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Title: Speaker-oriented and listener-oriented functions of gestures accompanying abstract speech

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A. Hypotheses

Theoretical Background

When we communicate in face-to-face settings, we often use gestures to support our speech. These co-speech gestures form an integral part of communication and cognition (Holler & Levinson, 2019). Although gestures can serve both speaker-internal and listener-oriented functions, the relation between these two remains unclear. The current study investigates the overarching question of why we gesture, and explores to which extent we gesture for ourselves, or for others.

According to one influential perspective on gesture, the Gesture as Simulated Action Framework (henceforth GSA), gestures reflect the motor activity that occurs automatically when people speak about things relating to action and perception. GSA assumes that language use is embodied, meaning that "the content of semantic representation is sensory and motor information" (Meteyard et al., 2012). Following this assumption, GSA hypothesizes that concrete speech, which link directly to motor action and perceptual states, sparks more gesture use compared to speech that relates to more abstract topics, as abstract content might not be embodied to the same extent as concrete speech (Fernandino et al., 2016).

From the perspective of the listener however, gestures primarily emerge when they are a useful communicative tool (e.g. Campisi & Özyürek, 2013; Kelly et al., 2011). In this framework, situations of communicative difficulty, such as misunderstanding or low common ground, might spark more gesture use compared to a communicative situation where there is clear understanding (Gerwing & Bavelas, 2005). Abstract concepts are in general more generic, and possess a greater contextual variation than concrete concepts (Barsalou & Wiemer-Hastings, 2005; Bolognesi et al., 2020). Therefore, speaking about abstract content might spark more gesture use as interlocutors might need more context, or "grounding" to reach a mutual understanding in social interaction (Brennan & Clark, 1996).

This makes abstract speech an interesting case study to investigate the balance between simulational, and communicative aspects of gesture use. If gestures are merely an expression of simulated action, we would expect people to use less gestures when they communicate about abstract topics. However, if gestures originate as a communicative tool regardless of the type of content they express, we would expect that they are used more accompanying abstract language. The current study sets out to investigate this topic.

Specifically, we ask 1) whether people gesture more, or less, when they speak about concrete versus abstract content, 2) to what extent gesture use accompanying abstract words is

affected by the communicative situation similarly to gestures accompanying concrete words, and 3) what specific role different types of gestures play in the balance between speaker-internal and listener-oriented functions of gesture.

As a bonus, the current study investigates multimodal communication in the modern era: we study gesture use in online communication using a video-conferencing tool. This novel approach gives us insight in online multimodal communication (e.g. using audio only versus audio and video) and might pave the way for gesture studies using online paradigms.

Before I turn to the setup and the hypotheses of the current study, I will elaborate more on 1) representation and communication of abstract concepts, and 2) functions and mechanisms underlying co-speech gesture.

Representation of abstract concepts

In the field of cognitive science, the embodiment hypothesis – that sensory and motor information form the basis of semantic representation – is gaining ground (Barsalou, 1999; Meteyard et al., 2012). Indeed, there is emerging evidence for a role of perceptual, motor, and affective simulation in language representation (Fischer & Zwaan, 2008; Shebani & Pulvermüller, 2013). The rationale here is that when we hear words such as "cutting a paper", we activate the same motor (cutting motion, holding scissors) and perceptual (visualizing the motion and the paper) information in our brain as when we see someone cutting a paper, or when we cut a paper ourselves.

Although an embodied account of concrete language may seem straightforward, it is more difficult to theorize an embodied representation of abstract language. One influential framework to account for the representation of abstract meaning is the Language and Situated Simulation theory (LASS, Barsalou, 1999; Barsalou et al., 2008). In this account, the representation of abstract concepts is partially accessed by situating it in concrete contexts. Thinking about *"convince"* for instance, might involve an image of a politician speaking to a crowd. By situating abstract concepts in concrete situations, they lose their abstractness and become connected to action and perception.

Some evidence to support this claim comes from Barsalou & Wiemer-Hastings (2005). They conducted an exploratory experiment in which participants were instructed to talk about either concrete (TREE) or abstract (TRUTH) concepts. In both conditions, participants described the meaning of the concepts in terms of agents, objects, entities, settings and events, implying that in both cases, the meaning of the words is accessed by situating them.

Following up on this, several other studies found that modality-specific information as well as social, introspective and affective information contributes to the representation of abstract concepts (Connell & Lynott, 2012; Crutch et al., 2013; Harpaintner et al., 2018; Kousta et al., 2011). It seems that for abstract concepts, affective and introspective information plays a relatively larger role than sensorimotor information, and that their understanding is based on a wider range of simulations than concrete words (Speed et al., 2015).

Furthermore, a large component of abstract meaning representation might not be embodied at all (Connell, 2019; Louwerse, 2011). Distributional models of language, such as LSA (Landauer & Dumais, 1997) or the topic model (Griffiths et al., 2007) show that words can also be represented as a large network, with connections between each words based on their context of use. In distributional models of language, words take their meaning through their relation to other words. Distributional models have been successful at predicting task performance in various psycholinguistic experiments such as word associations or semantic priming effects (Griffiths et al., 2007). As abstract words can be argued to have more widely distributed contexts (Barsalou & Wiemer-Hastings, 2005), and are relatively more generic compared to concrete words (Bolognesi et al., 2020), distributional models might be particularly good at predicting abstract language representation. Recently, attempts have been made to try and integrate distributional, or linguistic aspects of language, and embodied aspects of language representation (Barsalou et al., 2008; Günther et al., 2019; Vigliocco et al., 2009). In an integrated model, representation of meaning depends on both embodied and linguistic factors. Whereas concrete words might rely more on embodied components of meaning, for abstract words linguistic factors are relatively more important.

From the tradition of cognitive linguistics, a different source of representation of abstract concepts has been studied: metaphor (e.g. Gibbs, 2006; Lakoff & Johnson, 1980). A conceptual metaphor generally maps a concrete source domain onto an abstract target domain. For instance, we can use the concrete source domain of SPACE to think about the abstract target domain of TIME (Gentner et al., 2002). Conceptual metaphors are brought to expression in linguistic metaphors, such as “My day is completely full”, or “Can we move our appointment to another day?”. In these examples, time is mentioned in terms of space, which can be “full” and can be “moved”. Based on Conceptual Metaphor Theory (Lakoff & Johnson, 1980), abstract concepts rooted in metaphors can give rise to embodied simulations (Gibbs, 2006), in this case of a physical space. Although metaphor can help understand and ground abstract concepts, the question is whether they are fundamental for their representation. It is argued that

there are many aspects of abstract meaning that cannot be accounted by metaphor (Meteyard et al., 2012).

In sum, abstract language seems to rely relatively less on sensory and motor information, and more on introspective and affective information compared to concrete language. Moreover, a large part of abstract language representation might be attributed to its relation to information of word contexts. Metaphor can serve as an additional window into abstract thought. Before I elaborate on the consequences of the representation of abstract language for gesture production, I will first discuss theories of speaker-oriented and listener-oriented functions of manual gesture.

Speaker-oriented functions of gesture

We gesture even when we cannot see our addressee. This observation has led researchers to investigate speaker-oriented functions of gesture. Some have argued that gestures can facilitate lexical access (e.g. Hadar & Butterworth, 1997) by activating spatio-motoric content. In this model, conceptual processing activates visual imagery. This visual imagery then automatically activates iconic gestures, which in turn "hold" semantic features of the lexical entry that is sought for, facilitating word-finding. A similar line of research argues that gestures "organize rich spatio-motoric information into packages suitable for speaking" (Kita, 2000). According to this Information-Packaging Hypothesis, production of representational gestures can help speakers to organize rich spatio-motoric packages, that facilitate speaking.

Again others note that gestures can reduce cognitive load, by "offloading" the working memory into the visual modality (Wagner et al., 2004). In this context, it has been found that gestures increase memory (Wagner et al., 2004), and that more complex description tasks lead to higher gesture rates (Melinger & Kita, 2007; Mol et al., 2009).

In sum, the speaker-oriented functions of gestures seem to relate to their visuo-spatial properties. The Gesture as Simulated Action framework (Hostetter & Alibali, 2008, 2019) makes specific hypotheses on how visuo-spatial properties of gesture relate to language production. They base their framework on embodiment research, as explained above (Barsalou, 1999; Barsalou et al., 2008). Where language representation can be based on simulation of sensory and motor information, gesture makes this embodiment visible. The GSA framework lists three tenets that drive gesture production: the motor and perceptual simulation that also underlies language, motor simulation of the mouth, and the gesture threshold. The first tenet is based on embodiment research: if the idea that is to be conveyed is linked to spatial or motoric content, it is likely to be expressed in the form of gesture. Conversely, if an idea or concept is

not linked to spatial or motoric content, such as more abstract concepts, it is unlikely to be expressed in the form of gestures. The second tenet in the GSA framework is motor activation of the mouth. Most gestures occur simultaneous with speech, instead of while thinking. Although the relation between hand and mouth is of great importance, it is not relevant for the current study and therefore will not be considered in the current research. The third tenet is the gesture threshold. The gesture threshold represents "the speaker's own resistance to overtly producing a gesture" (Hostetter & Alibali, 2019, p. 722), and relates to his or her beliefs about the communicative effectiveness of a gesture in a specific situation. For instance, if a speaker cannot see the listener, they might believe that a gesture is not communicatively effective, which in turn increases the gesture threshold.

Hostetter & Alibali (2019) make two predictions based on GSA. Firstly, GSA proposes that people will gesture more when they activate spatio-motoric simulations (for instance when speaking about kicking a ball), than when they activate more propositional information (when speaking about a political debate). The rationale is that when there is no embodiment in representation, there will be no embodiment in communication. Preliminary evidence for this claim has been found in studies showing that people gestured more when they described objects such as tools, that had clear affordances (Masson-Carro et al., 2016) compared to objects that do not have these affordances. Similarly, people gesture more when they describe a cartoon that they saw compared to when describing a cartoon that they only heared (Hostetter & Skirving, 2011; Masson-Carro et al., 2017).

The second prediction of interest is that "gesture production varies dynamically as a function of both stable individual differences and more temporary aspects of the communicative and cognitive situation" (Hostetter & Alibali, 2019, p. 730). This prediction relates to the nature of the gesture threshold: gesture use can depend on the communicative situation and the belief of a speaker that gestures are communicatively effective. For instance, there is cross-cultural variation in the use of gesture (Kita, 2009), and there is abundant evidence that speakers adapt their gestures to the listener (e.g. Campisi & Özyürek, 2013), as I will discuss in the next section.

Finally, GSA predicts that the gesture threshold and level of activation on action simulations, interact. They hypothesize that "when action simulations are highly activated, the communicative situation should matter less than when simulations are less highly activated, because highly activated simulations should surpass even a very high threshold" (Hostetter & Alibali, 2019, p.739). This prediction is of particular relevance for the current study, and will be explained in more detail later. First, I elaborate on the communicative function of gesture.

Listener-oriented functions of gesture

Although people even gesture when they cannot see the listener, we know that gestures are an important part of communication. In fact, according to Kendon (2004), the very definition of gesture lies in their deliberately expressive nature. Evidence in audience-design of gesture is abundant on the production side of gesture. For instance, we change the way we gesture depending on the location of the addressee (Özyürek, 2002) or depending on whether we are talking to a child or an adult (Campisi & Özyürek, 2013). We gesture more when the stakes for communication are high (Kelly et al., 2011). We also adapt the shape of our gestures; in repeated reference to the same thing, our gestures become smaller (Hoetjes et al., 2015). And when we can see our interlocutor, our gestures tend to be bigger and more centrally located compared to when we cannot see our interlocutor (Bavelas & Healing, 2013). All of this evidence speaks to the idea that gestures have a communicative function. And indeed, a meta-analysis on the comprehension side (Hostetter, 2011), shows that in general gesture and speech leads to better understanding and memory compared to speech only.

So what is it about gestures that makes them communicative? One aspect is that gestures can add extra information to speech (Beattie & Shovelton, 1999). For instance, saying "you cut the parsley", paired with a gesture that depicts a scissor movement, gives us the information that the cutting is not done with a knife but instead with a pair of scissors. In this way gestures can reduce ambiguity in communication, as has also been shown experimentally (Holle & Gunter, 2007).

In this view gestures might be particularly useful in communicatively difficult situations. For instance, it has been found that when gestures are used in interaction, it has been found, speakers tend to mimic each other's gestures in collaborative referring (Holler & Wilkin, 2011). This mimicking occurs as a means for signalling mutual understanding, much like mimicking of each other's words (i.e. alignment) can do (Brennan & Clark, 1996; Clark & Wilkes-Gibbs, 1986; see also Rasenberg et al., 2020, for an integrative framework on this topic). More support from this position comes from findings that people use less precise and smaller gestures when common ground is larger (Gerwing & Bavelas, 2005). In this way, gestures can serve as a tool to increase common ground in social interaction.

Summarizing, gesture production seems to rely on speaker-oriented and listener-oriented functions. It is a complex interplay of these systems that gives rise gesture, and that influences its shape and size. Abstract content poses an interesting case study to investigate this interaction, as it may rely less on simulation of action compared to concrete content, but at the

same time can be more difficult to communicate than concrete content. For instance, in a Taboo Game study, (Zdrazilova et al., 2018), participants were less successful to communicate abstract words than concrete words. In the following section, I elaborate on the relation between abstract language and gesture.

Gesture and abstract concepts

Qualitative observations on metaphoric gestures, which might accompany abstract content more compared to concrete content, show how metaphoric gestures can have a communicative function much like iconic gestures. For example, when someone gestures with two hands moving with the palms towards their body, from the head down towards the torso, while saying "it's like an enchantment that you get", the gesture adds information to the speech, and reveals a metaphorical conception of enchantment as an object (such as a fabric) that can fall over someone. Other cases, where metaphorical gestures occur together with metaphorical speech, can be argued to highlight, or foreground, a metaphor in the discourse (Müller & Tag, 2010).

Another communicative function of gesture as described in the first section, is that they can help to increase common ground (Holler & Wilkin, 2011). Chui (2014) describes how participants can also mimic each other's metaphorical gesture. In one instance, a woman turns her right hand at the side of her right face clockwise, with the hand shaped as if holding a ball) that accompanies the verb "beautify". This gesture is then mimicked when another participant has trouble verbalizing, or when the interlocutors disagree on the meaning of the utterance, and are trying to find common ground. Similarly, Müller (2004) describes how gestures in the form of a Palm Up Open Hand (or PUOH), which are very frequent in interaction, can be functional in describing abstract content, by presenting abstract ideas as objects that can be manipulated, and inspected. A prominent function of this type of gesture can be to propose a common perspective on the topic under discussion, as well as to request or ask for something. In this way, PUOH gestures can be used to negotiate common ground, or conceptual pacts (Brennan & Clark, 1996) in interaction. Note that this type of gesture presents a clear metaphorical mapping from an abstract idea to a concrete object, much like metaphorical gestures in the examples above. However, Palm Up Open Hand gestures arguably do not clearly activate source domains relating to the content of the speech itself. Instead, they can might relate more to the social interaction on a pragmatic level (Müller, 2004).

In sum, qualitative evidence suggests that metaphorical gestures can have communicative functions much like iconic gestures: they can add extra information to the speech, and help increase common ground. In the GSA framework, metaphoric gestures can

also function similar to iconic gestures, by stemming from embodied simulations of sensorimotor information. However, although metaphor can function as a window into abstract thought, abstract concepts are in general assumed to rely less on sensory-motor simulations compared to concrete content. In light of this, gestures might not arise as easily accompanying abstract content as they do for concrete content. In contrast to iconic and metaphoric gestures, pragmatic gestures such as Palm Up Open Hand gestures might rely less on simulation of sensory and motor information. Instead, they might depend more on the communicative situation. As abstract content might be more difficult to lead to conceptual pacts in interaction compared to concrete content, pragmatic gestures could be very useful in this situation.

Quantitative studies on gestures accompanying abstract content remain scarce. In a meta-analysis, Hostetter (2011) investigated whether gestures are more communicative (i.e. whether they lead to increased comprehension or memory) when they accompany speech about spatial or motor topics than when they accompany abstract speech, and found that this indeed seemed to be the case. However, a closer look at the five studies that were part of the analysis, revealed that they investigated a mixture of abstract and concrete content, accompanied by emblematic gestures, pragmatic gestures amongst others (Berger & Popelka, 1971), or operationalised abstract content as abstract visual patterns (Krauss et al., 1995). The most recent study (Straube et al., 2009) did find that metaphoric gestures that are congruent with speech (that is, conveyed the same information) lead to increased memory, compared to speech-only. However, this study did not directly compare iconic to metaphoric gestures, and abstract to concrete content. Hostetter (2011) concluded that because most of the studies included in this analysis were vague in their descriptions and manipulations, the reason for the observed effect remains unclear.

A recent exploratory study directly contrasted concrete with abstract conversation topics (Zdrazilova et al., 2018). Their aim was to gain insight into the kinds of conceptual processes that are engaged during the communication of abstract word meanings. To this end, they set up an experiment, in which participants alternated between roles of the sender and the receiver and played a Taboo Task. The job of the sender was to communicate the meanings of words (either abstract or concrete) to the receiver without using the words themselves. The job of the receiver was then to accurately guess the words. They found, in line with earlier language production experiments (e.g. Barsalou & Wiemer-Hastings, 2005), that abstract words elicited more references to introspections and to people, whereas concrete words elicited more references to entities and objects. As for the use of gestures, they found that abstract trials were accompanied

by more metaphoric and beat gestures, whereas concrete trials were accompanied by more iconic gestures. For pragmatic gestures (which they coined communicative gestures), they did not observe a difference between abstract and concrete conditions.

This study leaves us with a number of open questions. First of all, we still do not know to what extent overall gesture rate was different for abstract compared to concrete trials. Furthermore, the experiment did not control for the content of what participants said during the trials. Therefore, we do not know whether participants in the abstract condition used more abstract words compared to the concrete trials. A second, more theoretical question concerns the communicative function of gestures. Were gestures in the abstract trials communicatively intended to the same extent as gestures in the concrete trials?

The current research aims to answer these questions, and I now turn to the description of the experimental setup.

The current study

The current study will investigate the research questions form above using an experimental task called the "Anti Taboo Task". In the Anti Taboo Task, participants are divided in pairs and alternate between the role of sender and receiver. The sender communicates a target word (i.e. the taboo word) without using that word to the receiver. In his or her description the sender should also use three obligatory clue words (hence the name Anti Taboo Task). The clue words are added to ensure that participants in the concrete condition use concrete words and participants in the abstract condition use abstract words. After the sender communicates the taboo word, the receiver has to guess the correct target word. To manipulate the communicative situation in this experiment, there will be a condition where participants can both see and hear each other (i.e. visibility condition), as well as a condition in which participants can only hear each other (i.e. non-visibility condition). A novelty to this task is that it will be conducted online, through the platform BigBlueButton.

This experiment will have a within-subjects design, meaning that all participants will take part in the visibility and the non-visibility condition, the order of which will be counterbalanced, and all participants will communicate both abstract and concrete words.

Hypotheses

I will now elaborate on the hypotheses concerning the different conditions ((1) concrete versus abstract, (2) visible versus non-visible, and (3) the interaction between visibility and

abstractness). To get more fine-grained insight into the specific functions of gesture types, I also list hypotheses on the role of specific gesture types in this experiment.

1. Concrete versus abstract topic

The Gesture as Simulated Action (GSA) framework (Hostetter & Alibali, 2008, 2019), hypothesizes that the gesture rate will be lower in topics that do not activate strong sensorimotor simulation. Therefore, the GSA predicts that there will be lower gesture rates in the abstract condition than in the concrete condition.

Because abstract words are in general more generic and vague than concrete words (Bolognesi et al., 2020) it may take more effort to ground the meaning of these words in social interaction. Therefore, the Communicative Tool approach hypothesizes that the gesture rate in the abstract condition will be higher than in the concrete condition.

2. Visible versus non-visible

Due to the communicative function of gestures and based on previous research (e.g. Bavelas & Healing, 2013) it is hypothesized that there will be more gestures in the visibility condition compared to the non-visibility condition. For GSA, this prediction is based on the gesture threshold (a speaker's own resistance to produce a gesture) which is arguable lower when interlocutors can see one another.

3. Interaction between visibility and abstractness

The GSA framework predicts that "when action simulations are highly activated, the communicative situation should matter less than when simulations are less highly activated, because highly activated simulations should surpass even a very high threshold" (Hostetter & Alibali, 2019). Thus, in a situation where simulations are less highly activated (in this case in the abstract speech) the communicative situation matters more. Following from this, the GSA predicts that in the abstract condition there is a difference in gesture rate between the visible and non-visible condition, and this difference is smaller in the concrete condition. After all, if simulations are highly activated, they should be harder to suppress, resulting in a higher gesture-rate even in non-visibility condition.

From a communicative tool perspective, the concreteness of the topic should not matter for the visibility effect. Therefore, this framework would not expect an interaction between visibility and abstractness of the topic.

An overview of the hypotheses for overall gesture rate can be found in table 1.

Table 1

Overview of hypotheses for overall gesture rate (contrasting hypotheses are marked in bold)

	Gesture as Simulated Action	Gesture as Communicative Tool
Concrete versus abstract	**More gestures in concrete**	**More gestures in abstract**
Visible versus non-visible	More gestures in visible	More gestures in visible
Interaction between visibility and abstractness	**Visibility effect larger in abstract than in concrete**	**No interaction between visibility and abstractness**

4. Gesture types

Zdrazilova et al., (2018) found that gesture types are affected differently by the abstractness of the topic. For instance, they found that speech about concrete meanings was accompanied by more iconic gestures, whereas speech about abstract meanings was accompanied by more metaphoric and beat gestures. As for pragmatic gestures, or communicative gestures, as Zdrazilova et al coined them, there was no difference between abstract and concrete conditions. Based on these findings, we expect the same results for the current study.

Earlier research might shed more light on the effect of visibility on different gesture types. Based on the gesture threshold, GSA would hypothesizes that iconic and metaphoric gestures are less frequent in a non-visible condition, compared to a visible condition. GSA poses no specific hypotheses for beat gestures and pragmatic gestures, although they do note that beat gestures seem to serve particularly for facilitating speech production (Lucero et al., 2014) and thus may not be affected by visibility as much. From the perspective of gestures as a communicative tool, especially pragmatic gestures, which are mainly used for the stability of the interaction (Bavelas et al., 2008), might be affected greatly by visibility. Similarly, iconic and metaphoric gestures are hypothesized to occur less in non-visible compared to visible conditions.

The current study will not list specific hypotheses for interactions between visibility and abstractness for different gesture types, no specific hypotheses, because such fine-grained hypotheses cannot be tested for the amount of data that will be collected in this study.

An overview of hypotheses for specific gesture types can be found in table 2.

Table 2

Overview of hypotheses for gesture types

	Concrete versus abstract	Visible versus non-visible
Iconic	more iconics in concrete	More iconics in visible
Metaphoric	More metaphorics in abstract	More metaphorics in visible
Pragmatic	more pragmatics in abstract	More pragmatics in visible
Beat	More beats in abstract	No difference

Manipulation checks

In this experiment, the communicative situation is manipulated by using a visibility condition and a non-visibility condition. Previous research has shown that this can be used for communicative context manipulation when speaking about concrete concepts (Bavelas & Healing, 2013). As a manipulation check, we analyze whether there is a difference in gesture use accompanying concrete words in visibility versus non-visibility.

Concreteness of the Taboo Words is manipulated using stimulus words with high concreteness ratings (taken from Brysbaert et al., 2014) in the concrete condition, and abstract stimulus words in the abstract condition. As a manipulation check for this variable, we will analyze whether the speech accompanying gestures in concrete versus abstract conditions is indeed concrete or abstract, respectively. This will be operationalized as follows. The speech of the participants will be transcribed, and average concreteness of the content words will be calculated. The difference in concreteness between abstract and concrete conditions will serve as a manipulation check.

B. Methods

The current section describes the method that was used for data collection of a pilot study (N=10), which will also be used for the full data collection.

Variables

Below is a list of all the variables that play a role in the current experiment.

- Independent variables:
  - Concreteness, within-subject
  - Visibility (+ ; -), within-subject
  - Gesture type, within-subject
- Dependent variables
  - Gesture rate
- Covariates
  - Round
  - Taboo word class (noun or verb)
  - Taboo word frequency

Planned sample

As preselection rules, we hold that participants must be native speakers of Dutch, with no knowledge of any sign language and no language problems. They should be between 18 and 50 years old. Lastly, we will control the gender balance in the participant pairs.

Data will be collected online. Participant pairs will be recruited from the MPI participant database. They will receive 10 euros in exchange for participation to the study. The data will be collected between December 2020 and February 2021.

The sample size of the current experiment will be based on a Bayesian Stopping Rule (e.g. Schönbrodt, 2018). Based on priors from a pilot study, we will collect data stepwise. We will minimally collect data from 20 pairs and maximally of 50 pairs.

The data will be collected and analyzed in steps: after N =20; after N=30; after N=40; and after N=50. After each step, the gesture data will be analyzed in ELAN (Wittenburg et al., 2006) and subsequently in R (R Core Team, 2017), using the brms package brms (Bürkner, 2017). The statistical model will be described in detail below. Data collection will be terminated if the BF for each hypothesis is below 1/6 or above 6 (or if the *Nmax* has been reached).

Exclusion criteria

Method-based:

If participants fail to accurately guess more than half of the taboo words, the pair should be excluded.

Technical:

Due to instable internet connections the video- and audio-quality of the to-be analyzed videos might not be very high. Furthermore, because participants will set up the camera in their own home, using the webcam of their computer, some of the gestures might fall outside of the screen. We predefine the cut-off rate for exclusion of trial here:

- Exclude a trial if there is more than 10 seconds of inaudible audio OR unclear video.
- Exclude a participant pair if more than 30% of the trials has to be rejected.

Stimuli

A complete list of the stimuli can be found in appendix A. Below, I describe the stimuli in more detail.

Taboo words

Taboo words (N = 36) were selected so that they have ratings for frequency, concreteness and valence. They were selected in pairs, in which the abstract taboo word was matched in topic with the concrete taboo word (e.g. BLUF; abstract, and POKER; concrete). To ensure that the taboo words are indeed linked to each other, the semantic distance between abstract and concrete taboo word pairs was compared with the semantic distance between random abstract and random concrete taboo words from the list. To this end, we used the word2vec measure, in the easily accessible tool snaut (Mandera et al., 2017). Original taboo word pairs (M=0.725, SD=0.07) have a lower semantic distance than random taboo word pairs (M=*0.864, SD*=0.10), (t (32) = 4.965, p <.001, CI -0.199; -0.0787]). Taboo words consisted of partly nouns (N=26) and partly verbs (N=10), to get a representative sample of stimuli.

Next to semantic similarity, the taboo words were matched in log frequency (Keuleers et al., 2010) and valence (Moors et al., 2013). Valence was measured on a using a 7-point scale (1=very negative/unpleasant; 7=very positive/pleasant). The concrete and abstract taboo words differed in rated concreteness (Brysbaert et al., 2014), which ranged from 1 (very abstract/language based) to 5 (very concrete/experience based). Descriptive statistics of the taboo words can be found in table 3 below.

Table 3

Concreteness, Frequency and valence of taboo words (N = 36)

	Concreteness *M* (*SD*)	Log frequency *M* (*SD*)	Valence *M* (*SD*)
Abstract taboo words	2.110 (0.221)	10.88 (1.295)	4.047 (1.500)
Concrete taboo words	4.147 (0.385)	10.53 (1.321)	4.009 (1.204)

Clue words

Clue words were selected so that their semantic distance to the taboo words would be sufficiently low for them to fit intuitively in a description of the words. They are matched in frequency and semantic distance, and differ in concreteness (as can be seen in table 4 below). All taboo words had three clues, one verb and two nouns, adding to the ease of the clues to match with a description of the taboo words.

Table 4

Concreteness, log frequency, and semantic distance from taboo word of clue words

	Concreteness *M* (*SD*)	Log frequency *M* (*SD*)	Semantic distance *M* (*SD*)
Abstract clues	2.213 (0.490)	10.718 (1.521)	0.656 (0.103)
Concrete clues	3.960 (0.650)	10.832 (1.209)	0.632 (0.101)

Procedure

Participants will be given a link to a "Virtual experiment room" hosted on the platform BigBlueButton. The experimenter will be present, with audio and video muted, during the entire course of the experiment. At the beginning of the experiment, participants will fill out a consent form on Qualtrics (see Appendix B*)*. The questionnaire contains written information about the experiment and a consent form. When participants have given written consent, they will proceed to the experiment. Both participants and the experimenter will have their webcam on when they receive oral instructions (see Appendix C, in Dutch). Crucially, participants will receive no specific instructions regarding the use of gesture. The participants are instructed to position their camera in such a way that their entire upper body is visible, before proceeding to the experiment. Before starting with the actual experiment, participants will take part in one practice block.

The experiment will consist of 4 blocks. At the beginning of each block a list of the target words and cue words for that block will be communicated to the sender through private chat. Their camera visibility will then be switched off for the non-visibility condition, or remain on for the visibility condition. The block order is displayed in table 5 below.

Table 5

Block order (for hypothetical participants A and B within pair X, and C and D within pair Y)

Group X		Group Y	
Visibility	*Sender*	*Visibility*	*Sender*
Visible	A	Non-visible	C
Visible	B	Non-visible	D
Non-visible	A	Visible	C
Non-visible	B	Visible	D

Each block has 9 trials (of one taboo word each). The taboo words will be presented in a randomized order. The sender will have 30 seconds to communicate the taboo word to the receiver, using the cues that are provided. Immediately following this, the receiver has 3 attempts to guess the correct taboo word.

At the end of the experiment, the recording will be stopped. Participants are thanked for their time and they are asked to fill out the second part of the online questionnaire where they answer questions concerning their (language) background and other demographic information, as well as their subjective experience of the experiment (see Appendix D). The participants will be debriefed and the meeting will be ended. In total, the experiment will take around 60 minutes (45 minutes for the experiment, and 15 minutes for set-up, briefing and questionnaires).

C. Analysis plan

The current study describes the data analysis plan for the full data. For this research project, pilot data (N=10) has already been collected and analyzed. Their results are described in section D. Pilot Study.

Confirmatory analyses

The hypotheses for the current study are listed in table 1 and table 2, in section A, Hypotheses. All hypotheses will be tested using a Bayesian mixed effects model predicting gesture rate, using the brms package (Bürkner, 2017). In this model, the following variables will play a role:

- **Gesture rate: DV**
- **Concreteness of trial: IV**
- **Visibility : IV**
- **Gesture Type : IV**
- **Concreteness * visibility * Gesture type : IV**
- Taboo word category (noun or verb) : Covariate
- Taboo word log frequency: Covariate
- Number of round: Covariate
- Individual taboo word (item): Random intercepts and slopes for Visibility
- Individual pair (participant): Random intercepts and slopes for Visibility and Concreteness.

In formal terms, the model will be as follows:

Gesture rate ~ concreteness*visibility*gesture type + Taboo word category + log freq + round + (1 + visibility | taboo) + (1+ concreteness*visibility | participant)

Priors

The priors in the Bayesian model will be based on the distribution and effect size of the pilot data. Gesture count data often has a rather non-normal distributions because often few of such behaviors occur for most participants. This is also the case for the data that was collected in our pilot study, as visualized in figure 1, below.

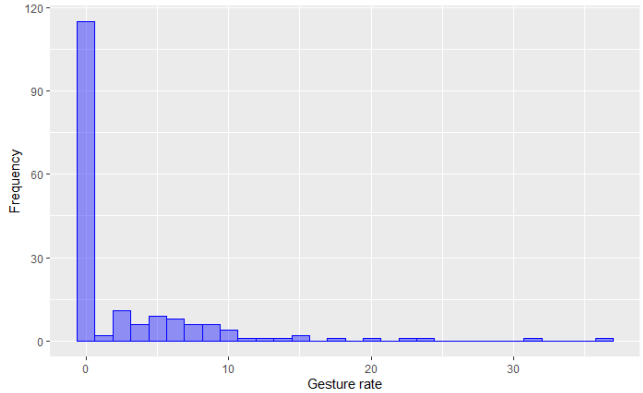

Figure 1. Histogram of gesture rate (amount of representational gestures per 100 content words)

Instead, the data in the current study might resemble a zero-inflated Poisson distribution, which can easily be taken into account in the brms package. As the Poisson distribution allows for integers only, gesture rate should be transformed to gesture count per 100 words and rounded if necessary. Furthermore, to reduce the impact of rounding, gesture count will be multiplied by 10.

Below follows a description of each of the individual variables in the two analyses, what their role is in the analysis and how they are calculated.

Gesture rate:

Gestures in the video data will be annotated using ELAN (https://archive.mpi.nl/tla/elan, Wittenburg et al., 2006). All gesture strokes will be annotated (Kita et al., 1998), and gestures will subsequently be divided in gesture categories, as explained below. Based on the annotation of the pilot data, a coding scheme is established that will be used to transparently annotate gestures (see appendix E).

Participants' speech is transcribed per trial, in order to calculate gesture rate per trial. For calculating the gesture rate, only content words will be included (i.e. nouns, verbs, adjectives and adverbs). Gesture rate will be calculated as the amount of gestures per 100 content words, and will be the dependent variable in the first statistical model.

Gesture type:

Gesture type consists of four levels: iconic, metaphoric, pragmatic, and beats. These categories are based on previous research in gesture (Cienki, 2016; Kendon, 2004; McNeill, 1992; Müller, 2004). Iconic and metaphoric gestures reference objects, actions, or relations by recreating an aspect of their referent's shape or movement. Iconic gestures represent physical objects or events. Metaphoric gestures represent the source domain of abstract target ideas or concepts, for example moving the hands forward, indicating SPACE, when talking about the future, in the TIME domain (Cartmill et al., 2012; Cienki, 2016; McNeill, 1992). Pragmatic gestures refer to the discourse on a higher level. They can present some concept as a focal part of the utterance (Müller, 2004), offer a common perspective on a presented object (Streeck, 1994), or show other aspects of the discourse such as continuity of the argument.[1] Beat gestures lastly, are

[1] As has been noted in the introduction, pragmatic gestures are often metaphoric as well (e.g. when using an open hand gesture to propose a common perspective on a presented object or concept). However, they do not refer to an aspect of source domain of the topic of the speech itself, but rather are used to structure the discourse.

gestures that have a rhythmic motion on the prosody of the speech. Deictics, emblems and other gestures that seem to fall in none of the categories specified above are not taken into account in the current analysis. More specific information on the gesture annotation can be found in appendix E.

Concreteness of trial:

Concreteness is calculated as the average concreteness of the speech in a trial. As not all words that were used by the participants are listed in the largest lexical norms database for Dutch (Brysbaert et al., 2014), concreteness per word is estimated using subs2vec (Paridon & Thompson, 2020), a python package that estimates concreteness based trained word embeddings in a vector space model. These estimated concreteness norms correlate well (r = 0.8) with existing lexical norms for concreteness such as (Brysbaert et al., 2014). In calculating average concreteness per trial, only content words only content words will be included (i.e. nouns, verbs, adjectives and adverbs). Concreteness is one of the independent variables in the statistical model.

Visibility:

Visibility has two levels: visible and non-visible. In the visibility condition, participants see each other through webcam, and hear each other through microphone. In the non-visibility condition, participants cannot see each other's webcam, but they can hear each other through microphone.

*Concreteness * visibility * gesture type:*

This is the interaction term of visibility, concreteness, and gesture type.

Taboo word category:

Taboo words are divided in nouns and verbs. Because verbs might be more prone to induce gesture use than nouns because of their tight link to action, this variable is taken as a covariate.

For the sake of clarity we refer to metaphoric gestures that refer to the content of the speech as "metaphoric" and to metaphoric gestures that refer to the discourse on a higher level as "pragmatic".

Log frequency:

Word frequency influences language production (Janssen & Barber, 2012). Participants might have more trouble finding the right words to describe less frequent words, leading to increased gesture rate.

Correction for multiple tests:

In the case that a significant interaction effect is found, follow-up pairwise comparisons will be conducted, using the emmeans package in R. We will correct for multiple tests using Bonferroni corrections.

Reliability of gesture coding:

All data will be annotated by the first coder. A portion of the data should also be annotated by a second coder in order to calculate inter-rater reliability for the identification of gestures, and classification into gesture categories. The inter-rater reliability should be at least 75%, and Cohen's Kappa should be at least .70.

D. Pilot study

Method

Participants

For a pilot study, data of 10 participants (5 male) in 5 pairs were collected. Their mean age was 21.0 (*SD*=1.76). They were all right-handed, with no language problems and Dutch as their mother tongue. Participants had been friends between 1 and 19 years and were in regular contact (i.e. they spoke to each other multiple times a week). Participants were payed 10 euros for their participation.

Experimental task

On average, it took participants about 40 minutes to complete the Taboo Game. Participants reported almost no impediments to the task due to internet connection. In the debriefing however, 3 out of 10 participant noted that they thought the experiment had something to do with gestures.

Results

To briefly restate the research questions of interest in the current study, we investigate to what extent overall gesture rate increases or decreases as a function of (1) abstractness of the

associated speech, (2) visibility of the interlocutors, and (3) the interaction between these two. To gain more insight in the relative contribution of different gesture type to these effects, I also provide descriptive statistics on gesture rate per gesture type in table 6. With respect to the descriptive statistics it must be noted that the data is not normally distributed, and means and standard deviations might therefore paint a different picture of the data compared to a statistical model.

Table 6

Median gesture rates (SD) per gesture type, by condition

		All gestures	Iconic	Metaphoric	Pragmatic	Beat
Concrete	Non-visible	5.642 (6.837)	2.077 (3.094)	0.127 (0.596)	2.432 (4.469)	1.005 (1.702)
	visible	10.667 (11.876)	6.501 (8.684)	0.280 (1.063)	2.789 (4.562)	1.097 (2.572)
Abstract	Non-visible	9.173 (9.648)	0.560 (1.747)	0.560 (1.417)	6.641 (7.359)	1.465 (2.803)
	Visible	10.253 (9.001)	0.384 (1.366)	0.955 (2.245)	7.483 (6.319)	1.431 (2.077)

As can be observed in table 6, the mean overall gesture rate is higher in visible compared to non-visible conditions. The average gesture rate also seems to be higher in abstract compared to concrete conditions. Furthermore, the difference between visible and non-visible conditions seems to be larger for concrete compared to abstract conditions.

As for the effect of abstractness on different gesture types, iconic gesture rate seems to be the highest in the concrete conditions. Mean metaphoric gesture rate is highest in abstract conditions, like mean pragmatic gesture rate. Beat gesture rate lastly, might be slightly higher in abstract compared to concrete conditions.

With respect to visibility, there is a difference in the concrete conditions for iconic gestures, where there are more iconic gestures in the visible compared to the non-visible condition. Similarly, the mean gesture rate for metaphoric gestures is higher in the abstract-visible condition compared to the abstract-non-visible condition, much like for pragmatic gestures. For beat gestures, no difference can be observed in the mean gesture rate for visible compared to non-visible conditions.

To test the hypotheses concerning the effects of abstractness and visibility on overall gesture rate, the pilot data was analyzed statistically using the model described in section C above, with a few differences. First of all, gesture type was not taken into account in the model. Secondly, abstractness was operationalized as a categorical variable (condition) instead of a concrete one

(average concreteness of trial). Thirdly, the covariates (taboo word frequency, taboo word category, and round) were not taken into account in this model. This was chosen because the small size of the dataset would make it difficult to give estimations for more complex model. However, we did estimate concreteness per trial, using subs2vec (Paridon & Thompson, 2020). Concreteness estimates differed significantly between the abstract and concrete condition ($t(158.54) = -14.937$, $p < 0.001$, 95% CI[-0.357; 0.273]), indicating that our manipulation of concreteness was successful.

The brms model was run with 4 chains, each with 10.000 iterations. Rhat values were all below 1.1, and visual inspection of the caterpillar plots indicated convergence of the model. The results are listed in table 7 below.

Table 7

Estimates of Bayesian mixed model predicting overall gesture rate

	Estimate	Estimate error	95% CI
Intercept	4.50	0.31	[3.78, 4.99]
Taboo category	-0.29	0.24	[-0.82, 0.12]
Visibility	0.27	0.23	[-0.08, 0.69]
Taboo category * Visibility	0.17	0.22	[-0.20, 0.68]

Bayes Factors were calculated for each of the hypotheses, using brms::hypothesis(). For the hypothesis that there would be a higher gesture rate in the concrete compared to abstract conditions, there is no evidence (BF = 0.09, posterior probability = 0.09). In contrast, there is moderate evidence for the hypothesis that gesture rate is higher in abstract compared to concrete conditions (BF = 10.74, posterior probability = 0.91). Note that the credible interval for the estimate passes 0, indicating that the effect is not significant.

Concerning visibility effects, I tested the hypothesis that the gesture rate is higher in the visible, compared to the non-visible condition. There is considerable evidence in favor of this hypothesis ($BF_1 = 13.76$, posterior probability = 0.94). Again, the credible interval for this estimate crosses 0, indicating that this effect is not stable.

Lastly, regarding the interaction between taboo category and visibility, the hypothesis was tested that there was a positive interaction, BF_1 was 3.98 (posterior probability = 0.80), indicating anecdotal evidence for the hypothesis. For the hypothesis that there was a negative interaction, BF_1 was 0.25 (posterior probability = 0.20), indicating anecdotal evidence in favor of the opposite hypothesis. Again, this effect is not significant.

To investigate the direction of the interaction effect in more detail, estimated marginal means per condition were calculated using the emmeans package. The estimates, with 95% Credible Intervals, are plotted in figure 2. No clear interaction patterns were found. There is a non-significant effect of visibility in concrete conditions (b = 0.793, 95% CI[-0.328;2.337]) and a very small effect of visibility in abstract conditions (b = 0.199, 95% CI [-0.696;1.131]). The abstractness effect was non-significant for the visible (b = -0.241, 95% CI [-1.109 ; 0.651]) and non-visible (b = -0.783, 95% CI [-2.609;0.482) conditions.

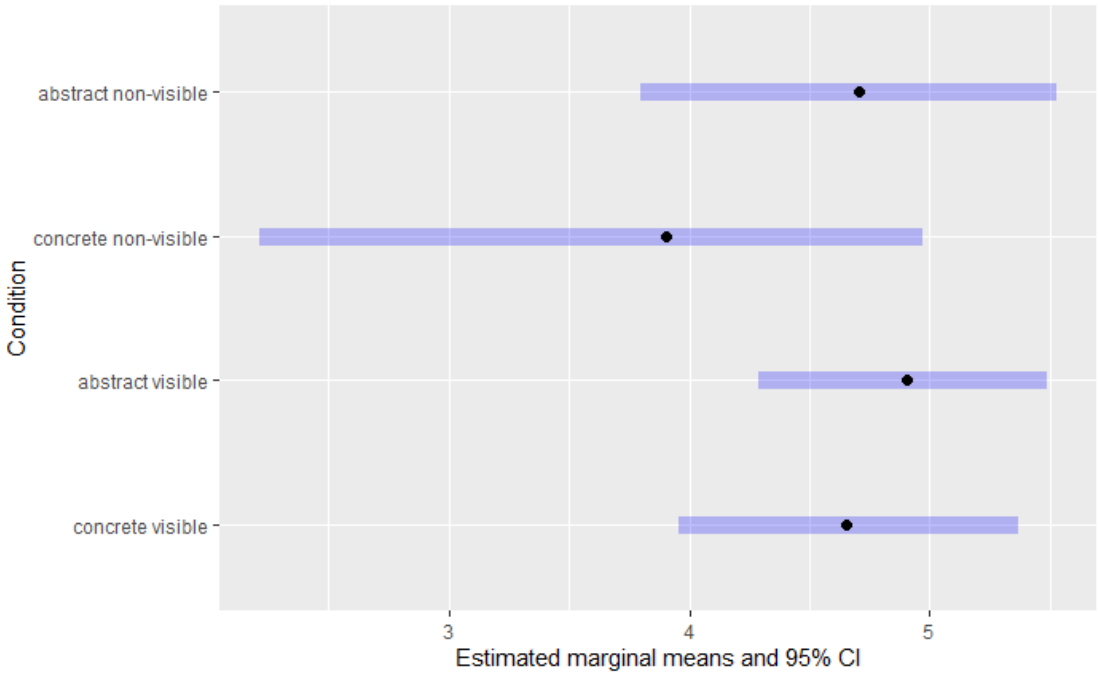

Figure 2. Estimated marginal means and 95% CI of gesture rate per condition.

Summarizing, a non-significant abstractness effect was observed in this pilot data, where overall gesture rate for gestures was higher for abstract compared to concrete trials. Furthermore, moderate evidence was found for a non-significant visibility effect, in which gesture rate is lower for the non-visibility compared to the visibility condition. As for the interaction effect, anecdotal evidence was found in favour of an interaction between visibility and concreteness. Follow-up paired comparisons showed no significant interaction effects. Full data collection will hopefully shed more light on the existence (and direction) of these effects.

Lastly, descriptive statistics on the distribution of gesture types over conditions, indicated that different gesture types might play a role in abstract compared to concrete conditions and visible versus non-visible conditions. However, only with a larger dataset will we be able to test predictions regarding their effects.

E. Discussion

The current study aims to investigate to what extent we gesture for ourselves or for others. Specifically, we investigate listener-oriented and speaker-oriented functions of gestures accompanying abstract speech. In this pre-registration, an online behavioural experiment is set up in which participants will communicate to each other using either abstract or concrete speech, where visibility of participants will be manipulated. The hypotheses for the current study are listed in table 8 and 9, below.

Table 8

Overview of hypotheses for overall gesture rate (contrasting hypotheses are marked in bold)

	Gesture as Simulated Action	Gesture as Communicative Tool
Concrete versus abstract	**More gestures in concrete**	**More gestures in abstract**
Visible versus non-visible	More gestures in visible	More gestures in visible
Interaction between visibility and abstractness	**Visibility effect larger in abstract than in concrete**	**No interaction between visibility and abstractness**

Table 9

Overview of hypotheses for gesture types

	Concrete versus abstract	Visible versus non-visible
Iconic	more iconics in concrete	More iconics in visible
Metaphoric	More metaphorics in abstract	More metaphorics in visible
Pragmatic	more pragmatics in abstract	More pragmatics in visible
Beat	More beats in abstract	No difference

The results of a small pilot study (N=10) point in the direction of part of the hypotheses. First of all, there seems to be an effect of visibility on overall gesture rate, be it non-significant, indicating that our manipulation of the communicative situation is successful. This also fits

with previous studies that found an effect of visibility on gesture rate (Bavelas & Healing, 2013). As for an effect of abstractness on overall gesture rate, a non-significant effect was found, where gesture rate is higher in the abstract compared to the concrete conditions. These results are in line with previous findings that show how gesture is a communicative tool, and can be used to increase common ground in social interaction (Chui, 2014; Holler & Wilkin, 2011; Özyürek, 2002). Lastly, anecdotal evidence was found for an interaction between abstractness and visibility, but follow-up pairwise comparisons showed no clear direction of the effect. Statistical analyses with a larger dataset are necessary to be able to interpret these findings in light of hypotheses from GSA or Communicative Tool.

A closer look into the distribution of gesture types over all conditions, revealed that different gesture types seem to be affected by abstractness and visibility in different ways, as was also found by Zdrazilova et al. (2018). Preliminary descriptive statistics hinted that iconic gestures, relating to sensory and motor content, occurred more in concrete compared to abstract conditions. Conversely, metaphoric gestures, that can relate to sensory and motor content through metaphorical mappings, occurred more in abstract compared to concrete conditions. These findings are in line with the GSA framework (Hostetter & Alibali, 2008, 2019), which hypothesizes that people gesture more when they activate spatio-motoric simulations. Both iconic gestures and metaphoric gestures seemed to be affected by visibility: gesture rate for iconic gestures was higher in concrete-visible compared to concrete-non-visible condition, and gesture rate for metaphoric gestures was higher in abstract-visible compared to abstract-non-visible condition. These findings are in line with the view of gestures as a Communicative Tool, which hypothesizes that gestures are used when they can function as a communicative resource. This is the case when interlocutors can see each other.

Pragmatic gestures rate was higher in abstract compared to concrete conditions. This is in line with Müller (2004), who argues that gestures such as Palm Up Open Hand gestures, can be particularly useful in negotiating meaning for abstract content. It is not in line with Zdrazilova et al. However, this may be a consequence of a different gesture coding system for communicative versus pragmatic gestures. Beat gestures lastly, seemed to occur more in abstract compared to concrete conditions, in line with Zdrazilova et al. (2018). It is also in line with earlier findings showing how beat gestures can facilitate speech production, which may be more difficult for abstract compared to concrete speech (Lucero et al., 2014). There was no clear visibility effect for beat gesture rate.

For all of these specific gesture types, it must be noted that no statistical analyses were conducted, and the findings must be interpreted with caution. Furthermore, as the data is not normally distributed, mean gesture rates might not provide accurate information.

In sum, results of this pilot study gesture rate seems to be higher for abstract compared to concrete speech, be it non-significantly. Furthermore, gesture rate seems to be higher in visible compared to non-visible conditions. No clear interaction pattern was found between visibility and abstractness. A closer look at gesture types revealed that gesture types seemed to be affected differently by abstractness and visibility. After more extensive data collection, we hope to be able to give more decisive answers to the research questions above.

The current study aims to contribute to the body of research investigating the subtleties of listener-oriented and speaker-oriented functions of gesture (Holler & Wilkin, 2011; Hostetter & Alibali, 2008; Kita, 2000; Özyürek, 2002). By investigating communicative functions gesture use accompanying abstract speech, we shed more light on the underlying mechanisms behind gesture use, and extend previous findings of Zdrazilova et al. (2018). Ultimately, this will contribute to more fine-grained knowledge of how and when gestures emerge in conversation (Holler & Levinson, 2019).

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Appendix A – Stimulus materials

Table 1

Taboo words and clues, in Dutch with English translations

Taboo	English	Clue 1	English	Clue 2	English	Clue 3	English
Applaus	Applause	klappen	To clap	concert	Concert	zaal	Hall
Bewondering	Admiration	streven	To strive for	idool	Idol	respect	Respect
Blijdschap	Happiness	uitdrukken	To Express	vrolijkheid	Cheerfulness	emotie	Emotion
Blozen	To Blush	gloeien	To glow	wang	Cheek	oogcontact	Eye-contact
Bluf	Bluff	belazeren	To pull a fast one	tactiek	strategy	misleiding	Deception
Bouwen	To build	slopen	To demolish	fundering	foundation	gereedschap	Tools/equipment
Buigen	To bend	Knielen	To kneel	troon	Throne	Rug	back
Charme	Charm	weerstaan	To Resist	betovering	Enchantment	Uitstraling	Aura/charisma
Clown	Clown	uitlachen	To laugh at	kostuum	Costume	circus	Circus
Gehoorzamen	To obey	dienen	To serve	eerbied	Esteem	autoriteit	authority
Gevecht	Fight	worstelen	To wrestle	wedstrijd	Contest	vuurwapen	firearm
Grijns	Grin	Glimlachen	To smile faintly	tanden	Teeth	smoel	Grimace

Jeugd	Youth	opvoeden	To bring up	generatie	Generation	kindertijd	childhood
Juweel	Jewel	opgraven	To dig up	halsketting	Necklace	ring	Ring
Knikken	To nod	gebaren	To gesture	stem	Voice	hoofd	Head
Kwaal	Ailment	verhelpen	To repair	aandoening	Complaint	slapeloosheid	Insomnia
Liegen	To tell a lie	verzwijgen	To conceal / keep silent	verzinsel	Fabrication	geheim	Secret
Lippenstift	Lipstick	smeren	To spread / smear	mascara	Mascara	zalf	Balm
Masker	Mask	verstoppen	To hide	Overvaller	Raider	vermomming	Disguise
Omhelzing	Embrace	strelen	To caress	knuffel	Hug	warmte	Warmth
Onderdrukken	To suppress	weigeren	To refuse	wilskracht	Will power	controle	Control
Onrust	Unrest	dreigen	To threat	chaos	Chaos	onzekerheid	Uncertainty
Ontploffing	Explosion	instorten	To collapse	dynamiet	Dynamite	bomaanslag	Bomb attack
Poker	Poker	kaarten	To play cards	casino	Casino	muntje	coin
Pop	Doll	verkleden	To dress up	kinderwagen	Pram / baby carriage	speelgoed	Toys
Rijkdom	Wealth	wensen	To wish	armoede	Poverty	Welvaart	Prosperity
Roem	Fame	najagen	To pursue	bekendheid	Reputation	populariteit	Popularity

Romantiek	Romance	ervaren	To experience	sfeer	Atmosphere	verliefdheid	Being in love
Rugpijn	Back ache	kreunen	To groan	kramp	Cramp	bekken	Pelvis
Schamen	To be ashamed	vernederen	To humiliate	schande	Disgrace	puberteit	Puberty
Schijn	Pretence	bedriegen	To deceive	illusie	Illusion	dekmantel	Cover
Stichten	To found	verwezenlijken	To achieve / realize	gedachte	Thought	vervulling	Fullfillment
Verlies	Loss	missen	To miss	verdriet	Sorrow	tegenslag	Setback
Verveling	Boredom	verzinnen	To make something up	bezigheid	Activity	sleur	Routine / grind
Wegduwen	To push away	verplaatsen	To transfer	beweging	Movement	hendel	Handle
Zucht	Sigh	uitademen	To breathe out	geluid	Noise	briesje	breeze

Appendix B Consent Form

Start of Block: Toestemming_deelnemer

Info_1 **Verklaring deelnemer**

Ik heb uitleg gekregen over het doel van het onderzoek. Ik heb vragen mogen stellen over het onderzoek. Ik neem vrijwillig deel aan het onderzoek. Ik begrijp dat ik op elk moment tijdens het onderzoek mag stoppen als ik dat wil. Ik begrijp hoe de gegevens van het onderzoek bewaard zullen worden en waarvoor ze gebruikt zullen worden. Ik stem in met deelname aan het onderzoek zoals beschreven in het informatiedocument.

Speaker-oriented and listener-oriented functions of gestures accompanying abstract speech

Toestemming Ik geef toestemming om (s.v.p. aankruisen wat van toepassing is):

	Ja (1)	Nee (2)
video-opnamen van mij te maken voor dit onderzoek en deze opnames op te slaan volgens de geldende regels van de Radboud Universiteit (1)	☐	☐
de video-opnamen te annoteren (annotatie) (3)	☐	☐
de anoniem gemaakte annotaties te gebruiken voor wetenschappelijk onderzoek (4)	☐	☐
de video-opnamen te laten tonen op congressen (5)	☐	☐
de video-opnamen te laten tonen voor onderwijsdoeleinden (6)	☐	☐
de video-opnamen te delen met andere betrokken onderzoekers bij het huidige onderzoek (7)	☐	☐

Overige_opmerkingen Overige opmerkingen (optioneel):

_____

Speaker-oriented and listener-oriented functions of gestures accompanying abstract speech

Persoonsgegevens Vul s.v.p. de volgende gegevens in:

- Voornaam (1) _____
- Achternaam (2) _____
- Geboortedatum (dd/mm/jjjj) (3)

_____

End of Block: Toestemming_deelnemer

Start of Block: Toestemming_onderzoeker

Q7 Verklaring uitvoerend onderzoeker

Ik verklaar dat ik de hierboven genoemde persoon juist heb geïnformeerd over het onderzoek en dat ik mij houd aan de richtlijnen voor onderzoekers zoals verwoord in het protocol van de Ethische Toetsingscommissie Geesteswetenschappen.

Q8 Vul de volgende gegevens in:

- Naam (1) _____
- Datum (2) _____

End of Block: Toestemming_onderzoeker

Appendix C Taboo Game Instructions

Jullie gaan zo mee doen aan het Taboespel. In dit spel moeten jullie net als in 30 Seconds om de beurt een aantal woorden (bijvoorbeeld “theepot”) naar elkaar communiceren.
Een van jullie is steeds de zender en de ander is de ontvanger. De zender is degene die het woord zal communiceren. Hierbij krijg je steeds drie hints om te gebruiken in je omschrijving. Bijvoorbeeld, in het geval van “theepot” krijg je de hints “schenken”, “drank”, en “kopje. Het is belangrijk dat je *alle drie* de hints gebruikt in je omschrijving.
Vanzelfsprekend mag je het taboewoord niet zeggen, en ook niet een woord dat onderdeel is van het taboewoord (bijvoorbeeld als het taboewoord “tandenborstel” is, mag je “tand” niet gebruiken). Je hebt steeds 30 secondes de tijd om het woord te communiceren.
Wanneer de zender klaar is met de omschrijving, is het de taak van de ontvanger om het woord te raden. Je mag geen vragen stellen aan de zender, alleen woorden noemen waarvan jij denkt dat het een mogelijke kandidaat is. Hiervoor heb je drie pogingen.

Het spel heeft 36 rondes, verspreid over 4 blokken. Aan het begin van het blok stuur ik steeds een lijst met de taboewoorden en de hints naar de zender van dat blok via de chat. Elke ronde gaat vervolgens zo:

- Eerst heeft de zender tijd om het taboewoord en de hints te bekijken
- Daarna heeft de zender 30 secondes de tijd om het taboewoord te communiceren naar de ontvanger.
- Vervolgens heeft de ontvanger drie pogingen om het woord te raden.
- Een ronde is voorbij als het woord geraden is, of als de ontvanger drie foute pogingen heeft gedaan.

De eerste 9 rondes is X de zender en Y de ontvanger. Na deze 9 rondes draaien we het om en is Y de zender en X de ontvanger. Zo doen we dat nog een keer, zodat er in totaal 4 blokken zijn.
Voordat we gaan beginnen met het experiment zullen we eerst een paar oefenrondes doen, zodat jullie het spel kunnen leren.

Appendix D Post-experiment questions

Start of Block: Task experience

Q2 Bedankt voor je deelname aan het experiment. Nu volgen er een aantal vragen over hoe moeilijk je het experiment vond, over hoe je ervaring van de online communicatie, en over jouw relatie tot je medespeler.

Page Break

pp_nr Vul hier eerst je proefpersoonnummer in:

_____

Words_difficulty

Hieronder staat een lijst met woorden. Dit zijn dezelfde woorden die je net hebt omschreven of geraden in het experiment.

Geef voor elk van deze woorden aan hoe moeilijk je het vond om deze woorden te omschrijven dan wel te raden.

Geef ook aan of je het woord hebt omschreven of geraden.

LET OP: de woorden die je omschreven en geraden hebt staan op alfabetische volgorde, dus niet op volgorde van het experiment.

	Moeilijkheid	Omschreven of geraden?

Heel moeilijk (1)	moeilijk (2)	Neutraal (3)	Makkelijk (4)	Heel makkelijk (5)	Omschreven (1)	Geraden (2)

applaus (1)	○	○	○	○	○	○	○
bewondering (2)	○	○	○	○	○	○	○
blijdschap (3)	○	○	○	○	○	○	○
blozen (4)	○	○	○	○	○	○	○
bluf (5)	○	○	○	○	○	○	○
bouwen (6)	○	○	○	○	○	○	○
buigen (7)	○	○	○	○	○	○	○
charme (8)	○	○	○	○	○	○	○
clown (9)	○	○	○	○	○	○	○
gehoorzamen (10)	○	○	○	○	○	○	○
gevecht (11)	○	○	○	○	○	○	○

grijns (12)	○	○	○	○	○	○	○
jeugd (13)	○	○	○	○	○	○	○
juweel (14)	○	○	○	○	○	○	○
knikken (15)	○	○	○	○	○	○	○
kwaal (16)	○	○	○	○	○	○	○
liegen (17)	○	○	○	○	○	○	○
lippenstift (18)	○	○	○	○	○	○	○
masker (19)	○	○	○	○	○	○	○
omhelzing (20)	○	○	○	○	○	○	○
onderdrukken (21)	○	○	○	○	○	○	○
onrust (22)	○	○	○	○	○	○	○

ontploffing (23)	○	○	○	○	○	○	○
poker (24)	○	○	○	○	○	○	○
pop (25)	○	○	○	○	○	○	○
rijkdom (26)	○	○	○	○	○	○	○
roem (27)	○	○	○	○	○	○	○
romantiek (28)	○	○	○	○	○	○	○
rugpijn (29)	○	○	○	○	○	○	○
schamen (30)	○	○	○	○	○	○	○
schijn (31)	○	○	○	○	○	○	○
stichten (32)	○	○	○	○	○	○	○
verlies (33)	○	○	○	○	○	○	○

verveling (34)	○	○	○	○	○	○	○
wegduwen (35)	○	○	○	○	○	○	○
zucht (36)	○	○	○	○	○	○	○

Page Break

vid_aud_difficulty Beantwoord nu de volgende stellingen over de interactie die je had **waarbij je jouw medespeler kon zien via webcam en kon horen via microfoon**.

	Helemaal oneens (1)	Oneens (2)	Een beetje oneens (3)	Neutraal (4)	Een beetje eens (5)	Eens (6)	Helemaal eens (7)
Ik vond het makkelijk om de woorden te omschrijven aan mijn spelpartner (1)	○	○	○	○	○	○	○
De communicatie met mijn spelpartner verliep soepel (2)	○	○	○	○	○	○	○
De modus van communicatie hielp bij het uitvoeren van het spel (3)	○	○	○	○	○	○	○

Het kostte mij veel moeite om in deze modus van communicatie het spel te spelen (4)	○	○	○	○	○	○	○
Ik vond het prettig om het spel in deze modus van communicatie te spelen (5)	○	○	○	○	○	○	○

Page Break

aud_only_difficulty Beantwoord nu de volgende stellingen over de interactie die je had **waarbij je jouw medespeler alleen kon horen via microfoon.**

	Helemaal oneens (1)	Oneens (2)	Een beetje oneens (3)	Neutraal (4)	Een beetje eens (5)	Eens (6)	Helemaal eens (7)
Ik vond het makkelijk om de woorden te omschrijven aan mijn spelpartner (1)	○	○	○	○	○	○	○
De communicatie met mijn spelpartner verliep soepel (2)	○	○	○	○	○	○	○
De modus van communicatie hielp bij het uitvoeren van het spel (3)	○	○	○	○	○	○	○

Het kostte mij veel moeite om in deze modus van communicatie het spel te spelen (4)	○	○	○	○	○	○	○
Ik vond het prettig om het spel in deze modus van communicatie te spelen (5)	○	○	○	○	○	○	○

Page Break

Speaker-oriented and listener-oriented functions of gestures accompanying abstract speech

Internet_stabiliteit

Beantwoord nu de volgende stellingen over de kwaliteit van het beeld en de audio tijdens het

Speaker-oriented and listener-oriented functions of gestures accompanying abstract speech experiment.

	Nooit (1)	Één keer (2)	Af en toe (3)	Regelmatig (4)	Vaak (5)
Tijdens het experiment haperde het beeld (1)	○	○	○	○	○
Tijdens het experiment haperde de audio (2)	○	○	○	○	○
Tijdens het experiment viel het beeld weg (3)	○	○	○	○	○
Tijdens het experiment viel de audio weg (4)	○	○	○	○	○
Een slechte internetverbinding tijdens het experiment belemmerde de communicatie in het experiment (5)	○	○	○	○	○

Page Break

End of Block: Task experience

Start of Block: Friendship questions

years_friendship Hoe lang ken jij jouw medespeler al? (in jaren)

_____

contact_ff_friend Hoe vaak spreken jullie elkaar (face-to-face)?

- elke dag (1)
- een paar keer per week (2)
- wekelijks (3)
- eens in de paar weken (4)
- maandelijks (5)
- minder dan maandelijks (6)

contact_onl_friend Hoe vaak hebben jullie op een andere manier contact (bijvoorbeeld via Whatsapp of Instagram)

- ○ elke dag (1)
- ○ een paar keer per week (2)
- ○ wekelijks (3)
- ○ eens in de paar weken (4)
- ○ maandelijks (5)
- ○ minder dan maandelijks (6)

End of Block: Friendship questions

Start of Block: Background_questions

Q17 Nu volgen er nog een aantal vragen over jouw achtergrond.

Speaker-oriented and listener-oriented functions of gestures accompanying abstract speech

gender Wat is je gender?

- ○ Man (1)
- ○ Vrouw (2)
- ○ Anders (3)
- ○ Zeg ik liever niet (4)

---

hand_pref Wat is je handvoorkeur

- ○ Rechtshandig (1)
- ○ Linkshandig (2)
- ○ Geen voorkeur / beide (3)

age Hoe oud ben je?

_____

Q15 Wat is je moedertaal?

- ○ Nederlands (1)
- ○ Anders, namelijk: (2) _____

End of Block: Background_questions

Appendix E Speech and Gesture Annotation Scheme

In the annotation of the data, we use the following tiers:

- Trial
- Taboo word
- Speech
- Gesture
- Gesture type

Trial tier

The experiment consists of 4 blocks of 9 trials each. The corresponding video-segments will be labelled “block.trial”, for instance, trial 8 of block three will be called 3.8 .

Taboo word

The taboo word is the target word that has to be guessed in the current trial.

Speech

Speech is transcribed per trial. We use standard orthographic transcription. This means that we spell words using standard spelling – even if participants reduce the words or pronounce them differently. If speech is unclear, write it between brackets. If it is unaudible, write (?) as a replacement for that word.

Transcribe

- All words
- Repetitions of the same word
- Partial words – end these with a hyphen
- Self-corrections
- Filled pauses
- Speech of others (i.e. the other participant or the experimenter) – mark these with a * .
- Non-verbal sounds, such as coughs – mark these with a # .

Gesture

The gesture tier has three levels

- Gesture
- Non-gesture
- Undecided

Gesture

- Co-speech gestures of the hands. Thus excluding such movements as pointing with the head, or moving whole body forward
- Only the stroke is coded as gesture
- Holds are excluded from the annotation. Superimposed beats during a hold are ignored.

Non-gesture

- E.g., self-adjustments or some participant-specific movements he/she makes all the time with the hands
- Movements which are finally regarded as preparation, retraction or hold

Undecided

- If it's really unclear if something is a gesture (stroke) or not. Mostly these are irrelevant gestures. These are excluded from the analysis.
- Gestures that are done outside of the screen (and thus are not visible to the coder)

Gesture type

The gesture type tier has 6 levels

- Iconic
- Metaphoric
- Pragmatic
- Beat
- Other
- Undecided

Iconic

Representational gestures which depict some (aspect of) a physical object or event in an iconic way.

Metaphoric

Speaker-oriented and listener-oriented functions of gestures accompanying abstract speech

Representational gestures which depict some (aspect of) the SOURCE DOMAIN of a metaphoric concept, that refer to the topic of interaction. Metaphoric gestures are identified using an adapted version of MIG-G (Cienki, 2016).

1. identify if the gesture serves any referential function, using form features hand shape, orientation, and movement
2. if the gesture serves a referential function, identify the physical referent(s) depicted in the gesture(s) (the potential Source domain);
3. identify the contextual topic being referenced (the potential Target domain);
4. is the topic being identified via a resemblance in experience to the referent depicted via the gesture?
    - If so, the gesture can be identified as metaphorically used via the mapping that the topic [This Target Domain] is being likened to the referent depicted [This Source Domain].

Pragmatics

Gestures that do not have to with the topic of interaction itself, but with the discourse. For example

- Circling gestures that show: "sort of like this" ("weet je wel") or continuity of the argument
- Hold gestures that show "this thing that I talked about earlier"
- Container gestures that show "this is the taboo word"
- Gestures changing location, accompanying "puntje puntje puntje"

Beat

These are gestures that have a rhythmic motion, relating to the prosody of the speech (Leonard & Cummins, 2011)

Other

These are conventional interactive gestures such as emblematic gestures (e.g. thumbs up) or deictic gestures. These are excluded from the analysis.

Undecided

If it's really unclear if a gesture is an iconic, metaphoric, interactive, beat or other gesture. These are excluded from the analysis.