphor. I propose that we can use the three criteria of gesture co-occurrence, gestural fit and gestural effort to observe whether the conceptual activation of a linguistic metaphor is affected by each of these four factors.

5.1. Emotional valence: the negativity bias

The linguistic metaphors 'low standards', 'high standards', 'lower the standards' and 'raise the standards' all express the same valence-space association. However, one difference between these linguistic metaphors is that 'low standards' and 'lower the standards' are -valence, whereas 'high standards' and 'raise the standards' are +valence. This difference in emotional valence may reflect conceptual differences. For instance, research suggests that humans are genetically hardwired to ascribe greater importance to negative over positive entities, which include events, objects and

personal traits (e.g., Bloom & Price, 1975; Kahneman et al., 1990; Kurzer et al., 2000). This has been called the 'negativity bias' (Rozin & Royzman, 2001; see also Jordan, 1965; Peeters, 1971; Lewick et al., 1992).

This proposed negativity bias has far-reaching implications for human judgments, behaviours and belief systems. For instance, it has been shown that people will demand much more money to sell an item they already own than they will pay to purchase the same item (Kahneman et al., 1990), indicating that people tend to overvalue losses in comparison to gains. Similarly, economic downturns in the run-up to a presidential election can reduce the number of votes for the incumbent political party, whereas upturns have almost no effect (Bloom & Price, 1975), suggesting that downturns are more salient for voters than upturns. In the realm of morality, people judge a single murder to be so impermissible that the murderer would have to save the lives of around 25 people to be forgiven for their crime (Kurzer et al., 2000) This negativity bias can even penetrate through to our social belief systems; for example, in Hindu cultures it is believed that high-caste Hindus can be lowered in social status by eating food prepared by lower castes, whereas lower castes cannot be granted higher social status by eating food prepared by higher castes (Stevenson, 1954; Rosin & Royzman, 2001).

In apparent opposition to this bias, it has been reported that +valence words are typically used more frequently than -valence words: the 'Pollyanna hypothesis' (Boucher & Osgood, 1969; see also Johnson et al., 1960; Unkelbach et al., 2010; Warriner & Kuperman, 2015). Taken in isolation, this token-based bias could be interpreted as showing that people are simply more likely to discuss their positive experiences than their negative ones. However, it has more recently been shown that languages generally contain more distinct +valence word *types* than -valence

(Kloumann et al., 2012), which can feasibly be explained as a communicative response to a wider range of +valence than -valence phenomena experienced by humanity overall (Gable et al., 2000; Rozin et al., 2010). Alternatively, if we do tend to talk about our positive experiences more often, we may have developed more fine-grained distinctions to describe these experiences, resulting in the creation of more positive word types (Steyvers & Tenenbaum, 2005; Warriner & Kuperman, 2015).

How can we reconcile the negativity bias and the Pollyanna principle? From an evolutionary standpoint, it makes sense that if positive phenomena are rarer than negative phenomena, it is adaptive to assume a positive state of affairs while being hyper-sensitive to the negative, which could represent danger to survival (Peeters, 1971, 1989; Peeters & Czapinski, 1990; Lewick et al., 1992). This is reflected in language: -valence words are rarer and hence more marked than +valence words, which results in -valence words being remembered relatively more easily (Clark & Clark, 1977). In contrast, because +valence words are used more frequently, they are responded to and evaluated more quickly (Bargh et al., 1992; Unkelbach et al., 2010, Kuperman et al., 2014). All this points towards the conclusion that while +valence entities are processed with greater ease, -valence entities are more salient. This suggests that both the negativity bias and the Pollyanna principle are valid.

How exactly might the negativity bias affect the conceptual activation of the linguistic metaphors in the current study? If we assign more importance to -valence entities than +valence entities, perhaps -valence linguistic metaphors (‘low standards’, ‘lower the standards’) will be more conceptually active than +valence linguistic metaphors (‘high standards’, ‘raise the standards’). This is because more neural pathways and links between these pathways may become activated when thinking about -valence concepts compared to +valence concepts (e.g., Cameron, 1999;

Müller, 2008). If so, according to the criterion of gesture co-occurrence, speakers should be more likely to gesture (vs. not gesturing) when using -valence linguistic metaphors than +valence linguistic metaphors. Speakers should also be more likely to produce gestures that align with the meaning of the linguistic metaphor they are using when this linguistic metaphor is -valence rather than +valence (gestural fit). Finally, speakers should be more likely to produce two-handed (vs. one-handed) gestures when using -valence linguistic metaphors than +valence linguistic metaphors (gestural effort).

We can tentatively explore the above prediction made in regard to gesture co-occurrence by re-analysing data reported by Casasanto and Jasmin (2010), who looked specifically at gestures produced by four presidential candidates (Barack Obama, John McCain, John Kerry, George Bush) across -valence and +valence clauses. The authors here were investigating the body-specificity hypothesis rather than the negativity bias, so they did not perform this particular analysis themselves. This re-analysis shows that speakers did gesture more for -valence clauses: 65.5% (N = 449) of -valence clauses were accompanied by gestures, whereas 34.5% (N = 237) were not. In contrast, 51.8% (N = 314) of +valence clauses were accompanied by gestures, whereas 48.2% (N = 292) were not. A simple Chi-squared test of independence shows that these results are incompatible with the null hypothesis of independence of clause valence (-valence vs. +valence) and gesture co-occurrence (gesture vs. no gesture) ($\chi^2(1) = 24.185$, $p < 0.001$, Cram r's $V = 0.14$). This suggests that -valence clauses are more conceptually active than +valence clauses.

The current study extends the question of whether -valence clauses are more conceptually active than +valence clauses to a dataset comprising 268 unique speakers, looking specifically at linguistic metaphors. This study goes beyond gesture

co-occurrence and also uses the criteria of gestural fit and gestural effort, which the data collected by Casasanto and Jasmin (2010) did not afford the possibility of doing.

5.2. Word class

Another factor that may or may not affect the conceptual activation of linguistic metaphor is word class. This is one of the main categorisations made by formal linguists between lexemes in a language, where words are sorted into part-of-speech groups. The word classes of interest in this study are adjectives and verbs. The criteria commonly used to distinguish between these two categories include syntactic and distributional criteria (what position the word appears in), morphological criteria (what kinds of affix can modify the word), and semantic criteria (what the word means) (Givón, 2001; see also Baker & Croft, 2017). The current study uses semantic criteria to define word class, following Murphy's (2010: 144) assertion that prototypical adjectives denote properties, whereas prototypical verbs denote physical actions (see also Givón, 2001; Langacker, 2008). Using these criteria, we can be fairly sure that when a speaker uses a prototypical verb, the analogue representation they are communicating primarily involves action. Likewise, when a speaker uses prototypical adjective, we can be fairly sure that the analogue representation they are communicating primarily involves the perception of physical properties.

Verbs also tend to be used to describe more dynamic concepts than adjectives. For instance, theorists have observed that verbs are not time-stable in that they represent concepts that are temporary and so are liable to change, just as the verb 'singing' is not expected to last forever (Givón, 2001: 141; see also Langacker, 2008: 112). In contrast, adjectives vary with respect to their time-stability; some adjectives are relatively time-stable (e.g., 'blue') whereas others are relatively instable (e.g.,

'happy') (Strik Lievers & Winter, 2018: 7-8). Empirical research on the topic of dynamicity was conducted by Strik Lievers and Winter (2018), who found that there are significantly more verbs in English used to describe sound than nouns or adjectives compared to other sensory modalities. This is pertinent because sound-related concepts are inherently dynamic, usually involving motion unfolding over time; for example, a rock by itself does not make a noise until it is thrown (Strik Lievers & Winter, 2018: 9; see also O'Callaghan, 2009). In addition, sounds are 'temporally composed' (Matthen, 2010: 79-80) in that they comprise multiple pulses that combine in seemingly continuous streams of sound. On a deeper level, sound itself is vibration, which is phenomenologically experienced as movement (e.g., Pasnau, 2000; Matthen, 2010; Kulvicki, 2015).

Previous research has shown that speakers are more likely to gesture when describing motor rather than visual imagery (Feyereisen & Havard, 1999; Hostetter & Alibali, 2007). This may be because motor imagery triggers greater activation in the speaker's mind, which then has a better chance of spreading from premotor to motor areas of their brain and resulting in a gesture. Because verbs are used more often to talk about actions and more dynamic concepts than adjectives, we might speculate that they are more likely to be connected to motor representations than adjectives. Thus, verbs may generally be more active than adjectives. If this is true, linguistic metaphors containing a metaphorical verb (e.g., '<u>lower</u> the standards', '<u>raise</u> the standards') may be more conceptually active than linguistic metaphors containing a metaphorical adjective (e.g., '<u>low</u> standards', '<u>high</u> standards'). According to gesture co-occurrence, then, speakers should be more likely to gesture (vs. not gesturing) when using a metaphorical verb than when using a metaphorical adjective. Speakers should also be more likely to produce gestures that align with the meaning of the

linguistic metaphor they are using when this linguistic metaphor contains a metaphorical verb than when it contains a metaphorical adjective (gestural fit). Finally, speakers should be more likely to produce two-handed (vs. one-handed) gestures when using a metaphorical verb than when using a metaphorical adjective (gestural effort).

5.3. Agency

A speaker might use a metaphorical verb ('lower', 'raise') to talk about an action performed by either themselves (speaker-agent) or someone else (other-agent). This might be reflected in the pronouns the speaker uses. If the verb is speaker-agent, the speaker might use a first-person pronoun such as 'I' or 'we' to indicate that they themselves performed the action. If the verb is other-agent, the speaker might use a second-person pronoun ('you') or a third-person pronoun (e.g., 'she', 'he', 'they') to indicate that someone or something else performed the action. The speaker might also use a proper noun, such as the name of a person or thing, to indicate that the verb is other-agent, and so on.

A speaker's use of speaker-agent or other-agent verbs may reflect or trigger mental simulations where a scene is imagined from a certain perspective (e.g., first-person vs. third-person). Indeed, research has provided evidence for perspective-taking in mental simulations: the so-called 'immersed experiencer' view (Zwaan, 2004). For instance, Yaxley and Zwaan (2007) showed that participants who read sentences such as *Through the fogged goggles, the skier could hardly identify the moose* were subsequently quicker to respond to a blurred image of a moose than a high-resolution image (see also Horton & Rapp, 2003; Borghi et al., 2004). This result suggests that participants imagined the scene described by the sentence from the

perspective of the skier, whose goggles were fogged up and thus made the moose appear blurred. Furthermore, the use of personal pronouns has been shown to trigger perspective-taking in narrative comprehension: for example, Brunyé et al. (2009) found that speakers tended to adopt a first-person perspective in narratives where the pronouns ‘you’ and ‘I’ were used, and a third-person perspective when ‘he’ was used (see also Ditman et al., 2010). Finally, Winter & Bergen (2012) found that participants were quicker to judge whether a pictured object was mentioned in a preceding sentence when the size of the object matched the distance implied by the sentence, with ‘far’ sentences facilitating responses to small objects, and ‘near’ sentences facilitating responses to large objects.

From this, we might predict that if a speaker uses a speaker-agent verb, they will probably imagine performing this verb from a first-person perspective. By definition, imagining one’s own body performing an action involves motor representations, which may be more likely to activate more neural pathways and links between these pathways (e.g., Cameron, 1999; Müller, 2008) than visual representations. Conversely, if a speaker uses an other-agent verb, they may be less likely to imagine performing this action from a first-person perspective. Instead, the speaker might simulate the experience of watching someone or something else performing the action from a third-person perspective, which would primarily involve visual rather than motor imagery (Hostetter & Alibali, 2008: 504). Visual imagery, compared to motor imagery, may result in lower levels of activation. Thus, it is possible that linguistic metaphors containing a speaker-agent verb will be more conceptually active than linguistic metaphors containing an other-agent verb. If so, speakers using a speaker-agent verb should be more likely to gesture (gesture co-occurrence), to gesture in line with the metaphorical meaning of the linguistic metaphor they are using

(gestural fit), and to gesture with both hands (gestural effort) than speakers using an other-agent verb.

5.4. Animacy

Even where the metaphorical verbs ‘lower’ and ‘raise’ are other-agent, there are potential differences in the types of other-agents that are described as performing these verbs. Namely, these other-agents may be either animate or inanimate, and this may affect the conceptual activation of the linguistic metaphors ‘lower the standards’ and ‘raise the standards’. The distinction between animate and inanimate other-agents corresponds to whether or not this other-agent is alive, conscious and capable of acting.

An obvious example of an animate agent would be a human; humans seem to move and act of their own volition, and because of this, it is relatively easy to put oneself in a human’s shoes and imagine performing their actions. In contrast, inanimate actors are sometimes described as being the agent of verbs. For example, a speaker might remark, ‘The book brings postcolonial Hong Kong to life’, where the inanimate object ‘book’ is described as being the agent of the verb ‘brings’. How does one imagine acting from a book’s-eye perspective? The difficulty of doing this may force speakers into taking a third-person perspective on the imagined scene, rather than a first-person one. Crucially, third-person perspective mental imagery or mental simulations are less likely to be motoric and more likely to be visual than their first-person perspective counterparts. As we have seen, motor imagery is likely to cause higher levels of activation than visual imagery. Thus, it is possible that linguistic metaphors containing a verb (‘lower’, ‘raise’) that is described as being performed by an animate other-agent will be more conceptually active than linguistic metaphors

containing a verb that is described as being performed by an inanimate other-agent. If so, speakers talking about an animate other-agent should be more likely to gesture (gesture co-occurrence), to gesture in line with the metaphorical meaning of the linguistic metaphor (gestural fit), and to gesture with both hands (gestural effort) than speakers talking about an inanimate other-agent.

* * *

In this section, I have suggested four factors that may affect the conceptual activation of linguistic metaphors: emotional valence, word class, agency, animacy. This resulted in the following four hypotheses:

1. *Emotional valence (the negativity bias):* are -valence linguistic metaphors more conceptually active than +valence linguistic metaphors?
2. *Word class:* are linguistic metaphors containing metaphorical verbs more conceptually active than linguistic metaphors containing metaphorical adjectives?
3. *Agency:* are linguistic metaphors containing speaker-agent metaphorical verbs more conceptually active than linguistic metaphors containing other-agent metaphorical verbs?
4. *Animacy:* are linguistic metaphors with animate other-agents more conceptually active than linguistic metaphors with inanimate other-agent?

In the next section, I explore one final factor that might affect the quality of speakers' gestures: 'articulatory plurality'. This is a phenomenon that has been

reported in sign languages, and I investigate whether it might also apply to co-speech gestures produced alongside vertical linguistic metaphors of emotional valence.

6. ARTICULATORY PLURALITY

One final issue that can be explored by analysing speakers' gestures is 'articulatory plurality' (Börstell et al., 2016c). This term refers to the use of plural articulators (e.g., more than one hand or finger) in sign languages to depict lexically plural words, such as those referring to groups containing multiple members (e.g., 'army', 'gloves') (e.g., Acquaviva, 2008, 2016; Wisniewski, 2010; Mihatsch, 2016). These plural signs include both-handed signs, and one-handed signs where multiple fingers are used in a meaningful way (e.g., performing a cutting motion with two fingers to depict the lexically plural word 'scissors'). These plural signs are thought to express the conceptual metaphor MORE OF FORM IS MORE OF CONTENT (Lakoff & Johnson, 1980: 127). In this way, articulatory plurality resembles processes used to depict plural concepts in spoken languages, such as reduplication and vowel lengthening (Dingemanse et al., 2015). In empirical investigations of articulatory plurality, researchers have shown that signers generally prefer both-handed signs for lexically plural concepts (Börstell et al., 2016c; Lepic et al., 2016), a trend that holds up for 120,000 sign videos across 31 different sign languages (Östling et al., 2018).[1]

Because sign language and gestures are both produced manually, they share certain characteristics. For instance, the manual modality facilitates imagistic depictions of referents that is more difficult in spoken language, which may influence the production of both signs and gestures towards iconic, visual depictions (Klima & Bellugi, 1979; Taub, 2001; Poggi, 2008; Streeck, 2008). As a result of these similarities, research has begun to bridge the gap between sign languages and co-

[1] Overall, the distribution of one- and both-handed sign types across languages is roughly 50/50 (B rstell et al., 2016; Crasborn & S f r, 2016).

speech gestures by investigating silent gestures produced by hearing non-signers without accompanying speech (e.g., Goldin-Meadow et al., 1996; Padden et al., 2013; Padden et al., 2015). In one such study, Börstell and Lepic (under review) found that silent gesturers tended to favour the use of both-handed signs to represent lexical plurals. This result suggests that, similarly to signers, silent gesturers also adhere to the principle of articulatory plurality; even though silent gesturers do not have a conventionalised inventory of lexical items to draw from, unlike signers. However, silent gestures arguably have more in common with sign languages than co-speech gestures; for instance, silent gesturers can only express meaning manually, whereas co-speech gesturers can also express meaning through language. Therefore, it is not clear whether or not speakers producing co-speech gestures generally adhere to the principle of articulatory economy.

The current study aims to illuminate this issue by comparing one-handed and both-handed co-speech gestures produced by speakers using the linguistic metaphors ‘low standards’, ‘high standards’, ‘lower the standards’ and ‘raise the standards’. A distinction can be made between linguistic metaphors with a singular noun (‘standard’) and linguistic metaphors with a plural noun (‘standards’) (see section 7.2 for variants of the linguistic metaphors included in this study). If speakers are more likely to produce one-handed gestures when they use singular linguistic metaphors, and both-handed gestures when they use plural linguistic metaphors, this would suggest that articulatory plurality extends to co-speech gestures. If no correlation between the number of hands used to gesture and the singular/plural distinction can be observed, this would suggest that articulatory plurality does not extend to co-speech gestures.

* * *

In this section, I have discussed the concept of articulatory plurality reported in sign languages, and I have suggested a method of determining whether this phenomenon extends to co-speech gestures.

Over the next five sections, I describe the main study that is the focus of this paper, discussing how I used the TV News Archive to conduct a large-scale, quantitative analysis of gestures produced by speakers using vertical linguistic metaphors of emotional valence (‘low standards’, ‘high standards’, ‘lower the standards’, ‘raise the standards’). I explain how I used the TV News Archive to assess whether:

1. These linguistic metaphors are conceptually active, and to what degree, using the criteria of gesture co-occurrence, gestural effort and gestural fit
2. Horizontal and sagittal conceptual metaphors of emotional valence, and size-based conceptual metaphors of quantity, are active when speakers use these linguistic metaphors
3. Emotional valence (the negativity bias), word class, agency and animacy affect the conceptual activation of these linguistic metaphors
4. Articulatory plurality extends to gestures produced by speakers when they use these linguistic metaphors

The next section details the methodology used to investigate these questions.

7. METHODOLOGY

In this section, I first justify my choice to use the TV News Archive as the basis of my corpus, and discuss the archive's advantages as well as its limitations. I also explain my chosen sample size. Second, I explain the reasoning behind the search terms used in the study. Third, I detail the coding procedure used for gesture analysis. Finally, I cite the tools used for all statistical analyses and provide information regarding ethical approval.

7.1. Corpus

A corpus of videos was assembled from the TV News Archive (https://archive.org/details/tv), a huge online database curated by the Internet Archive that, at the time of writing, contains over 1.6 million videos recorded between 2009 and 2018. These videos are predominantly from US networks, but also span the BBC, Al Jazeera and other non-US broadcasters. Speakers in the corpus include high-profile political figures such as Barack Obama and Steve King, news presenters such as Megyn Kelly and Laura Ingraham, lesser-known talk show panellists and lay interviewees. These speakers discuss a range of topics, such as women in the military, the law of probable cause and the United States 2016 presidential election.

The TV News Archive is completely open access, which makes it attractive as a means of easily accessing, collecting and sharing data. The size of the archive furthermore allows large amounts of data to be collected, more than would usually be feasible in an experimental setting. Large sample sizes then lend themselves to being quantitatively analysed, an approach relatively underutilised in gesture research up to

this point (e.g., Lanwer, 2017; Zima, 2017a; Hinnell, in preparation), without sacrificing statistical power.

While the TV News Archive does have precedent in gesture research (Winter et al., 2013), in my opinion it is underutilised as a resource. In addition to the reasons previously cited, I believe that the archive can be useful to gesture researchers for two reasons. First, all videos in the archive are closed captioned, which allows researchers to search for specific phrases to see how speakers gesture when they use these phrases. Second, speakers in the archive are presumably unaware that their gestures are being analysed, which means that they should gesture naturally. As a caveat, the fact that most videos in the archive are news broadcasts does introduce a degree of unnaturalness into the data due to the performative nature of the news genre; indeed, some speakers are even likely to have received speech and body language training. Nevertheless, it seems probable that these speakers will be paying more attention to their language than to their gestures, especially because gestures are usually produced unconsciously (e.g., De Ruiter, 2007: 21; McNeill, 1992; Goldin-Meadow et al., 1993; Beattie, 2003), whereas language production tends to be more controlled.

The TV News Archive does have its limitations, however. For instance, despite the generally high accuracy of the archive's closed captioning system, there are instances where it will misinterpret a speaker. As a consequence, searches often return a small number of videos where the relevant phrase does not appear. The archive also contains videos where the speaker is not visible, where their hands are not visible, or where their hands are occupied (e.g., holding an object or engaged in some other task, such as shuffling papers). Inevitably, these videos have to be excluded from the dataset. I have mitigated against this issue of data exclusion in the current study by taking a large enough sample (1600 videos) of videos that the number

of analysable videos should remain large even if reduced by the above factors. Another limitation of the archive is that it does not allow the grammar of a search term to be specified; so, for instance, searching for the phrase ‘lower standards’ returns some results where ‘lower’ is an adjective and others where it is a verb. I have tried to circumvent this issue in the current study by carefully selecting search terms containing words that are usually restricted to a single word class. I explicate this methodological choice and more in the following subsection.

7.2. Search terms

A draft of linguistic metaphors that metaphorically construe emotional valence in terms of vertical space was first compiled and preliminarily explored in the TV News Archive. Candidates included ‘cheer up’, ‘mood lift’, ‘feeling down’, and ‘lowering expectations’. Searches that returned fewer than 400 results were discarded, as it was thought that this was not enough videos for analysis. Moreover, linguistic metaphors that were only infrequently accompanied by gestures were also discarded, because it was thought that it would be difficult to uncover differences in conceptual activation between linguistic metaphors by examining speakers’ gestures if there were hardly any gestures in the dataset to begin with. A high rate of gesture co-occurrence was therefore expected.

The final search terms chosen were ‘low standards’, ‘high standards’, ‘lower the standards’ and ‘raise the standards’. These four terms were selected to include two -valence terms (‘low standards’, ‘lower the standards’) and two +valence terms (‘high standards’, ‘raise the standards’). These terms were also chosen to include two terms where vertical space was encoded in an adjective (‘low standards’, ‘high standards), and two terms where vertical space was encoded in a verb (‘lower the standards’,

‘raise the standards’). For the terms ‘lower the standards’ and ‘raise the standards’, the choice to include the determiner ‘the’ was made to avoid instances where ‘lower’ was used as an adjective rather than a verb (e.g., ‘We don’t want lower standards’). This determiner was also included in ‘raise the standards’ to make this term symmetrical with ‘lower the standards’. With this exception, the search terms differed only in the word used to encode vertical space.

These linguistic metaphors were also chosen to describe a topic that does not necessarily involve the use of two hands. This is important because both-handedness of gesture can only be a measure of gestural effort if the topic itself does not involve the use of both hands. For instance, the verb ‘push’ can be used metaphorically to describe the use of coercion (e.g., ‘She pushed him into applying for the job’). Because the act of pushing tends to involve the use of both hands, this may cause a speaker to produce a both-handed gesture alongside this linguistic metaphor. In contrast, the search terms ‘low standards’, ‘high standards’, ‘lower the standards’ and ‘raise the standards’ do not connote either one-handedness or both-handedness. This removes the potentially confounding factor of topic from analyses of gestural effort here.

Finally, these linguistic metaphors were chosen specifically to be conventional and transparent. They are conventional in that they are not novel, which is attested by the fact that each term occurs a minimum of 1,000 times overall in the TV News Archive. They are transparent in that the metaphorical meanings of the linguistic metaphors are encoded in words that conventionally refer to vertical position (‘low’, ‘high’) and movement through vertical space (‘lower’, ‘raise’). No additional etymological knowledge is needed to understand these metaphorical meanings. Conventionalisation is crucial because it means that each search term will be used by a large number of different speakers, a prerequisite for a large-scale, quantitative

corpus analysis. Transparency is important because opaque linguistic metaphors are extremely unlikely to be conceptually active, which would make any comparison of conceptual activation based on emotional valence, word class, agency or animacy uninstructive.

Using R (R Core Team, 2017), 400 videos per search term were randomly selected from the TV News Archive and exported into a spreadsheet for further analysis. Each video was approximately 1 minute long.

7.3. Coding

The coding scheme was devised with the aim that the procedure should be as objective as possible. While true objectivity is impossible when manually coding data, aiming towards this ideal meant not coding gestures as either iconic/metaphoric or beat gestures in the first instance. This is because the distinction between iconic/metaphoric and beat gestures derives from whether or not a gesture is meaningful, and this decision cannot be arrived at objectively by the coder. While this iconic/metaphoric-beat distinction was not used to code the data, in the general discussion (section 10) I appeal to this distinction to offer tentative explanations for the study's results. To further enhance objectivity, all coding decisions were based on directly observable qualities of the data, such as whether or not the speaker moved their hands upwards, or whether or not their hands were open or closed. For all these decisions there were occasional instances where a movement or hand configuration (etc.) was unclear, and so required discretion to decide between possible interpretations. Such decisions were impossible to avoid, and so were thought to involve an acceptable level of subjectivity. The following is a step-by-step explanation of the coding scheme.

7.3.1. Does the video contain the relevant linguistic metaphor?

It was first coded whether or not each video contained the relevant linguistic metaphor ('low standards', 'high standards', 'lower the standards', 'raise the standards'). Videos that did not were excluded from further analyses. Search crawls for all linguistic metaphors included both singular and plural versions of the noun 'standard/s'. Search crawls for 'lower the standards' and 'raise the standards' also included the variants 'lowers/raises', 'lowering/raising' and 'lowered/raised'. The noun in each linguistic metaphor was allowed to be modified by a single word (e.g., 'raising the education standards'). There were instances in the dataset where the linguistic metaphors 'low standards' or 'high standards' appeared but not as part of a noun phrase; for instance, if a speaker questioned 'how low standards will fall'. These videos were deemed not to contain the relevant linguistic metaphor. Videos where a verb could be construed as functioning as a gerund (e.g., 'The idea of lowering the standard'), which according to distributional criteria would be classified as a noun, were treated as verbs, the reason being that these gerunds still encode action-oriented information. This followed from the study's adoption of a semantic approach to categorising parts of speech (see section 2.5.1).

7.3.2. Is the speaker visible?

Of the videos that did contain the relevant linguistic metaphor, it was coded whether the speaker who uttered the linguistic metaphor was visible or not. Videos where the speaker was not visible were excluded from further analyses. If more than one speaker in the video uttered the linguistic metaphor, the first speaker's utterance was analysed. Moreover, if the relevant speaker used the linguistic metaphor more than once, their first use was analysed. Instances where the speaker was onscreen but their face was

not visible were excluded, due to this situation most commonly arising when the speaker was far away or facing away from the camera, making it difficult to discern their gestures. For the sake of having operational criteria for making decisions about borderline examples, speakers were coded as being visible if their nose, mouth and at least one eye were onscreen for the entirety of the linguistic metaphor. Videos whose audio and visual elements were significantly out of sync, or where the speaker's speech was translated into English via voiceover, were excluded.

7.3.3. Are the speaker's hands visible?

The remaining videos were then coded for whether the speaker's hands were visible, both or individually. Coding here initially used strict criteria where, if the speaker's hands were obscured at all during the relevant linguistic metaphor, their hands were coded as not being visible. This was to avoid any gestures being ambiguous, which would introduce more subjectivity into further analyses of these gestures.

However, a problem here was that overlaid screen graphics (e.g., displaying a speaker's name) are commonly used in news broadcasts, and speakers in these broadcasts are often only shown from the shoulders up. Because of this, speakers' hands were not visible for the entirety of the relevant linguistic metaphor in many videos, leading to the exclusion of a large portion of the dataset. As a consequence of this, generous criteria were introduced where speakers' hands were coded as being visible if they were visible enough to discern the speaker's gestures during the relevant linguistic metaphor. This is ultimately the criteria that was used in the final analyses to avoid excluding any more data than was necessary from the corpus.

7.3.4. Are the speaker's hands free to gesture?

Videos where the speaker's hands were visible were then coded for whether or not their hands were free to gesture during their use of the relevant linguistic metaphor. If the speaker's hands were holding an object that restricted gesture movement, such as a microphone or a book, their hands were coded as not being free. Smaller, less restrictive items such as pens were allowed. If the speaker's arms were crossed, or their hands clasped, again their hands were coded as not being free. The speaker's hands were also coded as not being free if they were engaged in some other task (e.g., shuffling papers).

There were some instances where a speaker's hands were initially occupied, but where they freed their hands to gesture later on in the video. This freeing of the hands would seem to indicate a strong compulsion to gesture, which would cause the speaker to stop what they are doing and/or set down the object they were holding. This compulsion to gesture could perhaps be correlated with high levels of conceptual activation. However, freeing of the hands can only be an indicator of conceptual activation where it is deliberate; alternatively, the speaker might have simply finished the task they were using their hands for, or they might have finished with the object they were holding. Deliberateness is impossible to determine objectively, so this question was avoided in the current study.

Furthermore, the speaker's hands were initially coded as not being free if they were in a position where, although technically free, it was thought that increased conceptual activation would be required to surpass the speaker's gesture threshold (see Hostetter & Alibali, 2007). In other words, although these speakers could theoretically still gesture, they might be less likely to because their hands were in a position where gesturing would take more effort than usual. Examples of this would

be if the speaker's hands were placed flat on a table or gripping the edge of a podium. Generous scoring criteria categorising these examples as free were later introduced, which were given preference in the final analyses to avoid unnecessarily excluding videos from the dataset. This was important given the large number of videos that had to be excluded based on the study's coding criteria (see section 8).

7.3.5. Negation and plurality

All videos were then coded for whether or not the relevant linguistic metaphor they contained was negated (e.g., 'there is not a high standard', or 'we are not raising the standards'). Videos were coded as being negated only if the relevant linguistic metaphor was explicitly negated with the adverb 'not'. For linguistic metaphors containing a metaphorical verb, instances where the preceding verb in the verb phrase was negated rather than the relevant linguistic metaphor itself (e.g., 'We are not trying to lower the standards') were not coded as being negated. Negated linguistic metaphors were excluded from the final analyses because, for instance, a speaker using negation to deny the existence of a 'low standard' may not be thinking about a 'low standard' at all.

It was then determined whether speakers used the singular noun 'standard', or the plural noun 'standards'. This was important for the purpose of investigating articulatory plurality.

7.3.6. What is the speaker's name?

For those videos that were analysable from a gesture perspective, speakers' names were recorded. This information was either provided in the video itself or was obtained via the internet, although in some instances speakers could not be identified. Having

this information made it possible to run additional analyses to control for speakers who appeared in multiple videos (see section 8.3 for qualitative examples). This also meant that duplicated videos in the dataset could be more easily identified and excluded. Only the first video of a duplicated series in the dataset was included in the final analyses.

7.3.7. Does the speaker gesture?

Next, it was coded whether the speaker's hands (either or both) were moving at the same time as uttering the relevant linguistic metaphor. The main criterion here was that the stroke of the gesture had to coincide with the relevant linguistic metaphor being uttered. Instances where the only movement was the speaker's hands returning to rest position after gesturing or performing some other task (e.g., shuffling papers) were coded as not moving.

For videos where there was no movement, it was coded whether or not the speaker gestured at all elsewhere in the video. This was to gauge whether or not the speaker was prone to gesturing generally; if not, their lack of gesturing during the relevant linguistic metaphor might say less about the conceptual activation of the linguistic metaphor itself and more about the speaker's individual propensity to gesture. Based on Hostetter and Alibali's (2008) GSA framework, it might suggest that the speaker simply has an unusually high gesture threshold and thus constitutes an outlier in the dataset. Videos where the speaker did not gesture at all over the course of the video were not included in the final analyses (see section 8). In addition, note that this stage of coding concerned the movement of hands visible at the time of the relevant linguistic metaphor being uttered only; if a speaker's hand became visible at some other point in the video, this hand was discounted from analysis.

7.3.8. What kind of gesture?

For videos where the speaker's hands were moving, it was coded which hand (or both) was moving. The configuration of this gesturing hand was then coded. This referred to whether the gesturing hand was held open and flat, or closed, with the speaker's fingers curled towards their palm. Pointing gestures, where the speaker's index finger was extended but all other fingers were curled in towards their palm, were coded as closed. A new category of hand configuration was also introduced for gestures midway between open and closed configurations, where the speaker's fingers were bent perpendicularly to their palm (see section 8.1 for qualitative examples). This category was introduced based on the frequent occurrence of this type of gesture in the corpus. For open and perpendicular configurations, it was coded whether the speaker's palm was facing upwards, downwards, inwards (towards the centre of their body), backwards (towards their body) or frontwards (away from their body). Following this, gestural movements along the vertical, horizontal and sagittal axes were coded. This included sequential movements along the same axis or different axes, as well as the use of different axes simultaneously (e.g., diagonally-moving gestures) (see Walker & Cooperrider, 2016).

7.4. Analysis

All data was analysed with statistical programming software R, version 3.4.3. (R Core Team, 2017), within the integrated development environment RStudio, version 1.1.423. (RStudio Team, 2016). The packages 'tidyverse', version 1.2.1 (Wickham, 2017), and 'tidyr', version 0.8.1 (Wickham & Henry, 2018), were used for data processing and visualisation. The packages 'lme4' (Bates et al., 2015) and 'effects' (Fox, 2003; Fox & Hong, 2009) were used respectively for fitting and plotting logistic

regression models. The package ‘dplyr’, version 0.7.5 (Wickham et al., 2018), was used for writing for loops. ‘Publish’, version 2018.04.17 (Gerds & Ozenne, 2018), was used for creating 2x2 contingency tables with manually-inputted values. Finally, ‘lsr’, version 0.5 (Navarro, 2015), was used for calculating Cram r’s *V* (effect-size test used in section 5.1).

All analysis and code are made available under the following Open Science Framework repository: https://osf.io/3mpc7/

7.5. Ethics

This study was approved by the University of Birmingham (ERN_18-1199) and was conducted in accordance with their guidelines.

* * *

In this section, I have explained the methodology used to investigate the main research questions in this paper, which were summarised at the end of section 6. Over the next two sections, I take a look at the corpus data itself, first qualitatively (section 8) and then quantitatively (section 9). Although the quantitative results are the focus of this paper, a preliminary qualitative exploration of videos in the corpus should be useful to give the reader an overview of the data analysed quantitatively in section 9

.

8. QUALITATIVE EXPLORATION OF THE DATA

In this section, I give an exposition of the types of gestures in the dataset. This is done to contextualise the quantitative results discussed in section 9 and make the different coding decisions discussed in section 7 clearer and less abstract. I also take this opportunity to highlight elements of the data that are not discussed quantitatively in this paper, but which may be worthy of further quantitative research. I present three examples of gestures accompanying each linguistic metaphor ('low standards', 'high standards', 'lower the standards', 'raise the standards') and interpret these gestures qualitatively, making suggestions as to their possible metaphorical meanings. I also highlight methodological issues that arose when analysing these videos quantitatively, which I hope will give some insight into the process of working with the TV News Archive.

I present these qualitative examples in the form of annotated screenshots which depict the salient elements of each gesture. These annotations are already partial, subjective interpretations of the data in that they constrain which parts of the gesture are shown and make a judgment about the main direction of the gesture (etc.) (see Cienki & Müller, 2008: 496-7). For this reason, I encourage the reader to watch the videos themselves, which are available under the following Open Science Repository: https://osf.io/3mpc7/.

Before I do this, however, it is worth addressing corpus size, which is an important point to consider for any researchers hoping to work with the TV News Archive in the future. As mentioned already, the total corpus size chosen was 1600 videos, a large sample selected based on my past experience with the archive, which predicted that a large proportion of these videos would have to be excluded on the basis of, for instance, the relevant linguistic metaphor not appearing, or the speaker

who uttered the linguistic metaphor not being visible. As Figure 1 demonstrates, once all the relevant exclusion criteria are applied, we are left with a much smaller sample: 387 videos, just below a quarter of what we started with.

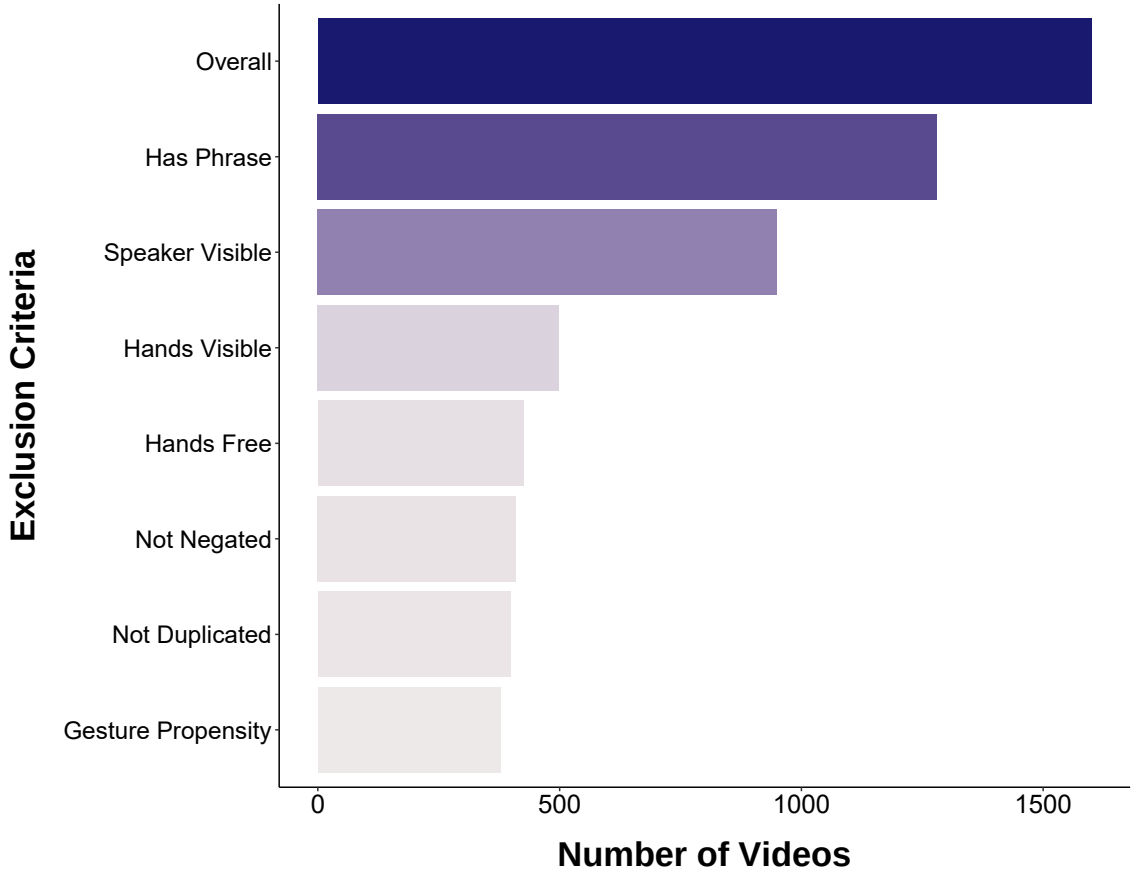

Figure 1: Number of videos at each level of coding process based on study's exclusion criteria; total corpus size was 1600, but total number of analysable videos was 387; Gesture Propensity refers to whether or not the speaker gestured at all over course of video

I now discuss the qualitative examples from this 387-video sample, beginning with 'low standards'. In each of the figures below, bold italics indicate speech co-occurring with the stroke of the depicted gesture.

8.1. ‘Low standards’

In Figure 2, we see Fox News legal analyst Lis Wiehl gesturing downwards with her right hand as she says “very low standard”. The stroke of Wiehl’s gesture begins roughly at chin-level and ends in line with her chest. This downwards movement could interpreted as representing the “low standard” mentioned in her speech as moving downwards through space. Wiehl’s fingers are bent perpendicularly to her palm throughout this downwards movement, extending horizontally outwards as if depicting the abstract “standard” as a flat level or surface. As previously mentioned, this perpendicular hand configuration was introduced as a new category of analysis due to its frequent occurrence in the data. Wiehl’s gesture also partly coincides with the intensifying adverb “very”, which precedes the linguistic metaphor “low standards”. This intensifier serves to increase the degree of ‘lowness’ expressed by this linguistic metaphor (e.g., König, 1991; Méndez-Naya, 2008), which may increase the likelihood of this linguistic metaphor being conceptually active. Whether or not intensifiers affect conceptual activation is a question for future research.

Figure 2: Lis Wiehl gesturing while saying, “It’s a ***very low standard***, Greg, as you know”.

Figure 3 sees former US president Barack Obama use a similar perpendicular gesture to Lis Wiehl while saying “rather than a low standard”. Unlike Wiehl, who uses her right hand to gesture, Obama uses his left hand. Obama’s gesture begins at nose-level and descends to a position in line with his chest. The key difference between Wiehl and Obama in these examples is that, unlike Wiehl, Obama expresses a contrast between the linguistic metaphors “high standards” and “low standards” in his speech. This contrast is also reflected in Obama’s gestures, with his left hand first occupying a relatively high position in vertical space to represent the “high standard”, before moving downwards to a lower position to represent the “low standard”. There is also a clear sagittal, frontwards-moving movement towards the end of this gesture, which seems to depict the “standard” as a flat, physical level. Alternatively, this combined vertical-sagittal movement could be said to align with both BAD IS DOWN and BAD IS FAR conceptual metaphors, which could point to a conceptual co-activation of the vertical and sagittal axes (see Walker & Cooperrider, 2016). Moreover, Müller (2008: 202-3) claims that the verbal elaboration of a linguistic metaphor, as evidenced in the contrast between “low standards” and “high standard” in this example, can be seen as an indicator of conceptual activation. The deliberate contrasting of opposite concepts, such as “low” and “high”, is also argued by Hostetter and Alibali to predict a high gesture co-occurrence rate relative to non-contrasted examples (2008: 504-5; see also McNeill, 2005).

Figure 3: Barack Obama gesturing while saying, “It’s at a high standard ***rather than a low standard****”*.

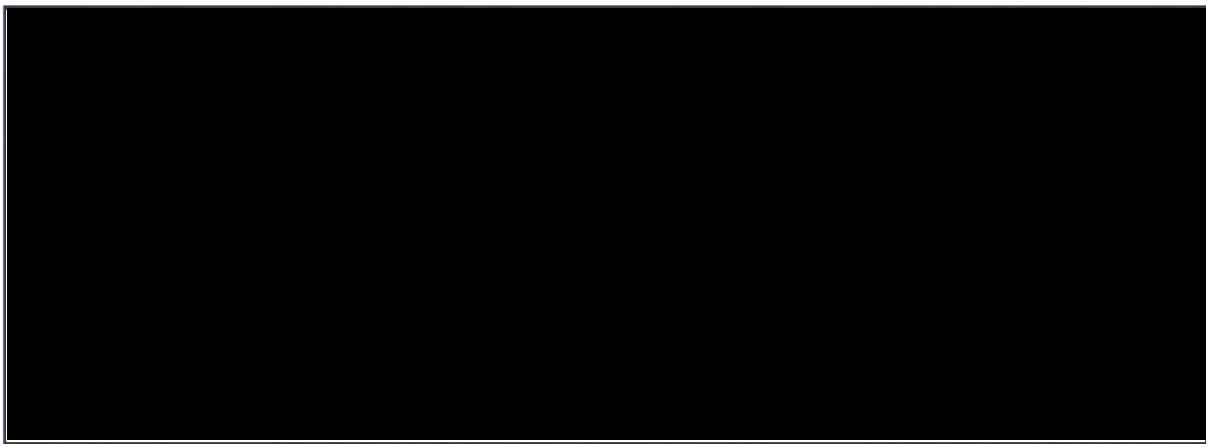

Figure 4: Barack Obama gesturing while saying, “In others, they’re ***pretty low standards****”*.

Another example from Barack Obama is shown in Figure 4, where he gestures while saying “pretty low standards”. Unlike Figure 3, there is no explicit reference here to a “high standard” to contrast with “low standards”, but Obama nevertheless seems to express this comparison through his gestures. He does this by using a similar perpendicular hand configuration to that which we have seen in Figures 2 and 3, positioning his left hand relatively high in vertical space (nose-level), and his right hand lower (chest-level). Here, Obama’s left hand seems to represent the unspoken ‘high standard’, while his right hand seems to represent the “low standards” expressed in his speech. When Obama actually utters the linguistic metaphor “low standards”, he

oscillates his right hand up and down to increase the salience of this part of his gesture. It should furthermore be noted here that, because in this example Obama's left hand is actually static when he uses the linguistic metaphor "low standards", only his right-hand movement was coded as a gesture.

8.2. 'High standards'

Figure 5 shows a gesture performed by Stephen Kinzer, former foreign correspondent at the New York Times. In this example, Kinzer gestures upwards from chest-level to eye-level with both his hands, his fingers bent perpendicularly to his palm. This perpendicular hand configuration strongly resembles the hand configuration of the gestures we saw performed by Lis Wiehl and Barack Obama in Figures 2-4. The upwards movement of Kinzer's gesture could be interpreted as depicting the "high" vertical position referenced in his speech. In this example, Kinzer actually gestures while saying "maintained Britain", and does not move his hands while using the linguistic metaphor "high standard" itself. Hence, although subjectively it may seem clear that Kinzer's prior gesture is connected semantically to the linguistic metaphor "high standards", the fact that this linguistic metaphor and the aforementioned gesture did not co-occur meant that this instance was not coded as a gesture. This type of coding decision may have been especially problematic for the metaphorical adjectives in the dataset ('low standards', 'high standards'), because these linguistic metaphors do not explicitly encode movement, only vertical position. I discuss this issue in more detail in section 10.2.2.

Figure 5: Stephen Kinzer gesturing while saying, “It was that oil that ***maintained Britain*** at a high standard of living”.

In Figure 6, we see another perpendicular gesture, this time performed by Jack Lew, who was United States Secretary of the Treasury at the time of this video’s recording. Lew performs this perpendicular gesture with his right hand while using the linguistic metaphor “high standards”. The movement of Lew’s gesture is relatively subtle, his hands rising only slightly from torso-level to chest-level. I have suggested already that the extent to which the gesturing hands move can arguably be seen as an indicator of gestural effort. If so, Lew’s gesture here could be seen as less effortful, and therefore point towards a lower level of conceptual activation, than the gestures we have seen so far in Figures 2-5. The extent of gestural movement, however, is much more difficult to quantify objectively than the number of hands used to gesture (one vs. both), which was the sole criterion used to measure gestural effort in the present study. On a methodological note, there is an overlaid screen graphic in this example which partly obscures Lew’s gesture, but the movement direction and hand configuration of this gesture is arguably still clear enough to analyse without sacrificing objectivity. It is for this reason that I made the choice to employ generous scoring criteria when coding whether speakers’ hands were visible or not. To use stricter criteria would mean unnecessarily excluding many videos containing slightly obscured

yet sufficiently clear gestures, further restricting the study's already-reduced sample size and therefore its statistical power.

Figure 6: Jack Lew gesturing while saying, "To raise the quality of trade agreements, and to have ***high standards***".

Figure 7: Megyn Kelly gesturing while saying, "We need a ***very high*** standard for commitment".

Figure 7 sees perhaps the most animated gesture yet, with then-Fox News presenter Megyn Kelly producing an upwards-moving, right-handed, perpendicular gesture. In this gesture, Kelly's hand travels from around the level of her chest to the

top of her head. This gesture mostly coincides with the intensifying adverb “very” contained in Kelly’s speech but continues into the metaphorical adjective “high”. Because “high” is part of the linguistic metaphor “high standards”, this example was coded as containing a gesture. As speculated in regard to Figure 2, the intensifier “very” used here could be seen as an indicator of conceptual activation. Moreover, it is intriguing to note that Kelly lengthens the /ɛ/ vowel in “very” /vɛrɪ/, and that this vowel lengthening roughly matches up with the duration of her gesture, the manual and vocal modalities here seeming to express meaning in combination with each other. In future studies it may be interesting to also investigate vocal gestures (e.g., Perlman, 2010; Perlman et al., 2001; Perlman & Cain, 2014) to see whether they can also reveal anything about conceptual activation. In particular, perhaps the greater the activation of a conceptual metaphor, the more likely it is that this conceptual metaphor will be expressed through different modalities simultaneously. Kelly goes on to say that the standard “used to be lower”, at which point she uses the same gesture as for “high standards” in most respects, except this time she moves her hand downwards from above her head to the top of her chest. As mentioned in relation to Figure 3, a contrast of opposites or near-opposites such as this (“high” vs. “lower”) can be another factor contributing to conceptual activation.

8.3. ‘Lower the standards’

For ‘lower the standards’, I present three gestures from US politician Steve King, who, as we will see, gestures slightly differently each time he uses this linguistic metaphor. I do so to demonstrate the potential variation in gesture production across contexts, even for a single speaker, despite the fact that many different speakers in the dataset produced similar gestures (e.g., Lis Wiehl in Figure 2 and Barack Obama in Figure 3).

To foreshadow some of the quantitative analyses I conduct in section 9, the fact that speakers such as King appear in the dataset multiple times and thus contribute more than one data point is problematic because it violates the independence assumption of inferential statistical tests. I address this problem by re-analysing parts of the quantitative data in section 9.4.

The first example in Figure 8 shows King gesturing downwards from chest-level to torso-level with his right hand while saying “lowers the standard”. During this gesture, King’s right hand is held open with his palm facing downwards. The downwards movement of King’s gesture here appears to enact the action of lowering an abstract “standard”, which may be conceptualised as a flat physical level or surface that can be pushed downwards. Intriguingly, in this example King does not describe himself as being the agent of the metaphorical verb “lowers”; rather, this agent position is filled by a non-specific “it”. Thus, here King appears to gesture from the perspective of this “it”. While it is not entirely clear from the video itself, when considering context, this “it” appears to be a bill passed in the senate, which is clearly not an animate actor. This is relevant because it shows that King is happy to take the perspective of an inanimate agent, despite inanimate agents obviously being incapable of actually performing actions.

Figure 8: Steve King gesturing while saying, “It ***lowers the standard*** to the point where fraud is anticipated”.

We can see a similar gesture in Figure 9, except this time King uses two hands instead of just one, while saying “lower the standards”. Although this is anecdotal, it is possible that King gestures with two hands here in response to the plurality of the noun “standards”, which may hint at a conceptualisation of multiple physical levels (“standards”) rather than just one (“standard”). This interpretation coincides with the concept of articulatory plurality. A potential ambiguity with this gesture is that before King utters the linguistic metaphor “lower the standards”, he uses the verb “pushing”, which is accompanied by a similar gesture to that which accompanies the linguistic metaphor itself. Therefore, it is possible that King’s gesture during the linguistic metaphor is merely a continuation of this “pushing” gesture, rather than representing his metaphorical conceptualisation of “lower the standards”. It is impossible to separate these possibilities without allowing a significant degree of subjectivity to enter the coding process, so only the speaker’s gestures during the relevant linguistic metaphor itself were considered here.

Figure 9: Steve King gesturing while saying “Pushing to ***lower the standards*** for Fannie and Freddie”.

Figure 10: Steve King gesturing while saying, “Pass legislation to ***lower the standards*** of Fannie Mae and Freddie Mac”.

The third and final example from Steve King can be seen in Figure 10. This particular example is clearly different from the others because, rather than using a perpendicular hand configuration, King uses a pointing gesture, while saying “lower

the standards". As noted previously, pointing gestures were coded as having a closed hand configuration, so long as only the speaker's index finger was extended, which is the case in this example. This gesture involves King moving his hand downwards from shoulder-level to chest-level. This example is potentially problematic for analysing gestural fit because, although the downwards movement of King's gesture appears to align with the meaning of the metaphorical verb "lower", this gesture could arguably be analysed as a meaningless beat gesture on account of beat gestures commonly having a downwards movement component (e.g., McNeill, 1992). This suggests that some downwards-moving beat gestures in the dataset might be erroneously coded as 'fitting' the meaning of the linguistic metaphors 'low standards' and 'lower the standards', despite carrying no real meaning component. I explore this point further in section 10.2.2.

8.4. 'Raise the standards'

In Figure 11, Antony Blinken, who was United States Deputy Secretary of State at the time of this video's recording, gestures with an upwards movement from the bottom to the top of his chest with his left hand while saying "raise the standards". He does this using an open hand configuration. What is interesting about this example is that Blinken uses a similar gesture multiple times prior to his use of the "raise the standards" metaphor, as if the GOOD IS UP conceptual metaphor is already active in his mind before he expresses it linguistically. This relates to McNeill's (2005) notion of 'catchment', where separate gestures produced by a speaker are similar in terms of two or more features. McNeill argues that catchment is the outwards manifestation of recurrent mental imagery, which in this case seems to be metaphoric. Alternatively, it could be argued that the recurrence of this same gesture in line with seemingly

unrelated words such as “tried” means that it is probably a beat gesture with no real meaning component. However, because beat gestures usually also contain a downwards movement (McNeill, 1992; Wang & Chu, 2013), this interpretation seems unlikely. This example illustrates the difficulty of categorising gestures into iconic/metaphoric or beat categories, which the current study aimed to circumvent by coding the form of gestures only and not making any interpretations of meaning.

Figure 11: Antony Blinken gesturing while saying, “We have tried throughout to ***raise the standards*** of these institutions”.

Next, in Figure 12 we see former Fox News presenter Bill O’Reilly gesturing upwards with his right hand from torso-level to chin-level with an open hand configuration while saying “raise the standard”. Similarly to Megyn Kelly in Figure 7, O’Reilly lengthens the diphthong /ɛɪ/ in the word “raise” /rɛɪz/, and the duration of this diphthong roughly matches the duration of his gesture stroke. Furthermore, O’Reilly’s gesture contains a greater extent of movement than Antony Blinken’s in Figure 11, which may be an indicator of conceptual activation. Altogether, these observations tentatively suggest that greater extent of gestural movement and the presence of

metaphoricity across multiple modalities may both point towards increased conceptual activation. In addition to this, similarly to Steve King in Figure 8, O'Reilly is not the agent of the verb "raise" in this example; rather, through his gestures O'Reilly appears to take the perspective of the other-agent "they" mentioned in his speech. Therefore, Figures 8 and 12 both suggest that agency has no effect on gesture production, although only a quantitative analysis can decisively answer this question (see section 9.1).

Figure 12: Bill O'Reilly gesturing while saying, "And they wanna ***raise the standard*** of living of the poor".

Figure 13: Michael Froman gesturing while saying, "What we're trying to do through TPP is to ***raise the overall standards***".

In Figure 13 we see something a bit different. In this example, US lawyer and former US trade representative Michael Froman gestures sagittally away from his body using his right hand while saying “raise the overall standards”. His left hand is static and so was not coded as gesturing, but this hand seems to play a role in representing the existing “standards” that Froman and his colleagues are trying to metaphorically ‘move away from’ (i.e., improve upon) with the Trans-Pacific Partnership (TPP). As with Barack Obama’s gesture in Figure 3, it is possible that this sagittal movement reflects Froman’s sagittal conceptualisation of emotional valence. However, if this were so, we would actually expect Froman to gesture towards, rather than away from, his body, due to the +valence of the linguistic metaphor “raise the standards” and the GOOD IS NEAR conceptual metaphor. An alternative interpretation, therefore, is that Froman is mentally superimposing a vertical axis onto the sagittal axis of the table in front of him, where nearer his body corresponds to DOWN, and further away corresponds to UP. In support of this interpretation, Tversky (2011: 506) speaks of the powerful nature of vertical-to-sagittal mappings in relation to paper (e.g., when looking at maps), where the sagittal space of the page is perceived to represent the vertical axis (see also Winter et al., 2015). This interpretation makes theoretical sense if we consider the upwards verticality of the linguistic metaphor “raise the standards”.

* * *

In this section, I have looked at a small selection of videos in my dataset that depict speakers gesturing while using the linguistic metaphors ‘low standards’, ‘high

standards', 'lower the standards' and 'raise the standards'. With the data now contextualised, in the next section I discuss the quantitative results from the study based on the final 387-video dataset.

9. QUANTITATIVE RESULTS

In this section, I use gesture co-occurrence (section 9.1.1), gestural fit (section 9.1.2) and gestural effort (section 9.1.3) to assess whether the four linguistic metaphors investigated in the current study ('low standards', 'high standards', 'lower the standards', 'raise the standards') are conceptually active, and to what degree. I also assess whether emotional valence, word class, agency and animacy affect the conceptual activation of these linguistic metaphors. In section 8.2, I then examine metaphorical mappings of emotional valence other than the vertical GOOD IS UP and BAD IS DOWN metaphors expressed linguistically (horizontal, sagittal). I also assess whether size-based metaphorical mappings of quantity are active in the minds of speakers who use these linguistic metaphors. In section 9.3, I investigate whether or not articulatory plurality, a widely-reported feature of sign languages, extends to gestures. Finally, in section 9.4 I re-analyse parts of the data to account for the fact that the independence assumption of the inferential statistical tests used in this section was violated by individual speakers contributing multiple data points.

9.1. Conceptual activation

To assess the conceptual activation of the four linguistic metaphors in the dataset ('low standards', 'high standards', 'lower the standards', 'raise the standards'), I use the criteria developed in this paper: gesture co-occurrence, gestural fit and gestural effort. I report the results for each of these tests overall across the four linguistic metaphors. I then perform simple binomial tests on the results of these tests to see whether, for instance, there are more instances of speakers gesturing than not gesturing than would be expected by chance alone.

I then use gesture co-occurrence, gestural fit, gestural effort to assess the four factors that might affect the conceptual activation of a linguistic metaphor (emotional valence, word class, agency and animacy). Because all values in the dataset were categorical and binary, I used logistic regression to model this data. The three tests of conceptual activation were included as dependent variables. The potential factors affecting the conceptual activation of linguistic metaphors were included as independent variables, which were treatment-coded. Treatment coding assigns 0 to one value and 1 to the other. This coding scheme was appropriate since I did not predict an interaction between any of these independent variables.

In the first logistic regression model, emotional valence (-valence vs. +valence) and word class (verb vs. adjective) were included as independent variables to model the effects of these variables separately. Agency and animacy were not included in this model because these two variables only applied to linguistic metaphors containing metaphorical verbs (‘lower the standards’, ‘raise the standards’). Including agency and animacy in the same model as emotional valence and word class would therefore have meant excluding all linguistic metaphors in the dataset that contained metaphorical adjectives (‘low standards’, ‘high standards’). For emotional valence, the value ‘-valence’ was treatment-coded as 0, and the value ‘+valence’ was treatment-coded as 1. For word class, the value ‘adjective’ was treatment-coded as 0, and the value ‘verb’ was treatment-coded as 1.

Next, two logistic regression models were fitted including the independent variables agency and animacy respectively. Agency and animacy were not included in the same model as each other because each variable contained different numbers of data points. This meant that entire rows of the data frame containing missing data points for either agency or animacy would have been ignored by a model containing

both variables. Consequently, agency and animacy were included in separate models to avoid excluding any more data than necessary from each analysis. For agency, the value ‘other-agent’ was treatment-coded as 0, and the value ‘speaker-agent’ was treatment-coded as 1. For animacy, the value ‘inanimate’ was treatment-coded as 0, and the value ‘animate’ was treatment-coded as 1. Videos where the animacy status (animate vs. inanimate) of an agent was unclear were excluded from all analyses of animacy.

9.1.1. Gesture co-occurrence

One way of quantifying the conceptual activation of a linguistic metaphor is by looking at gesture co-occurrence: how often the linguistic metaphor is accompanied by any type of gesture.

Figure 14 shows the level of gesture co-occurrence (gesture vs. no gesture) across the four linguistic metaphors in the dataset. As we can see, there was a general tendency for speakers to gesture rather than not across all four linguistic metaphors, with 85.3% (N = 330) of videos overall containing gestures, compared to 14.7% (N = 57) that did not. A binomial test indicates that these figures are unexpected under the assumption that either outcome (gesture vs. no gesture) is equally likely due to chance ($p < 0.001$). It must be remembered, however, that the linguistic metaphors in the dataset were chosen because speakers tended to gesture when using them, so this result is fairly unsurprising. Nevertheless, it is remarkable just how high this gesture co-occurrence rate is.

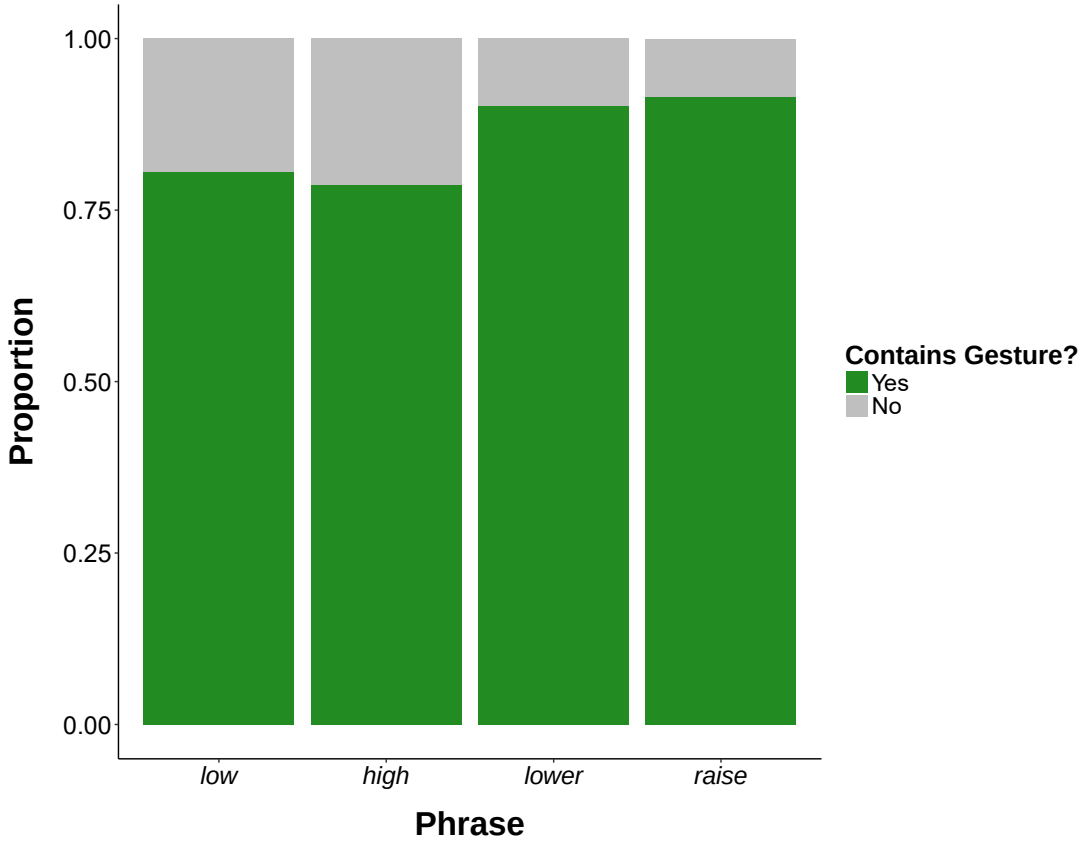

Figure 14: Proportion of videos per linguistic metaphor (low standards, high standards, lower the standards, raise the standards) containing gestures versus no gestures

9.1.1.1. Emotional valence and word class

For gesture co-occurrence, my first hypothesis was that -valence linguistic metaphors ('low standards', 'lower the standards') would have a higher rate of gesture co-occurrence than +valence linguistic metaphors ('high standards', 'raise the standards'). Descriptively, the data show a slight trend in the direction of this hypothesis: 85.6% (*N* = 184) of -valence videos contained gestures, whereas 14.4% (*N* = 31) did not. In comparison, 84.9% (*N* = 146) of +valence linguistic metaphors contained gestures, whereas 15.1% (*N* = 26) did not.

My second hypothesis was that linguistic metaphors containing a metaphorical verb ('lower the standards', 'raise the standards') would have a higher rate of gesture co-occurrence than linguistic metaphors containing a metaphorical adjective ('low standards', 'high standards'). The data suggest that this prediction may be correct: 90.8% (*N* = 177) of verb-containing videos contained gestures, whereas 9.2% (*N* = 18) did not. In contrast, 79.7% (*N* = 153) of adjective-containing videos contained gestures, whereas 20.3% (*N* = 39) did not.

A logistic regression model containing emotional valence and word class as independent variables reveals a reliable effect of word class (log odds: 0.92, *SE* = 0.31, *z*-score = 3, *p* = 0.0027), but not of emotional valence (log odds: -0.022, *SE* = 0.29, *z*-score = -0.076, *p* = 0.94). This indicates that speakers were reliably more likely to gesture when using metaphorical verbs than when using metaphorical adjectives, but there was no evidence to suggest that emotional valence affects the likelihood of a speaker gesturing.

9.1.1.2. Agency

Were speakers more likely to gesture alongside speaker-agent linguistic metaphors (e.g., "We have lowered the standards") than other-agent linguistic metaphors (e.g., "This bill raises the standard"). Superficially, the data suggest so, with 91.2% (*N* = 52) of speaker-agent videos containing gestures, compared to 8.8% (*N* = 5) that did not. In contrast, 90.6% (*N* = 125) of other-agent videos contained gestures, compared to 9.4% (*N* = 13) that did not. Despite these descriptive differences, a logistic regression model reveals no reliable effect of agency on gesture co-occurrence (log odds: 0.078, *SE* = 0.55, *z*-score = 0.14, *p* = 0.89). Therefore, the data do not suggest that agency affects the likelihood of a speaker gesturing.

9.1.1.3. Animacy

Were speakers more likely to gesture when referring to an animate other-agent than when referring to an inanimate other-agent? The data actually show a superficial trend in the opposite direction: 92.5% (*N* = 49) of videos referring to an animate other-agent contained gestures, whereas 7.5% (*N* = 4) did not. In comparison, 93.9% (*N* = 46) of videos referring to an inanimate other-agent contained gestures, whereas 6.1% (*N* = 3) did not. However, a logistic regression model reveals no reliable effect of animacy on gesture co-occurrence (log odds: -0.22, *SE* = 0.79, *z*-score = -0.28, *p* = 0.77). This indicates that animacy does not affect the likelihood of a speaker gesturing.

9.1.2. Gestural fit

Conceptual activation can also be assessed by examining gestural fit, which corresponds to whether or not a gesture aligns with the metaphorical meaning of the linguistic metaphor it accompanies. Gestural fit can be operationalised in the current study by looking at vertical gestural movement, the reason being that all four linguistic metaphors in the dataset encode some kind of verticality: ‘low standards’ and ‘high standards’ imply low and high spatial positions respectively, and ‘lower the standards’ and ‘raise the standards’ imply downwards and upwards movement respectively. Therefore, we can look at whether or not speakers gesture downwards when uttering ‘low’ and ‘lower’ linguistic metaphors, and upwards when uttering ‘high’ and ‘raise’ linguistic metaphors. I will call these instances ‘matching’ cases, distinct from ‘mismatching’ cases. Mismatching cases include gestures with mismatching vertical

movements, as well as those without any vertical movement at all.[2] To avoid confusing gestural fit with gesture co-occurrence, videos without gestures were excluded from the following analyses.

Figure 15 shows the level of gestural fit (matching vs. mismatching) across the four linguistic metaphors in the dataset. We can see from this that there was a general tendency for speakers to produce matching rather than mismatching gestures: overall, 61.5% (N = 203) of gestures were matching, and 38.5 (N = 127) were mismatching. A binomial test indicates that these results were unexpected under the null hypothesis of equal proportions ($p < 0.001$). However, this trend was reversed for 'high standards'.

[2] It is unclear whether these two types of mismatching gestures reflect differing levels of conceptual activation. On the one hand, incompatible vertical movements could indicate weaker conceptual activation because they go directly against the verticality expressed by the linguistic metaphor. On the other hand, a total lack of vertical movement could suggest weaker conceptual activation because there is apparently no sense of verticality activated in the speaker's mind at all.

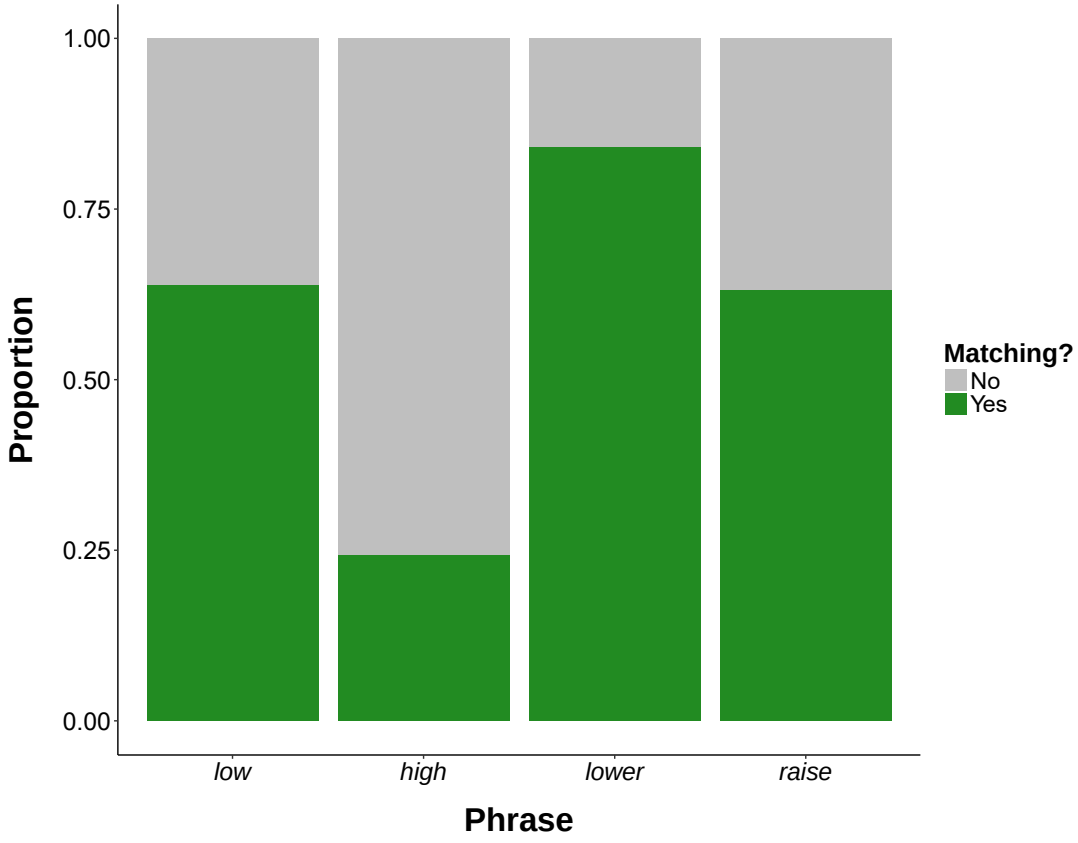

Figure 15: Proportion of videos per linguistic metaphor (low standards, high standards, lower the standards, raise the standards) containing matching (compatible vertical movement) versus mismatching (incompatible or absent vertical movement) gestures

9.1.2.1. Emotional valence and word class

For gestural fit, my first hypothesis was that there would be a higher rate of gestural fit (i.e., more matching gestures) for -valence linguistic metaphors compared to +valence linguistic metaphors. The data support this prediction: 75% (*N* = 138) of -valence videos contained matching gestures, whereas 25% (*N* = 46) contained mismatching gestures. In terms of +valence videos, 44.5% (*N* = 65) contained matching gestures, whereas 55.5% (*N* = 81) contained mismatching gestures.

My second hypothesis was that linguistic metaphors containing metaphorical verbs would have a higher rate of gestural fit than linguistic metaphors containing metaphorical adjectives. The descriptive data align with this prediction, showing that 75.1% (*N* = 133) of metaphorical verbs were accompanied by matching gestures, whereas 24.9% (*N* = 44) were accompanied by mismatching gestures. For metaphorical adjectives, the data show the opposite pattern: only 45.8% (*N* = 70) of metaphorical adjectives were accompanied by matching gestures, whereas 54.2% (*N* = 83) were accompanied by mismatching gestures.

A logistic regression model reveals reliable effects of both emotional valence (log odds: -1.43, *SE* = 0.26, *z*-score = -5.6, $p < 0.001$) and word class (log odds: 1.39, *SE* = 0.26, *z*-score = 5.43, $p < 0.001$) on gestural fit. These results indicate that speakers were more likely to produce a matching gesture when they used a metaphorical verb rather than a metaphorical adjective, and when they used a -valence linguistic metaphor rather than a +valence linguistic metaphor.

9.1.2.2. Agency

Were speakers more likely to produce matching gestures alongside speaker-agent linguistic metaphors than other-agent linguistic metaphors? The data suggest not, in fact showing a superficial trend in the opposite direction, with 67.3% (*N* = 35) of speaker-agent videos containing matching gestures, and 32.7% (*N* = 17) containing mismatching gestures. In comparison, 78.4% (*N* = 98) of other-agent videos contained matching gestures, and 21.6% (*N* = 27) contained mismatching gestures. Despite these descriptive differences, a logistic regression model reveals no reliable effect of agency on gestural fit (log odds: -0.57, *SE* = 0.37, *z*-score = -1.55, $p = 0.12$). Therefore,

agency does not seem to affect the likelihood of speakers producing matching gestures.

9.1.2.3. Animacy

Were speakers more likely to produce matching gestures when referring to other-agents that are animate rather than inanimate? Superficially, yes: 83.7% (*N* = 41) of gestures accompanying references to animate other-agents were matching, and 16.3% (*N* = 8) were mismatching. In contrast, 71.7% (*N* = 33) of gestures accompanying references to inanimate other-agents were matching, and 28.3% (*N* = 13) were mismatching. However, a logistic regression model reveals no reliable effect of animacy on gestural fit (log odds: 0.7, *SE* = 0.51, *z*-score = 1.39, *p* = 0.17). This suggests that animacy does not affect the likelihood of speakers producing matching gestures.

9.1.3. Gestural effort

Another way of quantifying the conceptual activation of a linguistic metaphor is by making a more fine-grained distinction between one-handed and both-handed gestures, which I argue corresponds to gestural effort. Because both-handed gestures are generally more effortful than one-handed gestures, both-handed gestures should evidence a higher level of conceptual activation. Future studies may wish to incorporate duration, speed of movement and extent of movement into analyses of gestural effort. The analyses in this section considered only those videos which contained gestures that aligned with the meaning of the linguistic metaphor they accompanied, and furthermore where both the speaker's hands were free to gesture.

Figure 16 shows the level of gestural effort (one-handed vs. both-handed) across the four linguistic metaphors. This figure shows that both-handed gestures were generally more likely than one-handed gestures, with 70.8% (N = 63) of videos overall containing both-handed gestures, and 29.2 (N = 26) containing one-handed gestures. A binomial test shows that these observed values are unexpected under the assumption that each outcome (both-handed vs. one-handed) is equally likely due to random chance ($p < 0.001$). However, as with gestural fit, this trend is reversed for 'high standards'.

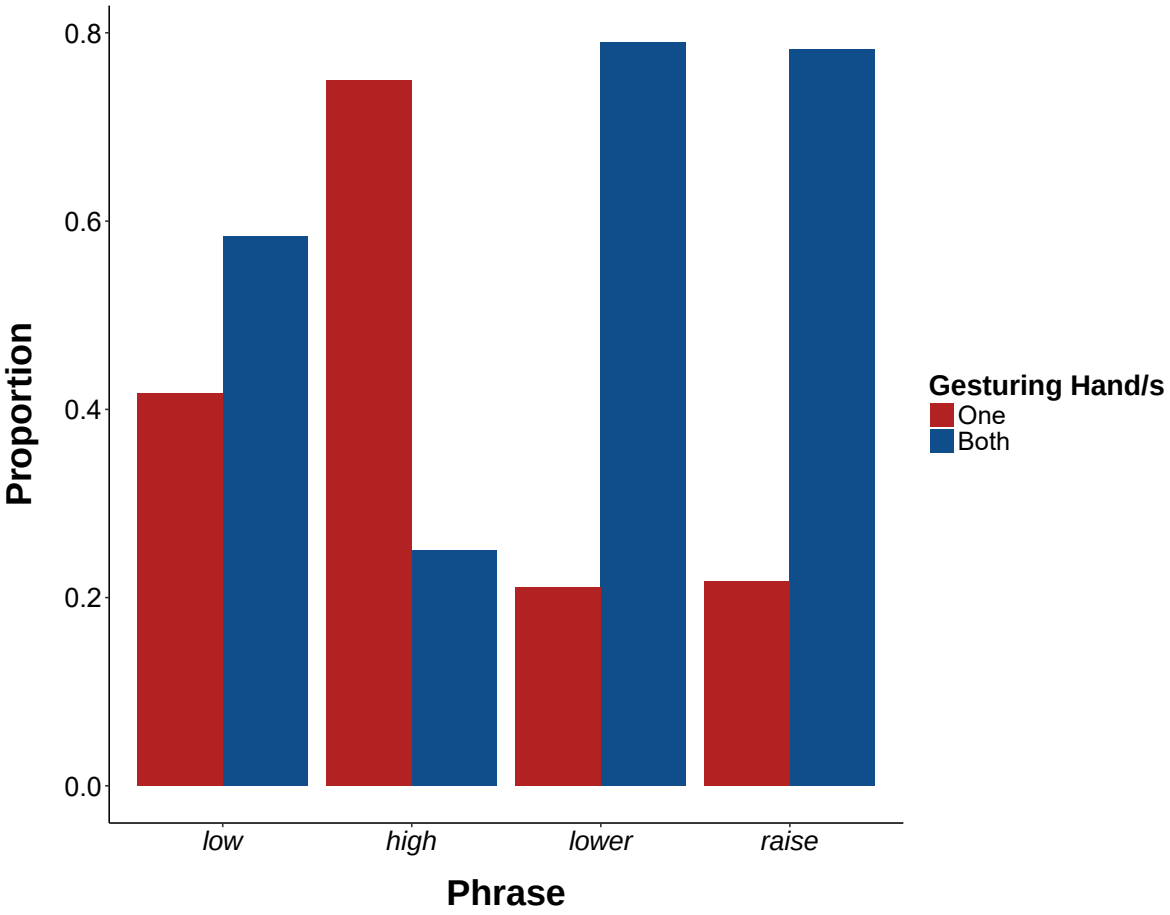

Figure 16: Proportion of videos per linguistic metaphor (low standards, high standards lower the standards, raise the standards) containing one-handed versus both-handed gestures

9.1.3.1. Emotional valence and word class

For gestural effort, my first hypothesis was that speakers would be more likely to gesture with both hands for -valence linguistic metaphors than +valence linguistic metaphors. Superficially, there was a very slight trend in this direction of this hypothesis: -valence videos contained both-handed gestures 71% (*N* = 44) of the time, and one-handed gestures 29% (*N* = 18) of the time; whereas +valence videos contained both-handed gestures 70.4% (*N* = 19) of the time, and one-handed gestures 29.6% (*N* = 8) of the time.

My second hypothesis was that speakers would be more likely to gesture with both hands (vs. one hand) when using a linguistic metaphor containing a metaphorical verb than when using a linguistic metaphor containing a metaphorical adjective. Descriptively, the data support this hypothesis: 78.7% (*N* = 48) of verb-containing videos contained both-handed gestures, while 21.3% (*N* = 13) contained one-handed gestures. In comparison, 53.6% (*N* = 15) of adjective-containing videos contained both-handed gestures, while 46.4% (*N* = 13) contained one-handed gestures.

Here, a logistic regression model reveals a reliable effect of word class on gestural effort (log odds: 1.26, *SE* = 0.52, *z*-score = 2.44, *p* = 0.015), indicating that speakers were reliably more likely to produce both-handed gestures alongside linguistic metaphors containing metaphorical verbs than metaphorical adjectives. However, this model reveals no reliable effect of emotional valence on gestural effort (log odds: -0.38, *SE* = 0.55, *z*-score = -0.69, *p* = 0.49), and therefore does not suggest that emotional valence (-valence vs. +valence) affects the likelihood of a speaker producing both-handed gestures.

9.1.3.2. Agency

Were speakers more likely to gesture with both hands (vs. one hand) alongside speaker-agent linguistic metaphors than other-agent linguistic metaphors? The data actually show a descriptive trend in the opposite direction: 76.5% (*N* = 13) of speaker-agent videos contained both-handed gestures, while 23.5% (*N* = 4) contained one-handed gestures. In comparison, 79.5% (*N* = 35) of other-agent videos contained both-handed gestures, while 20.5% (*N* = 9) contained one-handed gestures. Despite these superficial differences, a logistic regression model shows no reliable effect of agency on gestural effort (log odds: -0.18, *SE* = 0.68, *z*-score = -0.26, *p* = 0.79). These results therefore do not indicate that agency affects the likelihood of a speaker producing both-handed gestures.

9.1.3.3. Animacy

Were speakers who referred to animate other-agents more likely to gesture with both hands (vs. one hand) than those who referred to inanimate other-agents? The data show a slight superficial trend in this direction, with 83.3% (*N* = 15) of linguistic metaphors referring to an animate other-agent being accompanied by both-handed gestures, and 16.7% (*N* = 3) being accompanied by one-handed gestures. In comparison, 75% (*N* = 9) of linguistic metaphors referring to an inanimate other-agent were accompanied by both-handed gestures, and 25% (*N* = 3) were accompanied by one-handed gestures. However, a logistic regression model shows no reliable effect of animacy on gestural effort (log odds: 0.51, *SE* = 0.92, *z*-score = 0.56, *p* = 0.58). This suggests that animacy has no effect on the likelihood of speakers producing both-handed gestures.

9.2. Other conceptual metaphors

9.2.1. Horizontal metaphors of emotional valence

In this section I explore Casasanto's (2009) body-specificity hypothesis, the notion that we associate the dominant side of our bodies with +valence, and the non-dominant side of our bodies with -valence. By looking at which hand speakers use to gesture across -valence and +valence linguistic metaphors, it is possible to test this prediction. In addition, although body-specific associations are thought to derive primarily from handedness, these handedness-based associations may extend to left-side or right-side space (depending on one's handedness). Consequently, we might also observe body-specific associations in the horizontal movement of speaker's gestures.

An estimated 90% of the world's population is right-handed (Kassin, 2005: 72). This right-handed bias also means that the body-specific associations of right-handers, rather than left-handers, are more likely to be instantiated culturally. We see this in cultural customs, such as the raising of one's right hand when taking an oath, which can potentially even influence associations of emotional valence in left-handers (Casasanto & Bottini, 2014; Casasanto, 2017). Consequently, because it is impossible to determine the handedness of all but a select few speakers in the current study's dataset (e.g., Barack Obama is known to be left-handed), for the purposes of the following analyses it is assumed that all speakers in the dataset share BAD IS LEFT and GOOD IS RIGHT mappings of emotional valence. Based on this, we would expect speakers to gesture leftwards with their left hand when using -valence linguistic metaphors, and rightwards with their right hand when using +valence linguistic metaphors.

In the following analyses, I constructed two logistic regression models to test the dependent variables gesturing hand and horizontal movement direction

respectively. These two variables were not included in the same model because each variable contained a different number of data points. For emotional valence in both models, the value '-valence' was treatment-coded as 0, and the value '+valence' was treatment-coded as 1. Only videos where both the speaker's hands were free to gesture were included in these analyses.

As Figure 17 demonstrates, speakers were far more likely to gesture with their right hand than their left across all four linguistic metaphors. Specifically, 24.1% (N = 13) of gestures overall were left-handed, whereas 75.9% (N = 41) were right-handed. An exact binomial test shows that these results are unexpected under the null hypothesis of equal proportions ($p < 0.001$). These results suggest that speakers are more likely to use their dominant hand to gesture, regardless of emotional valence. This conclusion is only tentative, however, because we do not know for certain the handedness of speakers in the dataset.

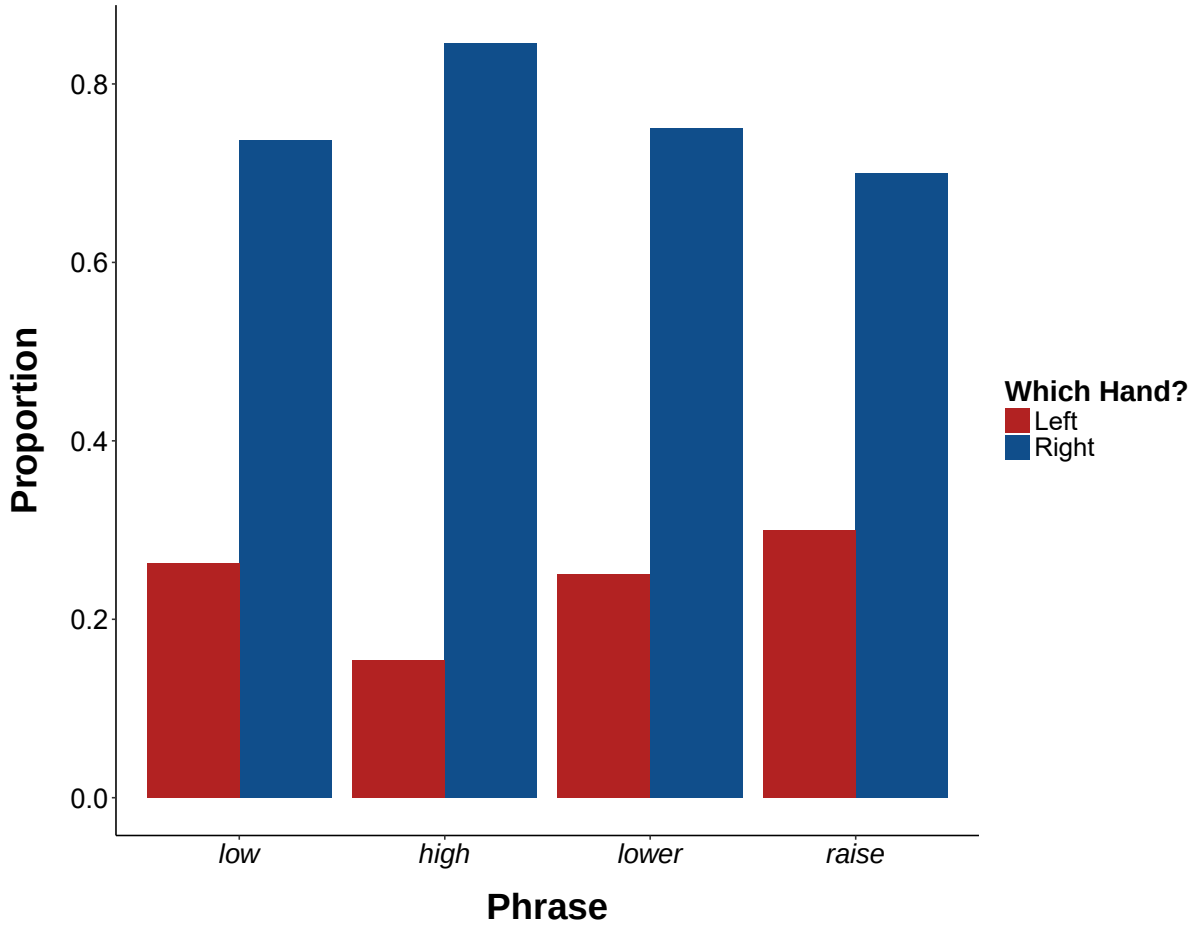

Figure 17: Proportion of videos per linguistic metaphor (low standards, high standards, lower the standards, raise the standards) containing left-handed versus right-handed gestures

Did speakers gesture with their left hand more often when talking about -valence linguistic metaphors, and with their right hand relatively more often when talking about +valence linguistic metaphors? The data show a descriptive trend in this direction: for -valence linguistic metaphors, 25.8% (*N* = 8) of gestures were left-handed, and 74.2% (*N* = 23) were right-handed. In comparison, for +valence linguistic metaphors, 21.7% (*N* = 5) of gestures were left-handed, and 78.3% (*N* = 18) of gestures were right-handed. However, a logistic regression model reveals no reliable body-specific effect on the hand speakers used to gesture (log odds: 0.22, *SE* = 0.65, *z*-score = 0.35, *p* = 0.73). This shows that speakers were not reliably more likely to

gesture with their left hand alongside -valence clauses, nor were they to gesture with their right hand alongside +valence clauses.

For horizontal movement direction, Figure 18 shows that speakers were more likely to gesture rightwards than leftwards overall. The exact figures show that 62.9% (*N* = 22) of gestures overall were rightwards-moving, whereas 37.1% (*N* = 13) were leftwards-moving. However, an exact binomial test shows that these figures were not unexpected under the null hypothesis of equal proportions (*p* = 0.18). Furthermore, for 'low standards', speakers were equally likely to gesture leftwards or rightwards.

Did speakers gesture leftwards relatively more often when talking about -valence linguistic metaphors, and rightwards relatively more often when talking about +valence linguistic metaphors? Descriptively, the data suggest so: for -valence linguistic metaphors, 44% (*N* = 11) of gestures were leftwards-moving, and 56% (*N* = 14) were rightwards-moving. In contrast, for +valence linguistic metaphors, 20% (*N* = 2) of gestures were leftwards-moving, and 80% (*N* = 8) were rightwards-moving. However, a logistic regression model shows no reliable main body-specific effect on horizontal movement direction (log odds: 1.15, *SE* = 0.89, *z*-score = 1.29, *p* = 0.2).

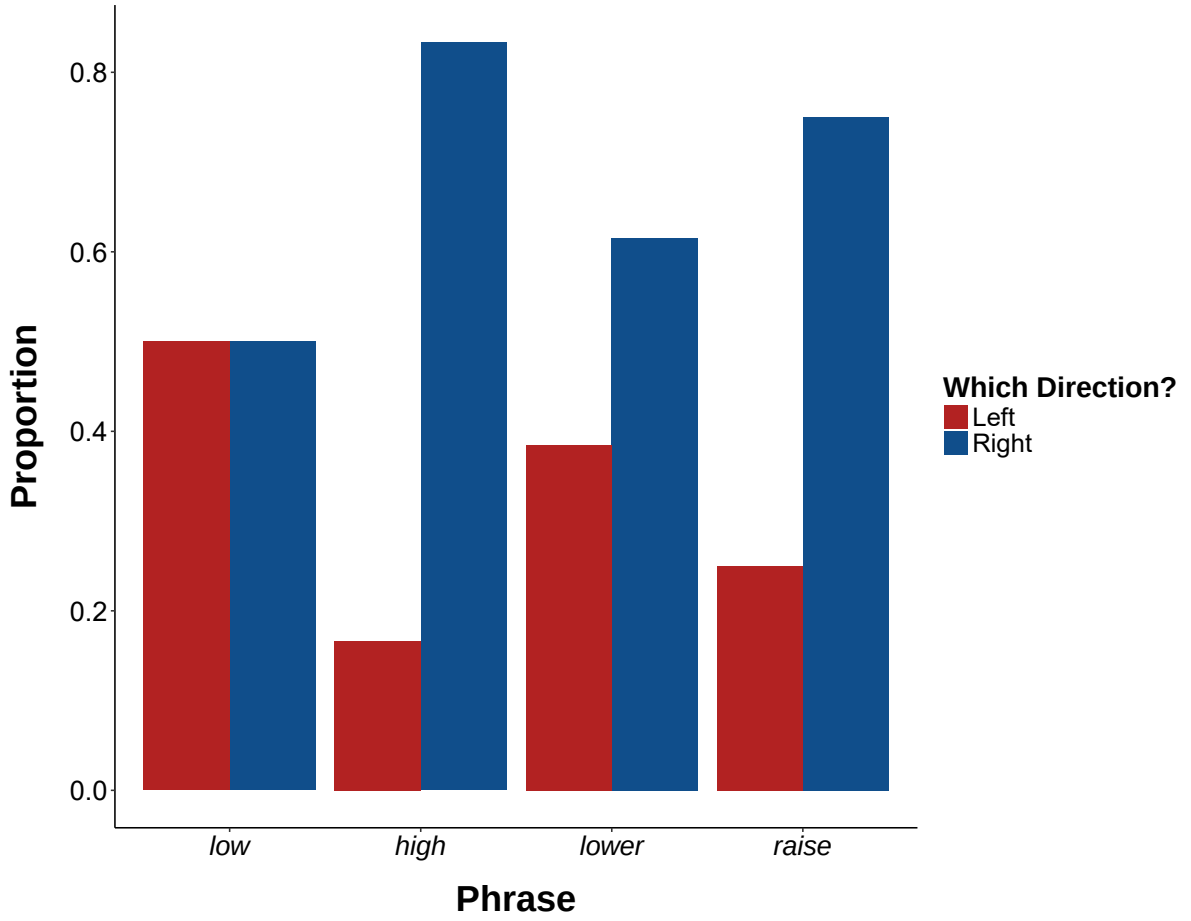

Figure 18: Proportion of videos per linguistic metaphor ('low standards', 'high standards', 'lower the standards', 'raise the standards') containing leftwards- versus rightwards-moving gestures

9.2.2. Sagittal metaphors of emotional valence

I now turn my attention to the approach-avoidance effect, where GOOD IS NEAR and BAD IS FAR. This effect suggests that speakers may be more likely to produce backwards-moving gestures towards their bodies when using +valence linguistic metaphors, and frontwards-moving gestures away from their bodies when using -valence linguistic metaphors. Unlike the body-specificity effect, the approach-avoidance effect should be universal due to its purported evolutionary origins, and therefore should not vary from speaker to speaker.

Figure 19 reveals an extreme bias towards frontwards-moving (vs. backwards-moving) gestures in the dataset overall across all four linguistic metaphors. Specifically, 94.3% (N = 82) of gestures overall were frontwards-moving, and 5.7% (N = 5) were backwards-moving. An exact binomial test shows that these results are unexpected under the null hypothesis of equal proportions (p < 0.001). The results from this test suggest that frontwards-moving gestures were far more likely than backwards-moving gestures.

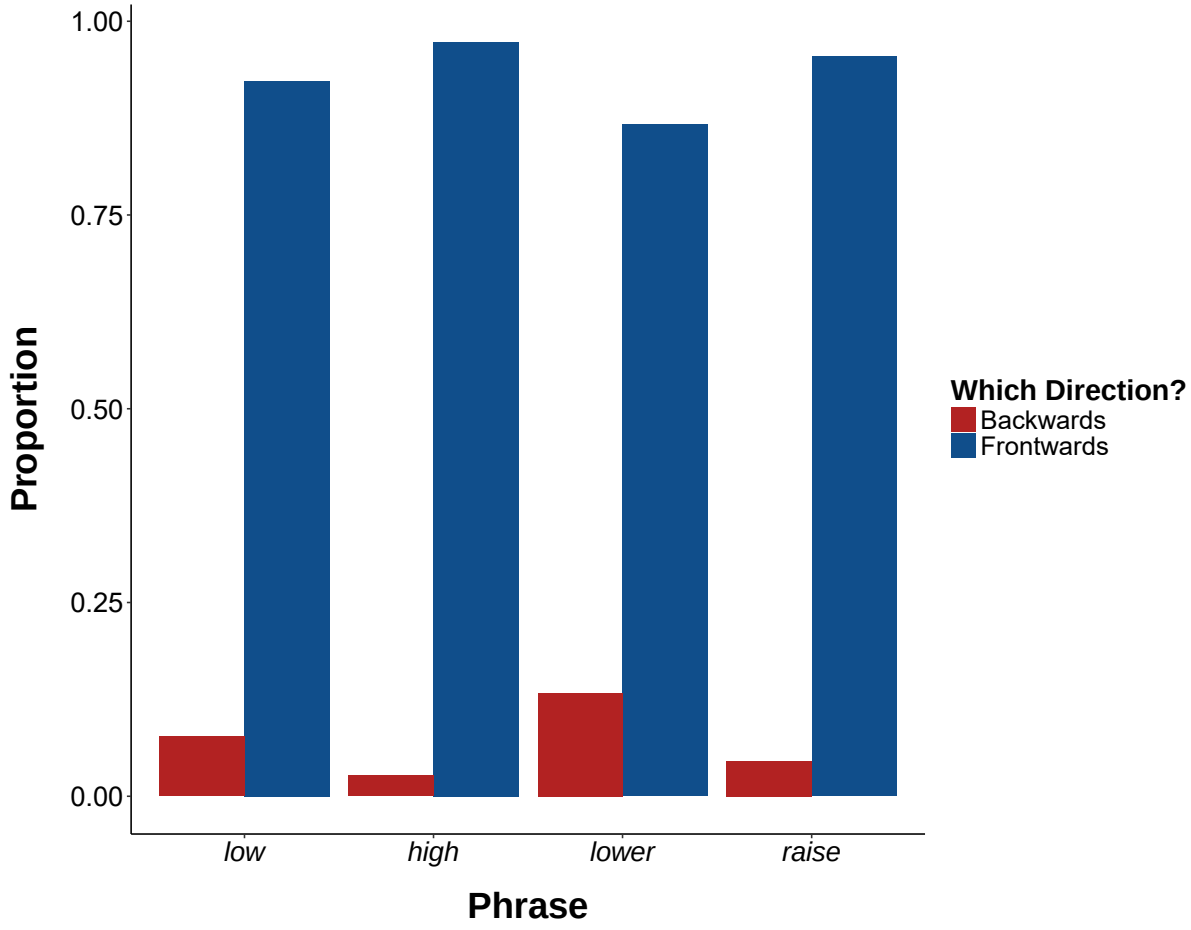

Figure 19: Proportion of videos per linguistic metaphor ('low standards', 'high standards', 'lower the standards', 'raise the standards') containing backwards-moving versus frontwards-moving gestures

I now use a logistic regression model to test the dependent variable sagittal movement direction (backwards-moving vs. frontwards-moving) against the independent variable emotional valence. For emotional valence, the value '-valence' was treatment-coded as 0, and the value '+valence' was treatment-coded as 1. Did speakers produce backwards-moving gestures relatively more often when using +valence linguistic metaphors, and frontwards-moving gestures relatively more often when using -valence linguistic metaphors? The data actually show the opposite pattern: for -valence linguistic metaphors, 89.29% (*N* = 25) of gestures were frontwards-moving, and 10.7% (*N* = 3) were backwards-moving. In contrast, for +valence linguistic metaphors, 96.6% (*N* = 57) of gestures were frontwards-moving, and 3.4% (*N* = 2) were backwards-moving. However, a logistic regression model shows no reliable approach-avoidance effect on sagittal movement direction (log odds: 1.23, *SE* = 0.94, *z*-score = 1.3, *p* = 0.19). Nevertheless, we should be cautious when generalising from this null result due to the small number of backwards-moving gestures in the dataset.

9.2.3. Size-based metaphors of quantity

Will speakers think in terms of size-based LESS IS SMALL and MORE IS BIG conceptual metaphors of quantity when they use vertical linguistic metaphors of emotional valence? I attempt to answer this question by looking at whether speakers were more likely to gesture with a closed hand configuration for -valence linguistic metaphors, and with an open hand configuration for +valence linguistic metaphors.

In Figure 20, we can see an overall bias towards open (vs. closed) gestures across all four linguistic metaphors in the dataset. Specifically, 81.3% (*N* = 205) of gestures overall were open, and 18.7% (*N* = 47) were closed. An exact binomial test

shows that these figures were unexpected under the null hypothesis of equal proportions ($p < 0.001$). This shows that speakers were far more likely to produce open gestures than closed gestures.

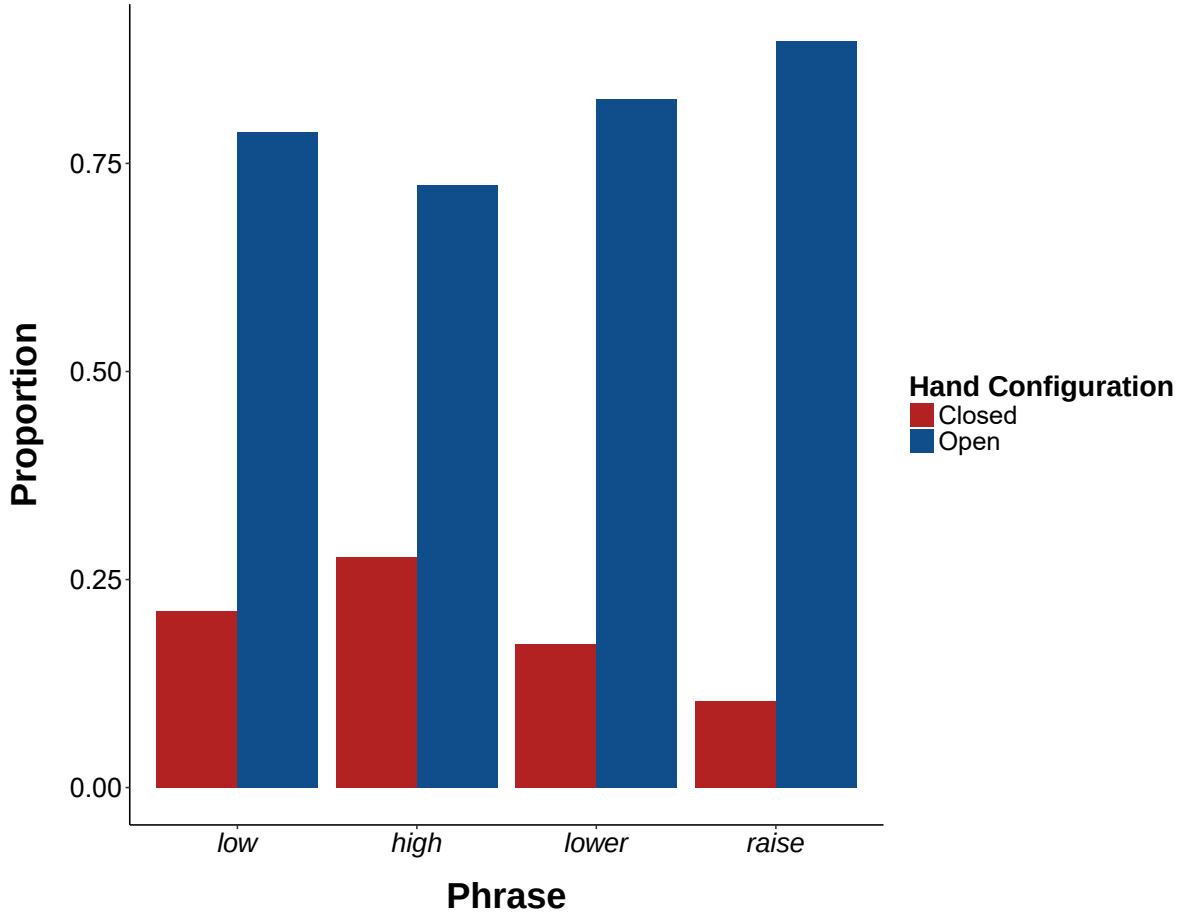

Figure 20: Proportion of videos per linguistic metaphor ('low standards', 'high standards', 'lower the standards', 'raise the standards') containing closed versus open gestures

I now use a logistic regression model to test the dependent variable hand configuration against the independent variable emotional valence. For emotional valence, the value '-valence' was treatment-coded as 0, and the value '+valence' was

treatment-coded as 1. Crucially, -valence is thought to correlate with lesser quantities, whereas +valence is thought to correlate with greater quantities. This means that we would expect speakers to produce closed gestures relatively more often when using -valence linguistic metaphors, and open gestures relatively more often when using +valence linguistic metaphors. Was this the case? Superficially, the data show a slight trend in this direction: 19% (*N* = 28) of -valence linguistic metaphors were accompanied by closed gestures, and 81% (*N* = 119) were accompanied by open gestures. In comparison, 18.1% (*N* = 19) of +valence linguistic metaphors were accompanied by closed gestures, and 81.9% (*N* = 86) were accompanied by open gestures. However, a logistic regression model shows no effect of emotional valence on hand configuration (log odds: 0.06, *SE* = 0.33, *z*-score = 0.19, *p* = 0.85). This shows that the hand configuration with which speakers gestured did not reliably correlate with size-based conceptual metaphors of quantity.

9.3. Articulatory plurality

I now test whether articulatory plurality, a phenomenon reported to exist in sign languages, extends to gestures. Articulatory plurality refers to the finding that signers tend to prefer one-handed signs to represent lexically singular concepts, and both-handed signs to represent lexically plural concepts. Because sign language and gesture can be seen as overlapping concepts, it is possible that speakers in the current dataset will be more likely to gesture with one hand for linguistic metaphors containing a singular noun (‘standard’), and with two hands for linguistic metaphors containing a plural noun (‘standards’).

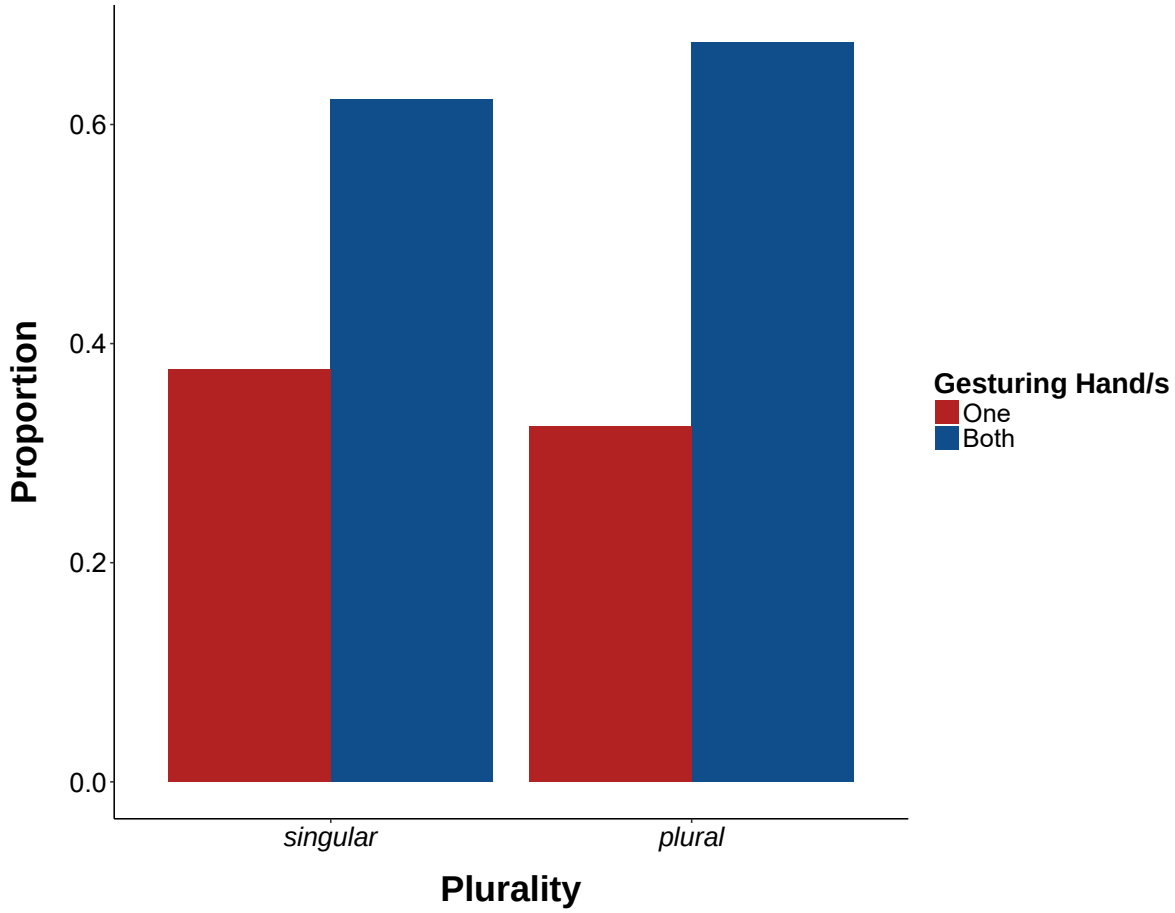

Figure 21: Proportion of videos per noun type (singular, plural) containing one-handed versus both-handed gestures

Figure 21 shows the spread of one-handed and both-handed gestures across singular and plural linguistic metaphors in the dataset. Similarly to Figure 16, which was presented as part of the subsection on gestural effort, both-handed gestures predominated across the dataset as a whole. For gestural effort, however, only those gestures that aligned with the meaning of the linguistic metaphor they accompanied were included in this comparison of one-handed and both-handed gestures. For articulatory plurality, all gestures were included, as long as both the speaker's hands were free to gesture. Overall, 71.7% (*N* = 137) of gestures were both-handed and 28.3% (*N* = 54) were one-handed. An exact binomial test here indicates that these

results were unexpected based on random chance ($p < 0.001$), showing that speakers were more likely overall to produce both-handed gestures than one-handed gestures.

In the following analysis, I used a logistic regression model to test the dependent variable number of gesturing hands against the independent variable noun plurality. For noun plurality, the value 'singular' was treatment-coded as 0, and the value 'plural' was treatment-coded as 1. Only videos where both the speaker's hands were free to gesture were included in this model.

The data show that for singular nouns, 37.7% ($N = 29$) of gestures were one-handed, whereas 62.3% ($N = 48$) were both-handed. In contrast, for plural nouns, 32.5% ($N = 25$) of gestures were one-handed, whereas 67.5% ($N = 52$) were both-handed. However, a logistic regression model reveals no effect of noun plurality on the number of hands used to gesture (log odds: 0.23, $SE = 0.34$, z-score = 6.8, $p = 0.5$). This suggests that speakers were not reliably more likely to gesture with one hand for singular linguistic metaphors, nor were they reliably more likely to gesture with both hands for plural linguistic metaphors.

9.4. Violation of independence assumption

Exact binomial tests and logistic regression models assume that every data point in a sample is independent from one another. This independence assumption was violated in the current study because some speakers appeared in more than one video, contributing multiple data points. An example of such a speaker is Steve King, whose gestures I analysed qualitatively in Figures 8-10 (section 8.3). These three videos containing King would be interpreted by an inferential statistical test as containing three different speakers, which would artificially inflate the sample size interpreted by the test and consequently increase its likelihood of producing false positive results

(Hurlbert, 1984; Winter, 2011). Furthermore, if we consider that we are using this sample to make assumptions about all English speakers, it is problematic that the sample is biased in favour of speakers that appear in it multiple times.

To show that the violation of the independence assumption did not affect the outcome of each test, for each statistically reliable result I simulated 1000 random samples where each speaker contributed only one data point. Following this, I ran the appropriate binomial test or logistic regression model again each time. I then calculated how many of these samples returned a *p*-value lower than the 0.05 cut-off commonly used in null hypothesis significance testing. I only did this for each test that directly related to the research questions investigated in this thesis.

For gesture co-occurrence, a binomial test initially indicated that speakers were reliably more likely to gesture than they were to not gesture across all four linguistic metaphors. When I ran this test again with 1000 random samples containing only unique speakers, all 1000 samples returned *p*-values lower than 0.05. Furthermore, an logistic regression model initially indicated that speakers were reliably more likely to gesture when using a metaphorical verb than when using a metaphorical adjective. Again, all 1000 random samples containing only unique speakers returned *p*-values lower than 0.05 here.

For gestural fit, a binomial test initially indicated that speakers were reliably more likely to produce matching gestures than they were to produce mismatching gestures across all four linguistic metaphors. This test was run again across 1000 random samples containing only unique speakers, and all 1000 samples returned *p*-values lower than 0.05. Furthermore, a logistic regression model initially showed that speakers were reliably more likely to produce matching (vs. mismatching) gestures when using a -valence linguistic metaphor than when using a +valence linguistic

metaphor, and when using a metaphorical verb than when using a metaphorical adjective. All 1000 random samples containing only unique speakers returned *p*-values lower than 0.05 for both emotional valence and word class.

For gestural effort, a binomial test initially showed that speakers were reliably more likely to produce both-handed gestures than they were to produce one-handed gestures across all four linguistic metaphors. When this test was run again across 1000 random samples containing only unique speakers, all 1000 samples returned *p*-values lower than 0.05. In addition, a logistic regression model initially showed that speakers were reliably more likely to produce both-handed (vs. one-handed) gestures when using a metaphorical verb than when using a metaphorical adjective. Across 1000 random samples containing only unique speakers, 1000 samples returned *p*-values lower than 0.05.

These simulated samples suggest that the initial results I reported were not significantly affected by the violation of the independence assumption. As originally reported, speakers were more likely to gesture than to not gesture, to produce matching gestures rather than mismatching gestures, and to produce both-handed gestures rather than one-handed gestures. In addition, there was a reliable effect of word class on gesture co-occurrence, gestural effort and gestural fit. There was also a reliable effect of emotional valence on gestural fit.

* * *

In this section, I reported the main quantitative results of the study. I found high rates of gesture co-occurrence, gestural fit and gestural effort across the four linguistic metaphors ‘low standards’, ‘high standards’, ‘lower the standards’ and ‘raise the

standards'. I also found that speakers were more likely to gesture, produce gestures that aligned with the meaning of the linguistic metaphor they were using, and produce both-handed gestures, when they used linguistic metaphors containing a metaphorical verb ('lower, 'raise') compared to when they used linguistic metaphors containing a metaphorical adjective ('low', 'high'). For emotional valence, I also found that speakers were more likely to produce gestures that aligned with the meaning of the linguistic metaphor they were using when they used a -valence linguistic metaphor ('low standards') compared to when they used a +valence linguistic metaphor ('high standards'). Neither agency (speaker-agent vs. other-agent) nor animacy (inanimate vs. animate) seemed to affect speakers' gestures. Furthermore, I found evidence for neither horizontal nor sagittal conceptual metaphors of emotional valence, nor size-based conceptual metaphors of quantity, being active when speakers used vertical linguistic metaphors of emotional valence. Finally, my findings did not suggest that articulatory plurality extends to co-speech gestures. In the next section, I discuss these results, what they might signify and other possible interpretations of the data.

10. GENERAL DISCUSSION

In this section, I first evaluate the TV News Archive as a tool for gesture research, specifically in relation to sample size. I then discuss the results for gesture co-occurrence, gestural fit and gestural effort overall, before examining the results from these tests in relation to potential factors affecting the conceptual activation of linguistic metaphors (emotional valence, word class, agency, animacy). Following this, I discuss the results for conceptual metaphors of emotional valence other than the vertical GOOD IS UP and BAD IS DOWN metaphors expressed linguistically (horizontal, sagittal), as well as size-based conceptual metaphors of quantity. Finally, I look at the results for articulatory plurality.

10.1. TV News Archive

Just over three quarters of the original 1600-video sample had to be excluded from all final analyses, leaving a total of 387 analysable videos. This was not an underpowered sample size, and indeed the size of the initial 1600-video sample was chosen to mitigate the negative effects of this initial sample being reduced in size. However, it is inconvenient that 1213 videos that were ultimately unanalysable had to be hand-coded and discarded one by one. It is my hope that automated methods could perform at least this first stage of coding in future studies, leaving human researchers to conduct the more difficult, context-dependent gesture analyses. The future looks bright in this regard, with Östling et al. (2018) conducting a relatively sophisticated, large-scale, automated analysis of sign languages with a high rate of accuracy. Nonetheless, researchers should bear these limitations in mind when deciding whether or not to use the TV News Archive in their research, and when choosing an appropriate sample size for their study.

The size of this study was considerably larger than much gesture research that has gone before it, with a total of 387 gestures produced by 262 unique speakers available to analyse. In contrast, Casasanto and Jasmin (2010) analysed 1747 gestures overall, but these gestures were produced by only 4 speakers, limiting the generalisability of their findings. Furthermore, Çatak et al. (2018) analysed 1208 gestures produced by 52 speakers, a similarly high number of gestures but still a relatively low number of speakers. Finally, Hinnell (in preparation) analysed 147 gestures produced by 126 speakers, these numbers getting closer to but not equalling those reported in this study. Large sample sizes are of paramount importance in quantitative gesture research, and this is true both in terms of the number of gestures analysed and the number of unique speakers that produced these gestures. It should also be noted that the original 1600-video sample taken from the TV News Archive was small compared to the much larger number of videos available in the archive overall, showing that the methodology delineated in this paper could easily be extended to an even larger-scale study.

10.2. Conceptual activation

10.2.1. Overall

In this paper I have described three methods of quantifying conceptual activation: gesture co-occurrence, gestural fit and gestural effort.

The results for gesture co-occurrence show that all four linguistic metaphors in the dataset were more likely to co-occur with gestures than not (85.3%). From one perspective, this is unsurprising seeing as the linguistic metaphors in the dataset were chosen precisely because they seemed to frequently co-occur with gestures during an initial exploration of the archive. However, it is striking just how high this figure is, as it

exceeds even those high gesture co-occurrence rates reported by previous studies; for instance, Zima (2017a) found a gesture co-occurrence rate of 80% for the partially filled [all the way from X PREP Y] construction, and Zima (2017b) found a 37%-75% gesture co-occurrence rate for English motion verbs. The comparatively high gesture co-occurrence rate reported here therefore lends weight to the conclusion that the linguistic metaphors in the dataset are highly conceptually active. This conclusion is further supported by the high rates of gestural fit (61.5%) and gestural effort (70.8%) overall. The fact that these three measures correlate relatively closely also tentatively suggests the validity of these tests as measurements of conceptual activation.

10.2.2. Factors affecting conceptual activation

Gesture co-occurrence, gestural effort and gestural fit were also used in the current study to investigate the following research questions:

1. *Emotional valence (the negativity bias):* are -valence linguistic metaphors more conceptually active than +valence linguistic metaphors?
2. *Word class:* are linguistic metaphors containing metaphorical verbs more conceptually active than linguistic metaphors containing metaphorical adjectives?
3. *Agency:* are linguistic metaphors containing speaker-agent metaphorical verbs more conceptually active than linguistic metaphors containing other-agent metaphorical verbs?
4. *Animacy:* are linguistic metaphors with animate other-agents more conceptually active than linguistic metaphors with inanimate other-agent?

Table 1 shows the results for these four hypotheses across the four measures of conceptual activation. Ticks indicate that a measure of conceptual activation revealed

a reliable trend in the direction of a hypothesis, whereas crosses indicate that no reliable effect was found. There were no cases in which a reliable trend was discovered in the opposite direction of a hypothesis. From this, I have assigned scores indicating how many measures discovered a reliable trend in the direction of each hypothesis.

Hypothesis	Test			Score
	Co-occurrence	**Fit**	**Effort**	
Emotional valence	✗	✓	✗	**1**
Word class	✓	✓	✓	**3**
Agency	✗	✗	✗	**0**
Animacy	✗	✗	✗	**0**

Table 1: Results for three measures of conceptual activation (gesture co-occurrence, gestural fit, gestural effort) across all four hypotheses; ticks indicate reliable results in direction of hypotheses, while crosses indicate non-reliable results

For emotional valence, only gestural fit indicated a reliable trend in the direction of this hypothesis. Because the two other tests did not indicate reliable trends, and in fact showed very strong null effects, it is possible that the operationalisation of gestural fit in terms of vertical movement generated a false positive result for emotional valence. This false positive result may have been due to the presence of beat gestures in the dataset, which often contain a downwards movement component. These downwards movements would have been coded as matching the meaning of -valence linguistic metaphors, but not +valence linguistic metaphors. This could have falsely

made the -valence phrases seem more conceptually active than the +valence phrases.

Word class was unique in that all three tests revealed reliable trends in the direction of this hypothesis. Based on this, one possible conclusion is that metaphorical verbs are indeed more conceptually active than metaphorical adjectives. However, it is possible that these results are simply a consequence of verbs being connected to more dynamic, motoric representations than adjectives, which could affect speakers' gestures even if these verbs are not necessarily understood as metaphorically standing for the target domain EMOTIONAL VALENCE. If so, this result would suggest that verbs in themselves reflect or trigger a more general motoric activation rather than conceptual activation. Of course, neither of these explanations is mutually exclusive: both could be valid.

A potential issue with the operationalisation of gestural fit that may have affected the result for word class is raised by the fact that there is no explicit upwards or downwards movement component in the adjectival linguistic metaphors '<u>low</u> standards' and '<u>high</u> standards' themselves, only vertical position. Thus, although the idea of vertical position may still be active in the mind of the speaker, they may not find it as necessary to gesture upwards or downwards at the same time as uttering these linguistic metaphors, or otherwise to make this vertical movement the stroke of their gesture. Instead, the speaker might choose to move their hands upwards or downwards to the relevant vertical level in preparation for the gesture stroke, and then perform a gesture stroke depicting a static vertical position. This is important because gestural movement was only coded if it occurred at the same time as the linguistic metaphor itself, and during the stroke of the gesture, meaning that cases such as described above would have been coded as mismatching. This explanation could

explain why there were so few matching cases for ‘high standards’ in the vertical movement operationalisation of gestural fit. The comparatively high incidence of matching cases for ‘low standards’ might derive from the presence of beat gestures in the dataset, which often contain a downwards movement component and so would have been falsely coded as matching the meaning of ‘low standards’.

Moreover, if it is true that speakers are more likely to gesture before but not concurrent with linguistic metaphors containing metaphorical adjectives, such cases would not have been coded as gestures at all. It is therefore possible that this skewed the gesture co-occurrence results and falsely made the linguistic metaphors containing metaphorical verbs seem more conceptually active than the linguistic metaphors containing metaphorical adjectives. Overall, more work needs to be done to verify the reliability of these measures, and to fine-tune how they are operationalised.

For agency and animacy, the three tests were unanimous in that none revealed any reliable differences in conceptual activation. However, there was less data for agency and animacy than for word class and emotional valence because they only applied to linguistic metaphors containing metaphorical verbs (‘lower the standards’, ‘raise the standards’) and not those containing metaphorical adjectives (‘low standards’, ‘high standards’). With more data, it is possible that statistically reliable patterns would be uncovered. This seems unlikely, though, when one considers how strong some of the null effects were for these two factors.

10.3. Other conceptual metaphors

10.3.1. Horizontal metaphors of emotional valence

Casasanto's (2009) body-specificity hypothesis predicts that right-handers will associate the dominant right side of their bodies (and therefore right-hand space) with +valence, and the non-dominant left side of their bodies (and therefore left-hand space) with -valence, whereas left-handers will exhibit the opposite pattern. Whereas Casasanto and Jasmin (2010) observed a body-specific effect in gestures performed by presidential candidates, Çatak et al. (2018) failed to observe a body-specific effect in gestures performed by laypeople. The latter study found evidence only for a handedness effect: speakers were more likely overall to gesture with their dominant hand, irrespective of emotional valence.

The results from the current study support those findings reported by Çatak et al. (2018) rather than Casasanto and Jasmin (2010), showing that speakers were more likely to gesture with their right hand across all four linguistic metaphors, irrespective of emotional valence. If we assume that the dataset in the current study is composed exclusively of right-handed speakers, these results suggest an effect of handedness rather than body-specificity. In other words, speakers were more likely overall to gesture with their dominant hand. However, they were not reliably more likely to gesture using their right hand during +valence linguistic metaphors, nor were they reliably more likely to gesture using their left hand during -valence linguistic metaphors.

Çatak et al. (2018) explain the lack of body-specific gestures in their study with the fact that their dataset was comprised of university students who would probably not have received speech and body language training. In contrast, Casasanto and Jasmin's (2010) dataset consisted solely of speakers who would almost certainly have

received such training. Implicit in this argument is that varying which hand one gestures with according to emotional valence is not something that people naturally do unless they have been taught to exert a greater degree of control over their gestures than the average person. However, the current study failed to find a body-specific effect even in the gestures of speakers (news presenters and politicians) who probably would have received speech and body language training. This suggests the need for an alternative explanation to explain the disparity in findings between Çatak et al. (2018) and Casasanto and Jasmin (2010). One explanation is suggested by the fact that Casasanto and Jasmin's (2010) study looked at only 4 speakers, whereas Çatak et al. (2018) gathered gesture production data from 52 speakers. Therefore, it is possible that larger sample sizes cancel out the body-specific gestural effects reported by Casasanto and Jasmin (2010). This would make sense if we consider that the present study gathered data from an even larger sample of 262 speakers and did not report any body-specific effects. Perhaps, then, the body-specific effect reported by Casasanto and Jasmin was a false positive result generated from a too-small sample that does not reflect the general population.

What does this mean for the body-specificity hypothesis? If producing body-specific gestures is not something that we do naturally, perhaps we do not even think about emotional valence in body-specific terms. However, many previous non-gesture studies have reported body-specific effects (e.g., Casasanto, 2009; Casasano & Henetz, 2012; de la Fuente et al., 2014), so we should refrain from coming to any firm conclusions about this, especially because the current study did not have the proper handedness information about speakers in the dataset. After all, there may be some reason why speakers do not produce body-specific gestures, even if they

conceptualise emotional valence in terms of horizontal space. It is unclear what this reason might be.

It is also possible that the methodology used in the current study restricted the likelihood of finding a body-specific effect. Specifically, the linguistic metaphors investigated all described emotional valence in terms of vertical rather than horizontal space. The fact that speakers used vertical linguistic metaphors to begin with might suggest that they were conceptualising emotional valence using the vertical axis. Moreover, even if the speaker's initial conceptualisation of emotional valence was not vertical, planning to use a vertical linguistic metaphor to describe emotional valence might also activate the vertical axis in their mind. This may have led participants to ignore the horizontal axis, causing to gesture vertically rather than horizontally. This interpretation is bolstered by the finding that although it is theoretically possible for both vertical and horizontal axes to be conceptually active at the same time (Walker & Cooperrider, 2016), people are more likely to use a single axis at a time to structure thought about emotional valence and other abstract concepts (Woodin & Winter, under review). The latter study cited here derives its conclusions from a pen-and-paper task, however, rather than gestures. Additional evidence that speakers were thinking more in vertical than horizontal terms comes from their gestures: overall, 251 gestures were vertical, whereas only 57 were horizontal. (I do not report percentages here because some gestures were both vertical and horizontal). A post-hoc binomial test indicates that these figures are unexpected under the assumption that each outcome (vertical, horizontal) is equally likely based on chance ($p < 0.001$).

For a proper confirmation or disconfirmation of the body-specificity effect in gestures, therefore, one would need to ignore linguistic metaphors entirely and look at non-metaphorical, emotionally valenced phrases without any references to space.

One would also need to have the proper information about the handedness of speakers, rather than assuming that all speakers were right-handed. In addition, while the sample of speakers in the current study was large, the selection of linguistic metaphors investigated was small. Future research might wish to investigate whether or not a body-specific effect can be observed with both a large sample of speakers and a large selection of emotionally valenced linguistic metaphors.

In addition to a lack of body-specificity, results also showed that speakers were more likely to gesture rightwards than leftwards. Although this result was not statistically reliable, there was only a small number of leftwards- and rightwards-moving gestures in the dataset overall, which limited the statistical power of the test used here. Thus, this null result may have been a false negative. If we assume this to be the case, the predominance of right-handed gestures in the dataset can shed light on other patterns in the data. For instance, the fact that most speakers gestured with their right hand and also gestured rightwards suggests that it may feel easier or more natural to gesture in the direction of the hand we are gesturing with (left or right). A post-hoc analysis of the data supports this conclusion: 81.3% (N = 26) of speakers gestured in same direction as the hand they used to gesture, whereas only 18.8% (N = 6) gestured in a different direction. An exact binomial test shows that these results are unexpected under the assumption that each outcome is equally likely based on chance ($p < 0.001$). The interpretation that speakers tend to gesture in the same direction as their gesturing hand because it is easier aligns with the principle of least effort, which is thought to underlie the vast majority of human behaviour (e.g., Ferrero, 1894; Bierbaum, 1990).

10.3.2. Sagittal metaphors of emotional valence

The approach-avoidance effect predicts that +valence stimuli will foster approach behaviour and that -valence stimuli will foster avoid behaviour. This may result in GOOD IS NEAR and BAD IS FAR metaphorical associations, which could be expressed through speakers' gestures when they use linguistic metaphors of emotional valence. However, the results here do not find gestural evidence for the approach-avoidance effect: speakers were not reliably more likely to use a backwards-moving gesture for +valence linguistic metaphors, nor were they to use a frontwards-moving gesture for -valence linguistic metaphors.

These results do not necessarily conflict with the approach-avoidance effect; as with the body-specificity effect, it is possible that this association exists but that it is not expressed gesturally. Indeed, much past research does support the existence of GOOD IS NEAR and BAD IS FAR metaphorical mappings (e.g., Solarz, 1960; Chen & Bargh, 1999; Centerbar & Clore, 2006). Moreover, the fact that speakers used vertical linguistic metaphors might suggest that they were focusing more on the vertical than the sagittal axis, and even if their initial conceptualisation of emotional valence was not vertical, the use of a vertical linguistic metaphors might cause them to conceptualise emotional valence vertically. Non-gestural research has shown that people are more likely to use a single axis than a combination to structure thought about emotional valence and other abstract concepts (Woodin & Winter, under review), so a vertical conceptualisation would make a concurrent sagittal conceptualisation less likely. Speakers' gestures provide additional evidence that they were thinking more in vertical than sagittal terms: overall, 251 gestures were vertical and only 89 were sagittal. (I do not report percentages here because some gestures were both vertical and sagittal). A post-hoc binomial test indicates that these figures

are unlikely under the assumption that each outcome (vertical, sagittal) was equally likely ($p < 0.001$). To conduct a more thorough investigation of the approach-avoidance effect in gestures, one would need to focus on emotionally valenced phrases that do not contain any references to space.

When compared to the number of horizontal gestures ($N = 57$), there were more sagittal gestures ($N = 89$) in the dataset overall. A post-hoc binomial test shows that these figures are unlikely under the null hypothesis of equal proportions ($p = 0.01$). One initial interpretation of this finding is that speakers were more likely to conceptualise emotional valence using the sagittal axis than the horizontal axis. However, subjectively, many sagittal gestures in the dataset seemed to be beat gestures; they seemed to not contain a meaning component, and seemed to function only to stress certain lexical items. Therefore, the higher number of sagittal gestures here may simply reflect the presence of beat gestures in the dataset.

10.3.3. Size-based metaphors of quantity

Another question explored in this study was whether or not conceptualisations of quantity might be conceptually active in speakers using linguistic metaphors that predominantly describe emotional valence. This was tested in the current study by investigating whether speakers tended to gesture more with a closed hand configuration for -valence linguistic metaphors (which can also be viewed as LESS IS SMALL), and more with an open hand configuration for +valence linguistic metaphors (which can also be viewed as MORE IS BIG) (see Henik and Tzelgov, 1982; Andres et al., 2004; Winter et al., 2014). The data did not reveal any reliable differences in hand configuration between -valence and +valence linguistic metaphors.

In the previous two subsections, I cited non-gestural research showing that people are more likely to use a single axis to structure spatial thought than a combination of axes (Woodin & Winter, under review). The fact that speakers used a vertical linguistic metaphor therefore might suggest that they were focusing on the vertical axis, which may have made them less likely to also recruit the horizontal or sagittal axes. Relatedly, if the speaker used a linguistic metaphor pertaining to vertical space, this may suggest that they were conceptualising the source domain VERTICAL SPACE at the expense of another available source domain, such as PHYSICAL SIZE. Therefore, conceptualising both VERTICAL SPACE and PHYSICAL SIZE at the same time seems unlikely, and because VERTICAL SPACE is referenced in the linguistic metaphors that speakers used, this source domain may have a better chance of being conceptualised than PHYSICAL SIZE. Of course, it is still possible that speakers gestured according to a vertical conceptualisation of quantity rather than emotional valence, but this is impossible to determine if we consider that, for instance, an upwards-moving gesture alongside the linguistic metaphor 'raise the standards' aligns with both emotional valence (GOOD IS UP) and quantity (MORE IS UP) conceptual metaphors.

On a more speculative note, we have seen already that financial gains are frequently depicted in TV news broadcasts with green, upwards-facing arrows, and that financial losses are frequently depicted with red, downwards-facing arrows (Winter & Matlock, 2017: 112). Financial gains are normally seen as positive, so in this case it is logical to associate MORE with GOOD, and vice versa. This is also true of the linguistic metaphors in the current study, where larger quantities are associated with +valence, and smaller quantities are associated with -valence. However, it is unclear whether people will still think in terms of MORE IS GOOD and LESS IS BAD conceptual metaphors when an increase in the relevant quantity is unequivocally negative (e.g.,

civilian casualties). It is also unresolved whether people will think about emotional valence in terms of quantity when the emotionally valenced concept has no 'actual' quantity component (e.g., love, peace). Does context matter in the case of conceptual metaphors? This is a question that future research might wish to investigate.

10.4. Articulatory plurality

One final issue explored in the present study is articulatory plurality (Börstell et al., 2016c; Lepic et al., 2016; Östling et al., 2018), the finding that sign language users tend to utilise two-handed signs to depict lexically plural words, and one-handed signs to depict lexically singular words. Relating this concept back to gesture, Börstell and Lepic (under review) found that silent gesturers preferred two-handed gestures for lexically plural concepts, and one-handed gestures for lexically singular concepts. From this, I sought to discover whether this finding held up for co-speech gestures accompanying linguistic metaphors. The data reported here suggest not: speakers did not consistently use both hands to gesture for plural nouns, nor did they consistently use one hand to gesture for singular nouns.

It may be the case, however, that articulatory plurality does extend to gestures depicting concrete rather than abstract concepts. While the notion of plurality is usually necessary and 'real' for concrete concepts, it may be less so for abstract ones, such as emotional valence; in other words, there may be no meaningful conceptual difference between 'standard' and 'standards' in the linguistic metaphors in this study. Moreover, when we metaphorically map qualities from a source domain to a target domain, it is well known that not all the qualities of the source are mapped over to the target. Thus, it is possible that the notion of plurality is not mapped over when people metaphorically construe emotional valence in terms of vertical space. Finally, the fact

that the present study focused solely on variations of one noun (‘standard’) limits the generalisability of the results reported here. Future research might therefore investigate articulatory plurality across a larger selection of phrases that literally (rather than metaphorically) express concrete (rather than abstract) ideas.

* * *

In this section, I have discussed the main quantitative results from the study in relation to the hypotheses investigated in this study. I have also offered additional interpretations of these results and suggested ways that future research could address some of the ambiguities in the data. In the next section, I summarise the study as a whole and come to some tentative conclusions.

11. CONCLUSIONS

Lakoff and Johnson's (1980) Conceptual Metaphor Theory (CMT) has long been criticised for its circular logic (e.g., Murphy, 1996, 1997; see also Gibbs & Colston, 1995), where linguistic metaphors are simultaneously held as reflections of, and evidence, for conceptual metaphors. Many researchers have championed gestures as a means of breaking this circularity (De Ruiter, 2007: 21; see also McNeill, 1992; Goldin-Meadow et al., 1993; Beattie, 2003). By looking at how speakers gesture when they use linguistic metaphors, we can assess whether these linguistic metaphors are conceptually active. Furthermore, Müller (2008) argues that conceptual activation is a gradable phenomenon rather than a binary yes/no decision: there are degrees of metaphoricity.

In this thesis, I have used Hostetter and Alibali's (2008) Gesture as Simulated Action framework to propose three criteria for identifying whether a linguistic metaphor a speaker uses is active at the conceptual level, and to what degree: gesture co-occurrence, gestural fit and gestural effort. I have applied these three criteria to a large-scale, quantitative analysis of gestures in the TV News Archive, looking specifically at linguistic metaphors of emotional valence ('low standards', 'high standards', 'lower the standards', 'raise the standards'). I have attempted to demonstrate the usefulness of the TV News Archive as a resource for gesture research, and to stress the importance of conducting quantitative analyses of gestures.

The main results from the study revealed high rates of gesture co-occurrence, gestural effort and gestural fit overall for the four linguistic metaphors, suggesting that they are highly conceptually active. These three tests also tentatively suggested that metaphorical verbs ('lower', 'raise') are more conceptually active than metaphorical

adjectives (‘low’, ‘high’), although this result could possibly be attributed to the dynamic, motoric properties of these verbs themselves rather than conceptual activation. Emotional valence, agency and animacy did not appear to have an effect on conceptual activation. Overall, more work is needed to verify the validity of these three tests of conceptual activation, and to fine-tune how they are operationalised. In addition, speakers’ gestures did not suggest that they were thinking in line with horizontal or sagittal conceptual metaphors of emotional valence, nor were they thinking in line with size-based conceptual metaphors of quantity. Finally, I found no evidence for articulatory plurality in co-speech gestures.

References

Acquaviva, P. (2008). *Lexical Plurals.* New York, New York: Oxford University Press.

Acquaviva, P. (2016). Structures for plurals. *Lingvisticæ Investigationes.* 39: 217-33.

Adolph, K. E. (1997). Learning in the development of infant locomotion. *Monographs of the Society for Research in Child Development*. 62: 1-140.

Agresti, A. (2002). *Categorical Data Analysis.* 2nd Edition. Hoboken, New Jersey: John-Wiley & Sons.

Alibali, M. W., Heath, D. C. & Myers, H. J. (2001). Effects of visibility between speaker and listener on gesture production: some gestures are meant to be seen. *Journal of Memory & Language*. 44: 169-88.

Alibali, M. W. & Nathan, M. J. (2007). Teachers' gestures as a means of scaffolding students' understanding: Evidence from an early algebra lesson. R. Goldman, R. Pea, B. Barron, & S. J. Derry (eds.). *Video Research in the Learning Sciences*. Mahwah, New Jersey: Erlbaum. 349-65.

Andres, M., Davare M., Pesenti, M., Olivier E. & Seron X. (2004). Number magnitude and grip aperture interaction. *Neuroreport*. 15(18): 2773–7.

Amstrong, D., Stokoe, W. & Wilcox, S. (1995). *Gesture and the Nature of Language.* Cambridge: Cambridge University Press.

Baker, M., & Croft, W. (2017). Lexical categories: Legacy, lacuna, and opportunity for functionalists and formalists. *Annual Review of Linguistics.* 3: 179-97.

Bargh, J. A., Chaiken, S., Govender, R. & Pratto, F. (1992). The generality of the automatic evaluation effect. *Journal of Personality and Social Psychology.* 62(6): 893–912.

Barsalou, L. W. (1999). Perceptual symbol systems. *Behavioral & Brain Sciences*. 22: 577-660.

Barsalou, L. (2008). Grounded cognition. *Annual Review of Psychology*. 71: 230-44.

Bates, D., Maechler, M., Bolker, B., Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software.* 67(1): 1-48.

Beattie, G. (2003). *Visible Thought: The New Psychology of Body Language*. Routledge: London.

Beattie, G. & Shovelton, H. (2002). What properties of talk are associated with the generation of spontaneous iconic hand gestures? *British Journal of Psychology.* 41: 403-17.

Beilock, S. L. & Holt, L. E. (2007). Embodied preference judgments: can likeability be driven by the motor system? *Psychological Science*. 18: 51-7.

Bergen, B. K. (2012). *Louder than Words: The New Science of How the Mind Makes Meaning*. New York, New York: Basic Books.

Bergmann K, Kopp S (2009). Increasing the expressiveness of virtual agents: Autonomous generations of speech and gesture in spatial description tasks. K. S. Decker, J. S. Sichman, C. Sierra & C. Castelfranchi C. *Proceedings of the 8th International Conference on Autonomous Agents and Multiagent Systems*. Ann Arbor, Michigan.

Berg, T. (2000). The position of adjectives on the noun-verb continuum. *English Language and Linguistics*. 4: 269-93.

Biederman, I. & Gerhardstein, P. C. (1993). Recognising depth-rotated objects: evidence and conditions for three-dimensional viewpoint invariance. *Journal of Experimental Psychology: Human Perception and Performance*. 19: 1162-82.

Bierbaum, E. (1990). A paradigm for the ‘90s. *American Libraries.* 21(1): 18.

Black, M. (1993) More about metaphor. A. Onony (ed.) *Metaphor and Thought*. Cambridge: Cambridge University Press: 19-41.

Bloom, H. S. & Price, H. D. (1975). Voter response to short-run economic conditions: the asymmetric effect of prosperity and recession. *The American Political Science Review*, 69: 1240-54.

Borghi, A. M., Glenberg, A. M. & M. P. Kaschak. 2004. Putting words in perspective. *Memory and Cognition*. 32: 863–73.

Börstell, C. & Lepic, R. (under review). More is more: articulatory plurality in the visual-gestural modality.

B rstell, C., H rberg, T. & stling, R. (2016a). Distribution and duration of signs and parts of speech in Swedish Sign Language. *Sign Language Linguistics*. 19: 143–96.

B rstell, C., Lepic, R. & Belsitzman, G. (2016b). A show of hands: plurality as a feature of both-handed forms in silent gesture. *7th Conference of the International Society for Gesture Studies.* Paris, France: Sorbonne Nouvelle University.

B rstell, C., Lepic, R. & Belsitzman, G. (2016c). Articulatory plurality is a property of lexical plurals in sign language. *Lingvisticæ Investigationes*. 39: 391–407.

Boucher, J. & Osgood, C. E. (1969). The polyanna hypothesis. *Journal of Verbal Learning and Verbal Behavior*. 8: 1-8.

Brinkmann, F. (1878). *Die Metaphern: Studien über den Geist der modernen Sprachen. Bd I: Die Thierbilder der Sprache.* Bonn: Adolph Marcus.

Brinton, L. (1988). *The Development of English Aspectual Systems.* Cambridge: Cambridge University Press.

Bruny , T. T., Ditman, T., Mahoney, C. R., Augustyn, J. S. & Taylor, H. A. (2009). When you and I share perspectives: Pronouns modulate perspective-taking during narrative comprehension. *Psychological Science.* 20: 27–32.

Bruny , T. T., Gardony, A., Mahoney, C. R. & Taylor, H. A. (2012). Body-specific representations of spatial location. *Cognition*. 123: 229–39.

Buccino, G., Lui, F., Canessa, N., Patteri, I., Lagravinese, G., Benuzzi, F., et al. (2004). Neural circuits involved in the recognition of actions performed by nonconspecifics: An fMRI study. *Journal of Cognitive Neuroscience*. 16(1): 114–26.

Bulthoff, H. H., Edelman, S. Y. & Tarr, M. J. (1995). How are three-dimensional objects represented in the brain? *Cerebral Cortex.* 5: 247–60.

Bybee, J. (2006). From usage to grammar: the mind's response to repetition. *Language*, 82: 711-33.

Calbris, G. (1990). *The Semiotics of French Gestures.* Bloomington: Indiana University Press.

Cameron, L. (1999). Operationalising 'metaphor' for applied linguistics research. L. Cameron & G. Low (eds.). *Researching and Applying Metaphor.* Cambridge: Cambridge University Press. 3-28.

Cameron, L. (2003). *Metaphor in Educational Discourse*. London: Continuum.

Casasanto, D. (2009). Embodiment of abstract concepts: good and bad in right-and left-handers. *Journal of Experimental Psychology: General*. 138: 351–67.

Casasanto, D. (2010). Space for thinking. V. Evans & P. Chilton (eds.). *Language, Cognition, and Space: State of the Art and New Directions.* 453-78.

Casasanto, D. (2014). Experiential origins of mental metaphors: Language, culture, and the body. M. Landau, M. D. Robinson & B. Meier (eds.). *The Power of Metaphor: Examining Its Influence on Social Life*. Washington, DC: American Psychological Association Books. 249–68.

Casasanto, D. (2017). The hierarchical structure of mental metaphors. B. Hampe

(ed.). *Metaphor: Embodied Cognition and Discourse*. Cambridge: Cambridge University Press. 46–61.

Casasanto, D. & Bottini, R. (2014). Spatial language and abstract concepts. *WIREs Cognitive Science*. 5(2): 139–49.

Casasanto, D. & Chrysikou, E. G. (2011). When left is “right” motor fluency shapes abstract concepts. *Psychological Science*. 22: 419–22.

Casasanto, D. & Dijkstra, K. (2010). Motor action and emotional memory. *Cognition.* 115: 179-85.

Casasanto, D. & Jasmin, K. (2010). Good and bad in the hands of politicians: Spontaneous gestures during positive and negative speech. *PLoS ONE*. 5(7): e11805.

Casasanto, D., & Jasmin, K. (2012). The hands of time: Temporal gestures in English speakers. *Cognitive Linguistics.* 23(4): 643–74.

Castaño, E., Gilboy, E., Feijóo, S., Serrat, E., Rostan, C., Hilferty, J., Cunillera, T. (2018). Hand position and response assignment modulate the activation of the valence-space conceptual metaphor. *Cognitive Science.* 20(1): 1-22.

Çatak, E. N., Açik, A. & Göksun, T. (2018). The relationship between handedness and valence: a gesture study. *Quarterly Journal of Experimental Psychology.* 00(0): 1-12.

Centerbar, D. B. & Clore, G. L. (2006). Do approach-avoidance actions create attitudes? *Psychological Science.* 17: 22–9.

Chawla, P. & Krauss, R. M. (1994). Gesture and speech in spontaneous and rehearsed narratives. *Journal of Experimental Social Psychology*. 30: 580-601.

Chen, M. & Bargh, J. A. (1999). Consequences of automatic evaluation: Immediate behavioural predispositions to approach or avoid the stimulus. *Personality &*

Social Psychology Bulletin. 25: 215–24.

Chinello, A., de Hevia, M. D., Geraci, C. & Girelli, L. (2012). Finding the spatial-numerical association of response codes (SNARC) in signed numbers: notational effects in accessing number representation. *Functional Neurology.* 27 (3): 177-85.

Chung, S. & Timberlake, A. (1985). Tense, aspect, and mood. T. Shopen (ed.). *Language Typology and Syntactic Description: Grammatical Categories and the Lexicon.* Cambridge: Cambridge University Press. 202-58.

Cienki, A. (1998). Metaphoric gestures and some of their relations to verbal metaphoric expressions. J.-P. Koenig (ed.). *Discourse and Cognition: Bridging the Gap*. Stanford, California: Center for the Study of Language and Information. 189–204.

Cienki, A. (2008). Why study metaphor and gesture? A. Cienki and C. Muller (eds.). Amsterdam: John Benjamins. 5-26.

Cienki, A. & Müller, C. (2008). Metaphor, gesture, and thought. R. W. Gibbs Jr. (ed.). *The Cambridge Handbook of Metaphor and Thought.* Cambridge: Cambridge University Press. 483-501.

Clark, H. H. & Clark, E. (1977). Psychology and language: An introduction to psycholinguistics. New York, New York: Harcourt Brace Jovanovich.

Clark, N., Perlman, M., Falck, M. J. (2013). Iconic pitch expresses vertical space. M. Borkent, B. Dancygier & J. Hinnell (eds.) *Language and the Creative Mind.* Stanford, California: CSLI Publications.

Comrie, B. (1976). *Aspect: An Introduction to the Study of Verbal Aspect and Related Problems*. Cambridge: Cambridge University Press.

Connell, L. & Lynott, D. (2016). Do we know what we're simulating? Information loss

in transferring unconscious perceptual simulation to conscious imagery. *Journal of Experimental Psychology: Learning, Memory and Cognition.* 48: 1218-32.

Cooperrider, K., & Núñez, R. (2009). Across time, across the body: Transversal temporal gestures. *Gesture*, 9(2): 181–206.

Corballis, M. C. (2002). *From Hand to Mouth: The Origins of Language*. Princeton, New Jersey: Princeton University Press.

Crasborn, O. & S f r, A. (2016). An annotation scheme to investigate the form and function of hand dominance in the Corpus NGT. R. Pfau, M. Steinbach & A. Herrmann (eds.). *A Matter of Complexity*. Boston, Massachusetts: De Gruyter Mouton & Ishara Press. 231–51.

Croft, W. 2012. *Verbs: Aspect and Causal Structure*. Oxford: Oxford University Press.

Dahl, . (1985). *Tense and Aspect Systems*. New York, New York: Basil Blackwell.

Davies, M. (2018). The 14 billion word iWeb corpus [online]. Available at: https://corpus.byu.edu/iWeb/ [Accessed 8th July 2018].

Decety, J., Grezes, J., Costes, N., Perani, D., Jeannerod, M., Procyk, E., et al. (1997). Brain activity during observation of actions. Influence of action content and subject's strategy. *Brain*. 120(Pt. 10): 1763–77.

Decety, J. & Jeannerod, M. (1995). Mentally simulated movements in virtual reality: Does Fitts's law hold in mental imagery? *Behavioural Brain Research.* 72: 127-134.

Decety, J., Jeannerod, M. & Prablanc, C. (1989). The timing of mentally represented actions. *Behavioural Brain Research*. 34: 35-42.

Dehaene, S., Bossini, S. & Giraux, P. (1993). The mental representation of parity and number magnitude. *Journal of Experimental Psychology: General.* 122(3): 371-

96.

de la Fuente, J., Casasanto, D., Rom n, A. & Santiago, J. (2014). Can culture influence body-specific associations between space and valence? *Cognitive Science*. 39: 821–32.

Delaporte, Y. & Shaw, E. (2009). Gesture and signs through history. *Gesture.* 9(1): 35-60.

de la Vega, I., De Filippis, M., Lachmair, M., Dudschig, C. & Kaup, B. (2012). Emotional valence and physical space: limits of interaction. *Journal of Experimental Psychology: Human Perception and Performance*. 38: 375–85.

den Dulk, P., Heerebout, B. T. & Phaf, R. H. (2003). A computational study into the evolution of dual-route dynamics for affective processing. *Journal of Cognitive Neuroscience*. 15: 194–208.

Derbyshire, N., Ellis, R. & Tucker, M. (2006). The potentiation of two components of the reach-to-grasp action during object categorisation in visual memory. *Acta Psychologica*. 122: 74–98.

De Ruiter, J. P. (2007). Postcards from the mind: the relationship between speech, imagistic gesture and thought. *Gesture*. 7(1): 21-38.

Dingemanse, M., Blasi, D. E., Lupyan, G., Christiansen, M. H., & Monaghan, P. (2015). Arbitrariness, iconicity, and systematicity in language. *Trends in Cognitive Science*. 19: 603–15.

Ditman, T., Bruny , T. T., Mahoney, C. R. & Taylor, H. A. (2010). Simulating an enactment effect: Pronouns guide action simulation during narrative comprehension. *Cognition.* 115: 172–8.

Duncan, S. (2002). Gesture, verb aspect, and the nature of iconic imagery in natural discourse. *Gesture*. 2: 183-206.

Ellis, R. & Tucker, M. (2000). Micro-affordance: The potentiation of components of action by seen objects. *British Journal of Psychology*. 91: 451-71.

Ferrero, G. (1894). L'inertie mentale et la loi du moindre effort. *Revue Philosophique de la France et de l'Étranger.* 37: 169–82.

Feyereisen, P. & Havard, I. (1999). Mental imagery and production of hand gestures while speaking in younger and older adults. *Journal of Nonverbal Behavior*. 23: 153-71.

Forceville, C. (1994). Pictorial metaphor in advertisements. *Metaphor and Symbolic Activity.* 9(1): 1-29.

Fox, J. (2003). Effect displays in R for generalised linear models. *Journal of Statistical Software.* 8(15): 1-27.

Fox, J. & Hong, J. (2009). Effect displays in R for multinomial and proportional-odds logit models: extensions to the effects package. *Journal of Statistical Software*. 32(1): 1-24.

Fox, P. T., Pardo, J. V., Petersen, S. E. & Raichle, M. E. (1987). Supplementary motor and premotor responses to actual and imagined hand movements with positron emission tomography. *Neuroscience Abstracts*. 1433.

Frawley, W. 1992. *Linguistic Semantics*. New York, New York: Routledge.

Frijda, N. (1986). *The Emotions*. Cambridge: Cambridge University Press.

Gable, S. L., Reis, H. T. & Elliot, A. J. (2000). Behavioral activation and inhibition in everyday life. *Journal of Personality and Social Psychology.* 78(6): 1135–49.

Gallese, V. & Lakoff, G. (2005). The brain's concepts: The role of the sensory-motor system in conceptual knowledge. *Cognitive Neuropsychology.* 22(3): 455–79.

Gentilucci, M., Benuzzi, F., Gangitano, M. & Grimaldi, S. (2001). Grasp with hand and mouth: A kinematic study on healthy subjects. *Journal of Neurophysiology*.

86(4): 1685–99.

Gerds, T. A. & Ozenne, B. (2018). Publish: format output of various routines in a suitable way for reports and publication. R package version 2018.04.17. Available from: https://CRAN.R-project.org/package=Publish [Accessed 17th August 2018].

Gibbs Jr., R. W. (1994). *The Poetics of Mind. Figurative, Thought, Language and Understanding.* Cambridge: Cambridge University Press.

Gibbs Jr., R. W. (2005). *Embodiment and Cognitive Science.* Cambridge: Cambridge University Press.

Gibbs Jr., R. W. (2006). Metaphor interpretation as embodied simulation. *Mind & Language.* 21(3): 434-58.

Gibbs Jr., R. W. (2011). Evaluating conceptual metaphor theory. *Discourse Processes.* 48(8): 529-62.

Gibbs Jr., R. W. & Colston, H. L. (1995). The cognitive psychological reality of image schemas and their transformations. *Cognitive Linguistics.* 6: 347–78.

Gibbs Jr., R. W. & Matlock, T. (2008). Metaphor, imagination, and simulation. R. W. Gibbs Jr. (ed.). *The Cambridge Handbook of Metaphor and Thought.* Cambridge: Cambridge University Press. 161-76.

Gibson, J. J. (1979). *The Ecological Approach to Visual Perception*. Hillsdale, New Jersey: Erlbaum.

Giv n, T. (2001 [1984]). *Syntax: A Functional-Typological Introduction*. *Vol. 1*. Amsterdam: John Benjamins.

Glenberg, A. & Kaschak (2002). Grounding language in action. *Psychonomic Bulletin & Review*. 9: 558-65.

Goldin-Meadow, S., Alibali, M. & Church, R. B. (1993). Transitions in concept

acquisition: Using the hand to read the mind. *Psychological Review.* 100: 279–97.

Goldin-Meadow, S., McNeill, D. & Singleton, J. L. (1996). Silence is liberating: removing the handcuffs on grammatical expression in the manual modality. *Psychological Review*. 103(1): 34–55.

Grady, J. (1997). *Foundation of Meaning: Primary Metaphors and Primary Scenes*. Unpublished doctoral dissertation. University of California. Berkeley, California.

Grezes, J., Armony, J. L., Rowe, J. & Passingham, R. E. (2003). Activations related to "mirror" and "canonical" neurones in the human brain: An fMRI study. *NeuroImage*. 18(4): 928–37.

Hadar, U., Burstein, A., Krauss, R. M. & Soroker, N. (1998). Ideational gestures and speech in brain-damaged subjects. *Language & Cognitive Processes.* 13: 59-76.

Hadar, U., Wenkert-Olenik, D., Krauss, R. & Soroker, N. (1998). Gesture and the processing of speech: Neuropsychological evidence. *Brain and Language*. 62(1): 107–26.

Hanks, P. (2006). Metaphoricity is gradable. A. Stefanowitsch & S. Gries (eds.). *Corpora in Cognitive Linguistics: Vol. 1: Metaphor and Metonymy*. Berlin: Mouton de Gruyter.

Hartmann, M., Grabherr, L. & Mast, F.W. (2012). Moving along the mental number line: interactions between whole-body motion and numerical cognition. *Journal of Experimental Psychology Human Perception and Performance*. 38(6): 1416-27.

Hauk, O., Johnsrude, I. & Pulvermüller, F. (2004). Somatotopic representation of action words in human motor and premotor cortex. *Neuron.* 41: 301-7.

Heerebout, B. T. & Phaf, R. H. (2010a). Emergent oscillations in evolutionary simulations. *Journal of Cognitive Neuroscience*. 22: 807–23.

Heerebout, B. T. & Phaf, R. H. (2010b). Good vibrations switch attention: an affective function for network oscillations in evolutionary simulations. *Cognitive, Affective, & Behavioural Neuroscience*. 10: 217–29.

Heine, B. & Kuteva, T. (2002). *World Lexicon of Grammaticalization*. Cambridge: Cambridge University Press.

Henik, A. & Tzelgov, J. (1982). Is three greater than five: the relation between physical and semantic size in comparison tasks. *Memory & Cognition.* 10(4): 389–95.

Horton, W. S. & Rapp, D. N. (2003). Out of sight, out of mind: Occlusion and the accessibility of information in narrative comprehension. *Psychonomic Bulletin and Review.* 10(1): 104 –10.

Hostetter, A. B. & Alibali, M. W. (2007). Raise your hand if you're spatial: relations between verbal and spatial skills and gesture production. *Gesture.* 7: 73-95.

Hostetter, A. B. & Alibali, M. W. (2008). Visible embodiment: gestures as simulated action. *Psychonomic Bulletin & Review.* 15(3): 495-514.

Hostetter, A. B., Bieda, K., Alibali, M. W., Nathan, M. & Knuth, E. J. (2006). Don't just tell them, show them! Teachers can intentionally alter their instructional gestures. R. Sun (ed.). *Proceedings of the 28th Annual Conference of the Cognitive Science Society.* Mahwah, New Jersey: Erlbaum. 1523-1528.

Hostetter, A. B. & Hopkins, W. D. (2002). The effect of thought structure on the production of lexical movements. *Brain & Language.* 82: 22-9.

Hurlbert, S. H. (1984). Pseudoreplication and the design of ecological field experiments. *Ecological Monographs*. 54(2): 187-211.

Jacobson, E. (1931). Electrical measurements of neuromuscular states during mental activities. *American Journal of Physiology*. 96: 116-21.

Jeannerod, M. (1994). The representing brain: Neural correlates of motor intention and imagery. *Behavioral & Brain Sciences.* 17: 187-245.

Jeannerod, M. (1995). Mental imagery in the motor context. *Neuropsychologia*. 33(11): 1419-32.

Jeannerod, M. (2001). Neural simulation of action: A unifying mechanism for motor cognition. *NeuroImage*. 14: S103-S109.

Johnson, R. C., Thomson, C. W. & Frincke, G. (1960). Word values, word frequency, and visual duration thresholds. *Psychological Review*. 67(5): 332–42.

Johnston, V. S. (2003). The origin and function of pleasure. *Cognition and Emotion*. 17: 167-79.

Jordan, N. (1965). The asymmetry of liking and disliking. A phenomenon meriting further reflection and research. *Public Opinion Quarterly*. 29: 315-22.

Kahneman, D., Knetsch, J. L. & Thaler, R. H. (1990). Experimental tests of the endowment effect and the Coase theorem. *Journal of Political Economy*. 98: 1325-48.

Kahneman, D. & Tversky, A. (1979). Prospect theory: an analysis of decisions under risk. *Econometrica*. 47: 263-91.

Kassin, S. (2005). Psychology in Modules. New Jersey: Pearson/Prentice Hall.

Kilner, J. M., Paulignan, Y. & Blakemore, S.-J. (2003) An interference effect of observed biological movement on action. *Current Biology.* 13: 522–25.

Kita, S., Alibali, M. & Chu, M. (2017). How do gestures influence thinking and speaking? The Gesture-for-Conceptualization hypothesis. *Psychological Review.* 124(3): 245-66.

Klatzky, R. L., Pellegrino, J.W., McCloskey, B.P. & Doherty, S. (1989). Can you squeeze a tomato? The role of motor representations in semantic sensibility judgments. *Journal of Memory and Language*. 28: 56-77.

Klima, E. S. & Bellugi, U. (1979). Iconicity in signs and signing. E. S. Klima & U. Bellugi (eds.). *The Signs of Language*. Cambridge, Massachusetts: Harvard University Press. 9–34.

Kloumann, I. M., Danforth, C. M., Harris, K. D., Bliss, C. A. & Dodds, P. S. (2012). Positivity of the English language. *PLoS One*. 7: e29484.

König, E. (1991). *The Meaning of Focus Particles: A Comparative Perspective.* London: Routledge.

Kosslyn, S. M. (1980). *Image and Mind*. Cambridge, Massachusetts: Harvard University Press.

Kosslyn, S. M. (1994). *Image and Brain: The Resolution of the Imagery Debate*. Cambridge, Massachusetts: MIT Press.

Kosslyn, S. M., Thompson, W.L. & Ganis, G. (2006). *The Case for Mental Imagery*. Oxford: Oxford University Press.

Kövesces, Z. (2002). *Metaphor: A Practical Introduction*. Oxford: Oxford University Press.

Krauss, R. M. (1998). Why do we gesture when we speak? *Current Directions in Psychological Science*. 7: 54-60.

Krauss, R. & Hadar, U. (1999). The role of speech-related arm/hand gesture in word retrieval. L. S. Messing & R. Campbell (eds.), *Gesture, Speech, and Sign*. Oxford: Oxford University Press.

Kulvicki, J. (2015). Sound stimulants: Defending the stable disposition view. D. Stokes, M. Matthen & S. Biggs (eds.). *Perception and its Modalities*. Oxford: Oxford

University Press. 205-21.

Kuperman, V., Estes, Z., Brysbaert, M. & Warriner, A. B. (2014). Emotion and language: valence and arousal affect word recognition. *Journal of Experimental Psychology*: General. 143(3): 1065-81.

Kurzer, N. C., Rozin, P. & Royzman, E. (2000). Individual differences in negativity bias. Unpublished raw data.

Kuteva, T. (2001). *Auxiliation: An Enquiry into the Nature of Grammaticalization*. Oxford: Oxford University Press.

Kyratzis, S. (2003*). A New Metaphor for Metaphor: Evidence for a Single Dynamic Metaphorical Category*. Unpublished manuscript.

Lakoff, G. (1993). The contemporary theory of metaphor. A. Ortony (ed.). *Metaphor and Thought.* Cambridge: Cambridge University Press. 202-51.

Lakoff, G. & Johnson, M. (1980). *Metaphors We Live By.* London: Chicago University Press.

Lakoff, G. & Turner, M. (1989). *More than Cool Reason: A Field Guide to Poetic Metaphors.* Chicago: Chicago University Press.

Langacker, R.W. (1987). *Foundations of Cognitive Grammar: Theoretical Prerequisites*. Stanford, California: Stanford University Press.

Langacker, R. W. (2000). A dynamic usage-based model. S. Kemmer & M. Barlow (eds.). *Usage-Based Models of Language*. Stanford, California: CSLI Publications. 1-63.

Langacker, R. W. (2008). *Cognitive Grammar: A Basic Introduction*. Oxford: Oxford University Press.

Lanwer, J. (2017). Apposition: A multimodal construction? The multimodality of linguistic constructions in the light of usage-based theory. *Linguistics Vanguard*.

3: 1-12.

Lepic, R., B rstell, C., Belsitzman, G. & Sandler, W. (2016). Taking meaning in hand: iconic motivations for both-handed signs. *Sign Language Linguistics*. 19: 37–81.

Levelt, W. J. M., Richardson, G. & La Heij, W. (1985). Pointing and voicing in deictic expressions. *Journal of Memory and Language.* 24: 133–64.

Levshina, N. (2015). *How to Do Linguistics with R: Data Exploration and Statistical Analysis*. Amsterdam: John Benjamins.

Lewick, M., Czapinski, J. & Peeters, G. (1992). Positive-negative asymmetry or 'When the heart needs a reason'. *European Journal of Social Psychology.* 22: 425-34.

MacSweeney, M., Campbell, R., Woll, B., Giampietro, V., David, A. S., McGuire, P. K., et al. (2004). Dissociating linguistic and nonlinguistic gestural communication in the brain. *NeuroImage*. 22(4): 1605–18.

MacSweeney, M., Woll, B., Campbell, R., McGuire, P. K., David, A. S., Williams, S. C., et al. (2002). Neural systems underlying British sign language and audio-visual English processing in native users. *Brain*. 125(Pt. 7): 1583–93.

Madden, C. J. & Therriault, D. J. (2009). Verb aspect and perceptual simulations. *The Quarterly Journal of Experimental Psychology.* 62(7): 1294–302.

Madden, C. J. & Zwaan, R. A. (2003). How does verb aspect constrain event representations? *Memory & Cognition.* 31(5): 663–72.

Marmolejo-Ramos, F., Correa, J., Sakarksr, G., Ngo, G., Ruiz-Fernández, S., Butcher, N. & Yamada, Y. (2017). Placing joy, surprise and sadness in space: a cross-linguistic study. *Psychological Research.* 81(4): 750-64.

Marmolejo-Ramos, F., Elosu´a, M. R., Montoro, P., Contreras, M. J. & Jiménez, W. A.

(2014). The activation of representative emotional verbal contexts interacts with vertical spatial axis. *Cognitive Processing*. 15: 253–67.

Marmolejo-Ramos, F., Tirado, C., Arshamian, E., Vélez, J. I. & Arshamian, A. (2018). The allocation of valenced concepts onto 3D space. *Cognition and Emotion.* 32(4): 709-19.

Matlock, T., Ramscar, M., & Boroditsky, L. (2005). The experiential link between spatial and temporal language. *Cognitive Science*. 29: 655–64.

Matlock, T., Sparks, D., Matthews, J.L., Hunter, J. & Huette, S. (2012). Smashing new results on aspectual framing. *Studies in Language*. 36: 700-21.

Matthen, M. (2010). On the diversity of auditory objects. *Review of Philosophy and Psychology.* 1(1): 63-89.

McGlone, M. S. & Harding, J. L. (1998). Back (or forward?) to the future: The role of perspective in temporal language comprehension. *Journal of Experimental Psychology: Learning, Memory, & Cognition.* 24: 1211–23.

McNeill, D. (1992). *Hand and Mind: What Gestures Reveal about Thought.* Chicago: University of Chicago Press.

McNeill, D. (2005). *Gesture and Thought.* Chicago: University of Chicago Press.

McNeill, D., & Duncan S. (2000). Growth points in thinking-for-speaking. D. McNeill (ed.). *Language and Gesture*. Cambridge: Cambridge University Press. 141–61.

McNeill, D. & Levy, E. (1982). Conceptual representations in language activity and gesture. R. J. Jarvella & W. Klein (eds.). *Speech Place and Action.* Hoboken, New Jersey: John Wiley & Sons.

Melinger, A. & Kita, S. (2007). Conceptualisation load triggers gesture production. *Language & Cognitive Processes*. 22: 473-500.

Meier, B. P. & Robinson, M. D. (2004). Why the sunny side is up: associations between affect and vertical position. *Psychological Science*. 15(4): 243-7.

Méndez-Naya, B. (2008). Special issue on English intensifiers. *English Language and Linguistics.* 12(2): 213-9.

Miall, R. C. & Wolpert, D. M. (1996) Forward models for physiological motor control. *Neural Networks.* 9: 1265–79.

Mihatsch, W. (2016). Collectives, object mass nouns and individual count nouns. *Lingvisticæ Investigationes.* 39: 289-308.

Moller, A. C., Elliot, A. J. & Maier, M. A. (2009). Basic hue-meaning associations. *Emotion.* 9(6): 898-902.

Morrow, D. G. (1985). Prepositions and verb aspect in narrative understanding. *Journal of Memory and Language*. 24(4): 390–404.

Morsella, E. & Krauss, R. M. (2004). The role of gestures in spatial working memory and speech. *American Journal of Psychology.* 117: 411-24.

Moulton, S. T. & Kosslyn, S. M. (2009). Imagining predictions: mental imagery as mental emulation. *Philosophical Transactions of the Royal Society B: Biological Sciences*. 364: 1273-80.

Müller, C. (1998). *Redebegleitende Gesten. Kulturgeschichte – Theorie – Sprachvergleich*. Berlin: Berlin Verlag Arno Spitz.

Müller, C (2008). *Metaphors Dead and Alive, Sleeping and Waking: A Dynamic View.* London: University of Chicago Press.

Müller, C., Cienki, A., Fricke, E., Ladewig, S.H., McNeill, D. & Teßendorf, S. (eds.) (2013). *Body – Language – Communication: An International Handbook on Multimodality in Human Interaction (Handbooks of Linguistics and Communication Science 1).* Berlin: De Gruyter Mouton.

Murphy, G. L. (1996). On metaphorical representation. *Cognition*. 60: 173-204.

Murphy, G. L. (1997). Reasons to doubt the present evidence for metaphoric representation. *Cognition*. 62: 99-108.

Murphy, M. L. (2010). *Lexical Meaning*. Cambridge: Cambridge University Press.

Nacey, S. (2013). *Metaphors in Learner English.* Amsterdam: John Benjamins.

Navarro, D. J. (2015). Learning statistics with R: a tutorial for psychology students and other beginners [online]. R package version 0.5. University of Adelaide: Adelaide, Australia. Available from: http://ua.edu.au/ccs/teaching/lsr [Accessed 23rd July 2018]

O'Callaghan, C. (2009). Sounds and events. M. Nudds & C. O'Callaghan (eds.). *Sounds & Perception*. *New Philosophical Essays*. Oxford: Oxford University Press. 26-49.

Oppenheimer, D. M. (2008). The secret life of fluency. *Trends in Cognitive Science*. 12(6): 237-41.

Östling, R., Börstell, C. & Courtaux, S. (2018). Visual iconicity across sign languages: large-scale automated video analysis of iconic articulators and locations. *Frontiers in Psychology*. 9(725): 1-17.

Padden, C., Hwang, S.-O., Lepic, R. & Seegers, S. (2015). Tools for language: patterned iconicity in sign language nouns and verbs. *Topics in Cognitive Science.* 7(1): 81–94.

Padden, C., Meir, I., Hwang, S. -O., Lepic, R., Seegers, S. & Sampson, T. (2013). Patterned iconicity in sign language lexicons. *Gesture*. 13(3): 287–308.

Pasnau, R. (2000). Sensible qualities: The case of sound. *Journal of the History of Philosophy*. 38(1): 27-40.

Peeters, G. (1971). The positive-negative asymmetry: on cognitive consistency and

positivity bias. *European Journal of Social Psychology*. 1: 455-74.

Peeters, G. (1989). Evaluative inference in social cognition: the role of direct versus indirect evaluation and positive-negative asymmetry. *European Journal of Social Psychology.* 21: 131-146.

Peeters, G. & Czapinski, J. (1990). Positive-negative asymmetry in evaluations: the distinction between affective and informational effects. W. Stroebe & M. Hewstone (eds.). *European Review of Social Psychology*. Vol. 1. New York, New York: Wiley. 33-60.

Perlman, M. (2010). Talking fast: The use of speech rate as iconic gesture. F. Perrill, V. Tobin & M. Turner (eds.). *Meaning, Form, and Body*. Stanford, California: CSLI Publications. 245-62.

Perlman, M. & Cain, A. (2014). Iconicity in vocalization, comparisons with gesture, and implications for the evolution of language. *Gesture*. 14: 320-50.

Perlman, M., Clark, N. & Johansson, F. M. (2015). Iconic prosody in story reading. *Cognitive Science.* 39(6): 1348-68.

Perlman, M. & Gibbs, R. W., Jr. (2013). Sensorimotor simulation in speaking, gesturing, and understanding. C. Müller, A. J. Cienki, E. Fricke, S. H. Ladewig, D. McNeill & S. Teßendorf (eds.). *Body – Language – Communication: An International Handbook on Multimodality in Human Interaction.* Berlin: De Gruyter. 512–32.

Phaf, R. H., Mohr, S. E., Rotteveel, M., Wicherts, J. M. (2014). Approach, avoidance, and affect: a meta-analysis of approach-avoidance tendencies in manual reaction time tasks. *Frontiers in Psychology.* 5: 1-16.

Poggi, I. (2008). Iconicity in different types of gestures. *Gesture*. 8(1): 45–61.

Pulvermüller, F. (2005). Brain mechanisms linking language and action. *Nature*

Reviews Neuroscience. 6: 576-82.

Pratt, C. (1930). The spatial character of high and low tones. *Journal of Experimental Psychology*. 13: 278–85.

Rauscher, F. H., Krauss, R. M. & Chen, Y. (1996). Gesture, speech, and lexical access: The role of lexical movements in speech production. *Psychological Science.* 7: 226-31.

R Core Team (2017). R: A language and environment for statistical computing [online]. Version 3.4.3. *R Foundation for Statistical Computing*. Vienna, Austria. Available from: https://www.R-project.org/ [Accessed 12th March 2018].

Rice, S. & Newman, J. (2004). Aspect in the making: a corpus analysis of English aspect-marking prepositions. M. Achard & S. Kemmer (eds.) *Language, Culture and Mind*. Stanford, California: CSLI Publications. 313-27.

Richardson, D.C. & Matlock, T. (2007) The integration of figurative language and static depictions: An eye movement study of fictive motion, *Cognition*. 102: 129-38.

Rizzolatti, G., Fadiga, L., Gallese, V. & Fogassi, L. (1996). Pre-motor cortex and the recognition of motor actions. *Cognitive Brain Research*. 3, 131-41.

Rodway, P., Wright, L., & Hardie, S. (2003). The valence-specific laterality effect in free viewing conditions: the influence of sex, handedness, and response bias. *Brain and Cognition*. 53: 452–63.

Roland, P. E., Meyer, E., Shibaski, T., Yamamoto, Y. L. & Thompson, C. J. (1982). Regional cerebral blood flow changes in cortex and ganglia during voluntary movements in normal human volunteers. *Journal of Neurophysiology.* 48: 467-78.

Rozin, P., Millman, L. & Nemeroff, C. (1986). Operation of the laws of sympathetic

magic in disgust and other domains. *Journal of Personality and Social Psychology*. 50, 703-12.

Rozin, P., Nemeroff, C., Wane, M. & Sherrod, A. (1989). Operation of the sympathetic magical law of contagion in interpersonal attitudes among Americans*. Bulletin of the Psychonomic Society*. 27: 367-70.

Rozin, P. & Royzman, E. B. (2001). Negativity bias, negativity dominance, and contagion. *Personality and Social Psychology Review.* 5(4): 296-320.

RStudio Team (2015). RStudio: integrated development for R [online]. Version 1.1.423. *RStudio, Inc*. Boston, Massachusetts. Available from: http://www.rstudio.com/ [Accessed 26th April 2018].

Rusconi, E., Kwan, B., Giordano, B., Umilt , C. & Butterworth, B (2005). Spatial representation of pitch height: The SMARC effect. *Cognition.* 1: 1-17.

Santiago, J., Ouellet, M., Román, A., & Valenzuela, J. (2012). Attentional factors in conceptual congruency. *Cognitive Science.* 36: 1051–77.

Saraiva, A. C., Schüür, F., & Bestmann, S. (2013). Emotional valence and contextual affordances flexibly shape approach-avoidance movements. *Frontiers in Psychology*. 4: 933.

Saussure, F. de (1966). *Course in General Linguistics*. Translated by W. Baskin. New York: McGraw-Hill Book Company.

Schoonjans, S., Feyaerts, K. & Br ne, G. (2013). Analyzing German modal particles as multimodal constructions. Paper presented at *Mapping Multimodal Dialogue*. Aachen, Germany.

Seno, T., Kawabe, T., Ito, H. & Sunaga, S. (2013). Vection modulates emotional valence of autobiographical episodic memories. *Cognition*. 126(1): 115-20.

Shaw, W. A. (1940). The relation of muscular action potentials to imaginal weight

lifting. *Archives of Psychology*. 35: 5-50.

Slobin, D. I. (1987). Thinking for speaking. *Proceedings of the Thirteenth Annual Meeting of the Berkeley Linguistics Society.* 435-45.

Solarz, A. K. (1960). Latency of instrumental responses as a function of compatibility with the meaning of eliciting verbal signs. *Journal of Experimental Psychology,* 59, 239–45.

Sperry, R W. (1952). Neurology and the mind–brain problem. *American Scientist.* 40: 291-312.

Stanfield, R. A. & Zwaan, R.A. (2001). The effect of implied orientation derived from verbal context on picture recognition. *Psychological Science.* 12: 153-6.

Stanley, J., Gowen, E. & Miall, R. C. (2007) Effects of agency on movement interference during observation of a moving dot stimulus. *Journal of Experimental Psychology: Human Perception and Performance*. 33: 915–26.

Stephan, K. M., Fink, G. R., Frith, C. D. & Frackoviak, R. S. J. (1933). Functional anatomy of mental representation of hand movements in healthy subjects. *International Union of Physiological Sciences, Glasgow: Abstracts*. 49 7/P.

Stern, D. (1985). *The Interpersonal World of the Infant*. New York, New York: Basic Books.

Stevenson, H. N. C. (1954). Status evaluation in the Hindu caste system. *Journal of the Royal Anthropological Institute of Great Britain and Ireland*. 84: 45-65.

Steyvers, M. & Tenenbaum, J. B. (2005). The large- scale structure of semantic networks: statistical analyses and a model of semantic growth. *Cognitive Science*. 29(1): 41–78.

Streeck, J. (2008). Depicting by gesture. *Gesture.* 8(3): 285-301.

Strik Lievers, F. & Winter, B. (2018). Sensory language across lexical categories.

Lingua. 204:
45-61.

Taub, S. F. (2001). *Language from the Body: Iconicity and Metaphor in ASL*. Cambridge: Cambridge University Press.

Tucker, M., & Ellis, R. (1998). On the relations between seen objects and components of potential actions. *Journal of Experimental Psychology: Human Perception & Performance*. 24: 830-46.

Tuuri, K. & Pirhonen, A. (2013). Gestural expressions in use for unveiling dynamic experience attributed to verbs. *Proceedings of the 10th International Gesture Workshop and the 3rd Gesture and Speech in Interaction Conference*. Tilburg: Tilburg University.

Tversky, A. & Kahneman, D. (1991). Loss aversion in riskless choice: a reference-dependent model. *The Quarterly Journal of Economics*. 106: 1039-61.

Tversky, B. (2011). Visualizing thought. *Topics in Cognitive Science.* 3: 499-535.

Tversky, B., Kugelmass, S. & Winter, A. (1991). Cross-cultural and developmental trends in graphic productions. *Cognitive Psychology*. 23: 515-57.

Unkelbach, C. (2012). Positivity advantages in social information processing. *Social and Personality Psychology Compass*. 6(1): 83–94.

Unkelbach, C., von Hippel, W., Forgas, J. P., Robinson, M. D., Shakarchi, R.J. & Hawkins, C. (2010). Good things come easy: Subjective exposure frequency and the faster processing of positive information. *Social Cognition*. 28(4): 538–55.

Van den Bergh, O., Vrana, S. & Eelen, P. (1990). Letters from the heart: affective categorization of letter combinations in typists and nontypists. *Journal of Experimental Psychology: Learning, Memory and Cognition*. 16: 1153-61.

Van Strien, J. W. & Van Beek, S. (2000). Ratings of emotion in laterally presented faces: sex and handedness effects. *Brain and Cognition*. 44: 645–52.

Varela, F. J., Thompson, E. & Rosch, E. (1993). *The Embodied Mind: Cognitive Science and Human Experience.* Cambridge, Massachusetts: MIT Press.

Vuilleumier, P., Henson, R. N., Driver, J. & Dolan, R. J. (2002). Multiple levels of visual object constancy revealed by event-related fMRI of repetition priming. *Nature Neuroscience* 5. 491– 9.

Walker, E. & Cooperrider, E. (2016). The continuity of metaphor: evidence from temporal gestures. *Cognitive Science.* 40: 481-95.

Wang, L. & Chu, M. (2013). The role of beat gesture and pitch accent in semantic processing: An ERP study. *Neuropsychologia.* 51: 2847-55.

Warriner, A. B. & Kuperman, V. (2014). Affective biases in English are bi-dimensional. *Cognition and Emotion.* 29(7): 1147-67.

Warriner, A. B., Kuperman, V., Brysbaert, M. (2013). Norms of valence, arousal, and dominance for 13,915 English lemmas. *Behavior Research Methods.* 45: 1191-207.

Wehner, T., Vogt, S. & Stadler, M. (1984). Task-specific EMG characteristics during mental training. *Psychological Research*. 46: 389-401.

Wickham, H. (2017). tidyverse: easily install and load the 'tidyverse' [online]. R package version 1.2.1. Available from: https://CRAN.R-project.org/package=tidyverse [Accessed 26th April 2018].

Wickham, W., François, R., Henry, L. & Müller, K. (2018). dplyr: a grammar of data manipulation. R package version 0.7.5. Available from: https://CRAN.R-project.org/package=dplyr [Accessed 17th August 2018].

Wickham, H. & Henry, L. (2018). tidyr: Easily Tidy Data with 'spread()' and 'gather()'

Functions [online]. R package version 0.8.0. Available from: https://CRAN.R-project.org/package=tidyr [Accessed 4th May 2018].

Wilson, N. L. & Gibbs Jr., R. W. (2007). Real and imagined body movement primes metaphor comprehension. *Cognitive Science.* 31: 721-31.

Winter, B. (2011). Pseudoreplication in phonetic research. *Proceedings of the International Congress of Phonetic Science.* Hong Kong. 2137-40.

Winter, B. (2014). Horror movies and the cognitive ecology of primary metaphors. *Metaphor & Symbol*. 29(3):151-170.

Winter, B. & Bergen, B. (2012). Language comprehenders represent object distance both visually and auditorily. *Language and Cognition.* 4(1): 1-16.

Winter, B. & Matlock, T. (2013). More is up… and right: random number generation along two axes. M. Knauff, M. Pauen, N. Sebanz & I. Wachsmuth (eds.). *Proceedings of the 35th Annual Conference of the Cognitive Science Society*. Cognitive Science Society: Austin, Texas. 3789-94

Winter, B. & Matlock, T. (2017). Primary metaphors are both cultural and embodied. B. Hampe (ed.) *Metaphor: Embodied Discourse and Cognition.* 99-115.

Winter, B., Matlock. T., Shaki, S. & Fischer, M. H. (2015). Mental number space in three dimensions. *Neuroscience and Biobehavioural Reviews.* 57: 209-19.

Winter, B., Perlman, M. & Matlock, T. (2013). Using space to talk and gesture about numbers: evidence from the TV News Archive. *Gesture.* 13(3): 377-408.

Wisniewski, E. J. (2010). On using count nouns, mass nouns, and pluralia tantum: what counts? F. J. Pelletier (ed.). *Kinds, Things, and Stuff: Mass Terms and Generics*. New York, New York: Oxford Scholarship Online. 1–24.

Wohlschl ger, A. (2000) Visual motion priming by invisible actions. *Vision Research.* 40: 925–30.

Wood, G., Nuerk, H. C., Willmes, K. & Fischer, M. H. (2008). On the cognitive link between space and number: a meta-analysis of the SNARC effect. *Psychology Science Quarterly*. 50(4): 489-525.

Woodin, G. & Winter, B. (under review). Placing abstract concepts in space: quantity, time and emotional valence. *Frontiers in Psychology.* OSF: https://osf.io/48u5q/

Yasinnik, Y., Renwick, M. & Shattuck-Hufnagel, S. (2004). The timing of speech-accompanying gestures with respect to prosody. J. Slifka, S. Manuel & M. Mathies (eds.). *Conference Proceedings: From Sound to Sense: 50+ Years of Discoveries in Speech Communication*. Cambridge, Massachusetts: MIT Press. C97–C102.

Yaxley, R. H. & Zwaan, R. A. (2007). Simulating visibility during language comprehension. *Cognition.* 105(1): 229–36.

Yu, N., Yu, L. & Lee, C. L. (2017). Primary metaphors: Importance as size and weight in a comparative perspective. *Metaphor and Symbol.* 32(4): 231-49.

Zajonc, R. B. (1968). Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology.* 9(2 Pt2): 1–27.

Zbikowski, L. (1998). Metaphor and music theory: Reflections from cognitive science. *Music Theory Online 4.*

Zima, E. (2017a). On the multimodality of [all the way from X PREP Y]. *Linguistics Vanguard (Special Issue): Towards a Multimodal Construction Grammar 3.* 3(s1).

Zima, E. (2017b). Multimodal constructional resemblance. The case of English circular motion constructions. F. Ruiz de Mendoza Ibáñez, A. Luzondo Oyón & P. P rez-Sobrino (eds.). *Constructing Families of Constructions*. Amsterdam:

John Benjamins.

Zipf, G. (1936). *The Psychobiology of Language.* London: Routledge.

Zipf, G. (1949). *Human Behavior and the Principle of Least Effort.* New York, New York: Addison-Wesley.

Zwaan, R. A. (2004). The immersed experiencer: toward an embodied theory of language comprehension. B. H. Ross (ed.). *The Psychology of Learning and Motivation: Advances in Research and Theory*. 44. New York, New York: Elsevier Science. 35-62.

Zwaan, R. A. & Taylor, L. (2006). Seeing, acting, understanding: Motor resonance in language comprehension. *Journal of Experimental Psychology: General.* 135: 1–11.