

Ostensive signals: markers of communicative relevance of gesture during multimodal demonstrations to adults and children

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Abstract

Speakers adapt their speech and gestures in various ways for their audience. We investigated further whether they use ostensive signals (eye gaze, ostensive speech (e.g. *like this, this*) or a combination of both) in relation to their gestures when talking to different addressees, i.e., to another adult or a child in a multimodal demonstration task. While adults used more eye gaze towards their gestures with other adults than with children, they were more likely to use combined ostensive signals for children than for adults. Thus speakers mark the communicative relevance of their gestures with different types of ostensive signals and by taking different types of addressees into account.

Index Terms: gesture, recipient design, ostensive signals, eye gaze, ostensive speech

1. Introduction

In a face-to-face communication, the visual modality has provided us with communicative tools like our hands, facial expressions and eye gaze, in addition to the verbal modality. The final message that we produce is the interplay of all of these and other communicative channels. This implies that we are free to manipulate them and encode our message according to our preference or necessity [1]. It also implies that we are likely to accentuate the core information and attend to the modality in which it is present or more relevant [2]. In other words, considering that we are capable of shifting information from one channel to another and also employ different channels simultaneously, we are able to accentuate the relevant information wherever it might be encoded.

Even though hand gestures accompanying speech have been intensively studied in the context of communication and research has provided extensive support for its communicative function [3,7,8,9 among many], almost nothing is known concerning the circumstances under which speakers foreground information in their gestures. For example, it has been proposed that gesture use is designed differently for children in comparison to adults in order to enhance the understanding of the message [3,4]. Very little is known, however, about why and how speakers make their gestures communicative or, more precisely, alter the level of their communicativeness. Within this study we therefore set out to unravel the use of ostensive signals, namely eye gaze and/or ostensive speech (e.g. *like this, this*), relating to gesture in face-to-face communication, and investigate whether it is implemented as a strategy to highlight the communicative relevance of the information expressed by gesture. Secondly, we are interested in the contexts where such highlighting of gesture occurs and how this highlighting is achieved.

Accordingly, we aim to answer the following questions:

- What are the patterns of the ostensive signals (eye gaze and/or ostensive speech) used to emphasize information in gestures during a demonstration task?
- Do these patterns change in certain communicative contexts (e.g. demonstration to a child or an adult)?

2. Background

Addressees tend to pick up the most relevant stimuli from the speaker in order to process a message and understand its meaning [5]. Accordingly, speakers are likely to produce such stimuli that will be relevant to the addressee and that will help the addressee in deriving the meaning of what is expressed more efficiently. Such inferential communication is rooted in an attempt to make the addressee recognize that the speaker has intended to affect the state of her knowledge by manifesting such intention. Therefore, this communication is not merely inferential but also ostensive. It results in a communicative act having two intentions - informative and communicative. A speaker's *informative intention* is the intention to inform the addressee about something. A *communicative intention*, in turn, informs the addressee that the speaker intends to provide the information. Such communicative intention can be realized through *ostensive signals* [6]. By means of the ostensive signals the speaker invites the addressee to attend to what she has referred to and by doing so she informs the addressee that the particular piece of information is relevant in the processing of the meaning of the message. Ostensive signals go beyond the verbal domain of lexical/semantic information, word order, morphology and prosody, manifesting themselves also visually [2, 5, 7, 8].

It is important to note that in face-to-face interaction a variety of ostensive signals combine or compete in a discourse. The role of the speaker is a crucial one in selecting the most adequate signal in order to manifest her communicative intention [7]. Therefore, the speaker has to assess the context of the interaction and decide to implement a particular communicative strategy (recruiting multi-modal signals) from which the addressee would benefit the most, allowing the addressee to process the message more efficiently. In other words, recipient-design plays an important role in the decision of how to encode the message [9].

Regarding the age of the recipient, the importance of ostensive signals in communication has been investigated mostly in relation to very young children (infants and toddlers) and the way mothers change their communicative patterns. Studies have shown that infants become aware of the ostensive signals at an early stage (during the first year of their life) and react to the communicative nature of the message when it is transmitted not only through the verbal modality like child-directed speech or naming [10,11,12], but also eye gaze [11,12,13], object exchange [11], object demonstrations, object displays and pointing [4]. Even though picking up the

communicative signals to process the message does not end at infancy and is not limited to input of the mothers alone, to date there is only one study that looked into multi-modal communicative strategy implemented towards school-age children (12 years old) in comparison to adults.

[3] looked into differences in gesture use according to the age of the addressee – child or adult. Participants in the study did not have an actual addressee present but they had to imagine the addressee in order to describe an action (a child, an adult who knows how to prepare coffee (*expert*) and adult who does not know how to prepare coffee (*novice*)). Therefore, differently from experiments with very young children, where the object is usually manipulated (displayed, demonstrated or exchanged) or at least is present during interaction, in this study speakers had to bear in mind that addressees would have to interpret the message based solely on a mental representation. This study showed that speakers tended to use more iconic gestures with children rather than with adults who knew how to prepare coffee. This result shows that iconic gestures might have been implemented as an informative tool in order to provide a clearer message. A follow-up study showed that iconic gestures addressed to the children were considered more informative and bigger than gestures in both adult conditions, thus suggesting that implementing iconic gesture might serve as a strategy to improve the effectiveness of the message for children [3]. Such an assumption seems plausible if we take into account that integrating gesture and speech makes the interpretation of the message easier for very young children [4] and therefore, this aspect of ease might stand for older children as well.

It has been proposed that gesture is a communicative strategy used in order to determine a discourse referent [8]. Unlike linguistic signals that compete between each other in order to manifest the relevant information, gesture and linguistic signals tend to combine. It was presumed that these signals may cluster to help to identify the referent and the more clustering there is the more likely that the referent is determined [8]. Considering that gesture may be seen as a bridge that combines world knowledge and language, in the sense that it encodes world knowledge visually and relates it to the co-occurring verbal expression, it serves as a strong signal to the information that was expressed by the speaker. In such contexts, gesture serves as an ostensive signal to the co-occurring speech. According to [8], the main idea is that the core information is contained in speech - which is the informative intent of the speaker - while gesture functions as intensifier, a communicative intent by letting the addressee know that the information contained in the speech is relevant [8].

Although there has been some interest in investigating ostensive signals that lead to attending to gesture from the perception point of view [7,14], to our knowledge there is no research that centers exactly on production of those signals (except [16] who investigated how speakers attend to their gestures after the feedback from the addressee). However, without understanding how and why speakers attend to their gestures, research on perception of these gestures and signals renders such studies somewhat incomplete. In fact, in order to make a judgment on why addressees attend to particularly highlighted gestures, it is first necessary to find the answers on how this highlighting occurs. According to the literature, the main ostensive signals to gesture are eye gaze and ostensive speech [7,14, 2].

[2] points out that gestures are not solely internal conceptualizations, but also images that can be perceived as material objects and therefore pointed to by means of an eye gaze. The hand creating a gesture becomes a representational

artifact that is meant to be seen by others. Moreover, by attending with eye gaze to the self-produced gesture, the speaker signals that the gesture is meant to provide information. The main point made by [2] is that mere research of speech and gesture is not entirely reliable in order to investigate the function of gesture. In fact, there is the third aspect, eye gaze that has to be taken into account when making any inferences about intended communicativeness of the gesture. [14] presents results indicating that addressees fixate very few gestures produced by the speaker; they are, however, more likely to fixate the gestures that the speakers gazed at themselves, and therefore they conclude that eye gaze serves as an effective attention drawing device for the addressees.

Eye gaze is not the only tool used by the speakers to direct attention of the addressees to their gestures. For example, [2] refers to the ostensive speech (demonstratives e.g. *like this, that*) as a signal to the relevance of gesture in conversation. When a speaker ostensively refers to a gesture, this becomes the core of the utterance because ostensive speech is not providing any concrete information but is only pointing to the gesture as the one that possesses it [2]. Also, [16] report that participants used ostensive speech significantly more when they were requested to elaborate on the information they had provided before, which signals that ostensive speech, indeed, is implemented as a tool to direct attention toward the gesture in order to provide a clearer message.

As stated above, a communicative act requires two intentions – the informative intention, which is the content of the message, and the communicative intention, which is a manifestation of willingness to transmit the message. According to the reviewed literature, it is plausible to suggest that, if gesture is communicatively intended in the sense that it possesses relevant informative value, it should be manifested through ostensive signals like the eye gaze (2, 7, 14) and/or the ostensive speech [2, 4]. The gesture might serve not only as the ostensive signal to the co-occurring speech in order to determine the referent [7, 8], but as the content of the information in its own, which is manifested by means of ostensive signals. Thus, if the speakers attend to their own gestures, they mark the relevance of the information contained in them and not only the information contained in the speech.

The purpose of this study is to extend existing research on the communicative function of representational gestures (gestures that have a semantic relation to their referent) from the encoding point of view. Furthermore, it aims to be the first systematic study to stress the role of ostensive signals in the light of gesture's relevance to the encoding of the message. We reviewed the study of [3] who stated that using iconic gesture might be used as a strategy with children to render the message during a demonstration more comprehensible. Thus we predict that:

- Speakers attend more (by means of eye gaze and/or ostensive speech) to their gestures with children than adults during a demonstration task.

We make no predictions about which type of the ostensive signals will be used, nor about the preference for one ostensive signal over another due to the lack of literature on which to base such predictions.

3. Method

3.1. Participants

Forty-eight right-handed Italians, born and raised in Sicily, participated in the study. Thirty-two participants were undergraduate students, ranging from 20 to 30 years. Sixteen participants were school-age children, ranging from 9 to 10 years. None of the adult participants had experience with children (they had no children, no very young siblings, no teaching experience). None of the participants knew each other before the experiment. All of the participants were informed about presence of the cameras before the recording and gave their written consent to the use of recorded material.

3.2. Material

The material for the study was a game called „Camelot“. The idea of the game is to create a path through which a prince, who is located on one tower, can arrive at the princess, who is located on the other tower. The game consists of wooden blocks that have to be put together (either in line horizontally on the wooden plate with 6 spaces for each block, or vertically with a block on another block) to create a path without gaps from one tower to the other, which are situated at the extremes of a wooden plate. Some of the blocks have the shape of a stair, which is the difficult part of the game. Player's task is to understand how to put these stairs appropriately in order to create a path without gaps. This game was chosen to provide speakers with stimuli to recruit gesture use, as the rules, which the speaker has to explain, require a lot of form, location and motion explanations.

3.3. Design

A within-subject design was used. Sixteen randomly chosen Italian adult participants (12 female, 7 male) were assigned the role of the *speakers* in the study, while another 16 adults and 16 children had a role of the *addressees*, which represented two conditions (adult and child). The order of the conditions was counter balanced. Only *speakers* were analyzed for the present study.

3.4. Procedure

The speakers were introduced to the rules of the game by the experimenter who presented them in written form. After, the speakers had to complete the game on their own to be able to explain it to the addressees at a later time.

The addressees were asked not to ask questions during speaker's description and they were informed that they could ask them, if there were any, once the speaker has finished speaking. The reasoning behind this arrangement was that dialog might affect gesture use frequency [15] and addressee's feedback might result in changes of the frequency with which speakers gazed at their gestures [16]. It is important to note, that even though such preventives secured a lower chance of verbal feedback, it could not limit non-verbal feedback of the addressees (e.g., face expressions). At the end of the session the addressees were asked to fill in a questionnaire and answer the question *how difficult was it to understand the speaker's descriptions?* by using Likert scale responses from 1 to 5 (1= *very easy*, 5= *very difficult*).

Before the experiment, each speaker had a warming-up session with both addressees (one at a time), during which they had small talk on random topics. The speaker and the addressee were seated at adjacent sides of the table (squared shape) and in chairs without armrests.

Data were recorded on two cameras from two different angles. The first camera recorded a frontal, diagonal view, so both participants were visible. The second camera recorded from the top down and to the left of the speaker; this view covered the whole surface of the table.

3.5. Coding

Data were coded for speech and gesture, as well as for ostensive signals investigated in the present study, which are eye-gaze and ostensive speech. All the data were coded using the video annotation software ELAN [21], developed at the Max Planck Institute for Psycholinguistics.

3.5.1. Speech

The speech of the speaker was transcribed and divided in words [3]. Then it was coded for *description* and *question/answer* segments. Few instances occurred where the addressees interrupted the speakers while they were describing the rules (in total 5 occurrences in adult condition, and 6 occurrences in child condition). The answers to the question and interruptions of the addressee were excluded from the analysis.

3.5.2. Gesture

All gesture strokes during the description were coded, where the stroke is considered the part of the gesture that conveys the most meaningful part and requires the most effort [17, 18]. In this study, the focus is put on representational gestures that, in our corpus, consist of iconic gestures and abstract deictic gestures [17]. Pragmatic gestures were coded but were not considered in the present study (9% of all gestures in both conditions), as they do not provide information on the content itself but they mark pragmatic aspects of the speech act [18]. Representational gestures were labeled as iconic (a gesture reflecting the property of the referent, e.g., a speaker traced a line with a hand palm down to represent a path) or abstract deictic (a gesture referring to abstract location, e.g., a speaker pointed with finger to the right side of the table to refer to the location of the prince) [17]. Only gestures with co-occurring intelligible speech were taken into account for analysis. In other words, gestures that were produced during disfluencies were not analyzed due to the possibility of disfluencies affecting the way speakers gestured [19].

3.5.3. Eye gaze as ostensive signal

Speakers' eye gaze was coded for "bouts". We considered a bout as an eye-gaze that was directed to the gesture regardless of its duration [5]. Eye gaze bouts were divided into two categories: bouts to the iconic gesture and bouts to the pointing gesture. For example, a speaker uttered "a path has to be straight" and accompanied *to be straight* with an iconic gesture by tracing a straight line on the table with both hands and directed her eye gaze to the gesture as she was tracing the line. This gesture was assigned one eye gaze bout to the iconic gesture. Instances where, due to the hindered visibility of the eye gaze direction (shadow, eye glasses), it was not clear whether or not eye gaze bouts referred to the gesture, they were not coded as a bout.

3.5.4. Ostensive speech

Ostensive speech utterances (e.g. speaker uttered "like this", "this figure") that accompanied gestures were annotated. Within this annotation it was distinguished whether ostensive

speech referred to a complementary or a redundant gesture. For example, if the speaker said “the stair can’t be positioned like this” and while uttering *like this* performed an iconic gesture that represents the stairs’ peak touching the ground, ostensive speech was annotated as complementary, due to the fact that the position of how the stair is located was present in the gesture, but not in the speech. However, if the speaker said “this knight” and simultaneously performed an iconic gesture representing the knight, it was annotated as redundant, because *the knight* was present in the speech and in the iconic gesture. Furthermore, ostensive speech was annotated whether it referred to the iconic or pointing gesture.

3.5.5. Combination of eye gaze and ostensive speech

The last type of ostensive signal assessed in our study was the combination of eye gaze and ostensive speech. Namely, if the same gesture received an eye gaze bout and was accompanied by ostensive speech it was coded as a combination of eye gaze and ostensive speech. Importantly, we considered using both ostensive signals – eye gaze and ostensive speech – in combination as a separate type of ostensive signal. In other words, three types of the ostensive signals – eye gaze only, ostensive speech only, and combination of eye gaze and ostensive speech were counted separately.

3.6. Reliability

All data were transcribed and coded by the first author of the present study who has a near-native proficiency in Italian language (certified CEFR-C2 level). Randomly selected 20% of the data (3 speakers for each condition) were coded by a second coder. Third author of the present study - a native speaker of Italian language, coded gesture segmentation in strokes and their classification. The agreement between coders on the gesture segmentation was 88%. The strength of agreement between coders on gesture classification was good as indicated by Cohen’s Kappa = .76. Ostensive signals (eye gaze bouts to the gesture and ostensive speech utterances) were coded by another native speaker of Italian language, naïve to the hypothesis of the study. The agreement on eye gaze bouts was almost perfect as indicated by Cohen’s Kappa = .96, and there was a total agreement on ostensive speech utterances (Cohen’s Kappa=1).

4. Results

4.1. Analysis

All analyses, except number of words, were performed on arcsine transformed proportions. Based on previous literature, analyses of number of words, rates of iconic gestures (per 100 words) and proportion of total ostensive signals used were planned comparisons with a prediction that proportions in the child condition will be higher than in adult condition (1-sided) based previous literature and findings of [3]. In regard to the particular type of the ostensive signals no predictions were made.

4.2. Speech and gesture

Speakers produced comparable amount of words ($F(1,15)=2.104$, ns, one-sided) in child ($M=130.44$, $SE=8.34$) and adult ($M=118.56$, $SE=10.31$) conditions during descriptions of the rules of the game.

Speakers did use slightly more iconic gestures in the child condition ($M=23.10$, $SE=1.2$) in comparison to the adult condition ($M=21.15$, $SE=1.45$). However, this difference did

not reach significance ($F(1,15)=2.532$, ns, but approaching $p=.07$, one-sided, $\eta^2=.144$). Speakers used pointing gestures with comparable frequency ($F(1,15)=.093$, ns, two-sided) in child ($M=2.89$, $SE=0.67$) and adult conditions ($M=2.62$, $SE=0.74$).

Due to the fact that pointing gestures were used scarcely and 4 out of 16 participants did not produce any pointing gestures at all, they were excluded from the further quantitative analyses. In further analyses only iconic gestures were considered.

4.3. Overall use of ostensive signals with iconic gestures

The amount of iconic gestures attended to by means of eye gaze and/or ostensive speech during description differed according to the age of the addressee. The prediction was that speakers would use more ostensive signals with children than adults. Indeed, when talking to a child, speakers, on average, highlighted 33% ($M=0.33$, $SE=0.04$) of their iconic gestures but 25% ($M=0.25$, $SE=0.03$) when talking to an adult. A simple contrast revealed this difference to be significant ($F(1,15)=4.268$, $p=.03$, one-sided, $\eta^2=.222$).

4.4. Eye gaze

Eye gaze was the preferred ostensive signal in both conditions. However, speakers used significantly more eye gaze ($F(1,15)=6.766$, $p=.02$, two-sided, $\eta^2=.311$) with the adults ($M=0.89$, $SE=0.03$) than with the children ($M=0.77$, $SE=0.04$).

4.5. Ostensive speech

Complementary and redundant ostensive speech utterances were collapsed into a single variable due to the scarce use (3 out of 16 participants) of complementary ostensive speech.

When describing the rules of the game, speakers used ostensive speech to highlight their gestures more with children ($M=0.15$, $SE=0.01$) than with adults ($M=0.10$, $SE=0.03$), but the analysis showed that this difference was not significant ($F(1,15)=1.871$, ns, two-sided).

4.6. Combination of eye gaze and ostensive speech

The strategy to use a combination of the eye gaze and ostensive speech to the gesture was almost exclusively used with the children ($M=0.08$, $SE=0.02$) rather than with adults ($M=0.02$, $SE=0.01$). The difference was statistically significant ($F(1,15)= 6.019$, $p=.03$, two-sided, $\eta^2=.286$).

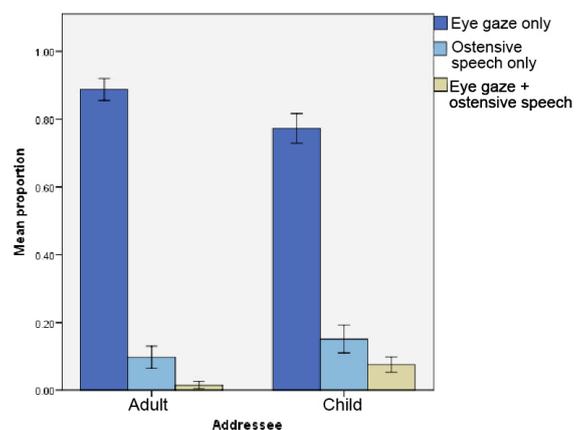


Figure 1: Mean proportion of ostensive signal types to iconic gesture. Error bars display +/- 1 SE of the Mean

5. Discussion and conclusions

There has been no quantitative research investigating the signals that speakers use to attend to their gestures. Therefore, the finding that speakers do highlight approximately 33% of their gestures with children and 25% with adults by means of eye gaze, ostensive speech or combination of both during a demonstration task merits attention in its own right. We also confirmed that speakers use more ostensive signals to the iconic gesture with children than adults. The main findings are discussed below.

5.1. Words and gesture

In the present study, speakers produced a comparable amount of words and iconic gestures in both conditions while in [3] the difference for both reached significance. The absence of the difference in our study might be rooted in the similar state of the addressees' knowledge of the task in both conditions. Research has shown that common ground between the speaker and the addressee plays an important role in the way speakers encode their message, also in regard to iconic gesture use [20]. [3] had three different conditions, which compared three imaginary addressees: an *adult - expert*, an *adult - novice*, and a *child - novice*. A difference between the *expert* and *child* was observed, resulting in speakers producing more words and more iconic gestures with children. However, the amount of words and gestures produced with the *novice* did not reveal significant difference in comparison to the child condition. In our study, all addressees, adults and children, did not know the rules of the game. It is therefore possible that the difference was not observed in our study due to the fact that both conditions employed novices as in [3].

5.2. Ostensive signals to gestures

It is plausible to suggest, after examining the present data, that some iconic gestures are used more intentionally than others and therefore not all iconic gestures are intended as equally communicative. Speakers decide which of the iconic gestures are more important to accentuate and they alter the level of the gesture's communicativeness. Just like speech, gesture is at the disposal of the speaker to convey the information. Furthermore, if a particular gesture, according to the speaker's judgment, is able to provide information more efficiently than speech, then attention of the addressee is brought to it by means of ostensive signaling. This assumption is in accordance with [18] who considers gesture as an „equal partner“ of speech in utterance formation, where the speakers are free to construct their utterance by means of both modalities and give preference to one or the other according to the context.

Speakers attended to approximately one-third of iconic gestures produced with the children, while with the adults one-fourth of the total iconic gestures was accentuated with an ostensive signal. Our results show that the average rate of iconic gesture use did not differ significantly across conditions (not expected); nevertheless, speakers highlighted more iconic gestures with children than adults. They attended more to gestures with children and an explanation of this may be that, by doing so, they prompted the young addressees to ground the concepts expressed in speech with their referents in gesture and as a consequence provide more diversified input to ease comprehension. Our results cannot say anything about beneficial effects on the addressees. It is nevertheless possible to conclude that speakers, when referring to the children, were significantly more active in providing signals to bring their attention to the iconic gestures they produced.

5.3. Eye gaze

Although total use of ostensive signals was more frequent in the child condition, the analysis showed that within the three different types investigated in this study, speakers used eye gaze to highlight the relevant gesture significantly more with adults. Here, perhaps, one needs to think not about why speakers used more eye gaze with adults, but rather why speakers used less eye gaze to iconic gestures with children compared to adults. A possible answer to this is an increased necessity to control the child's attention. [11] shows that mothers, when demonstrating objects, gaze significantly more and longer at their children than when performing a demonstration task with the adults. This was explained by the need to monitor the children's attention and maintain interest in the activity (demonstrating an object) they were performing.

This study shows that, in general, adults do feel the need to control the attention of the older children regardless of speakers' previous experience with them. It is common sense to assume that it is more difficult to maintain the attention of a child than that of an adult, who is cognitively more disposed to concentrating on the task. It is important to note that even though speakers' eye gaze to the addressee was not coded, throughout the data, when speakers did not look at their gestures, their eye gaze was mainly directed to the addressee.

It is possible to argue that when speakers used eye gaze to look at their gestures, this may have served as a self-assuring or cognitive strategy for the speaker herself rather than as an attention-directing strategy for the addressee. Namely, the speaker might have gazed at her gesture to make sure for herself that she is representing the concept in a precise way. However, since eye gaze to gesture differed between adults and children, this corroborates the communicative function hypothesis. Otherwise, speakers would be as likely to look at their own gestures in both conditions.

5.4. Combination of the ostensive signals: eye gaze and ostensive speech

It is quite plausible to assume that it would require extra effort to provide a clear message to a child in comparison with an adult. The significant trend in the use of combinations of ostensive signals to highlight the gesture mainly with children seems to signal that, indeed, this is the case. In fact, it seems that the most efficient strategy for adults to highlight attention to gesture is not eye gaze or ostensive speech alone but to use eye gaze and ostensive speech together.

Our results support the claim of [3] that speakers might use iconic gesture as a communicative strategy with children to transfer the message more efficiently. How this is achieved, however, seems to differ when the address is imagined versus when the addressee is present. In the present study, speakers highlight iconic gestures that are relevant to the message, namely the gestures that might lead to better understanding of the message. Results of this study demonstrate that adults are aware of the possible benefits of the gesture in comprehension of the message. They are also aware that children might require more guidance to locate this information. Therefore, they use more signals overall, and they combine these signals to render their referent more salient to children.

To summarize, during a demonstration task speakers tended to use more eye gaze to accentuate the relevant gestures with adults compared to children, but a combination of eye gaze and ostensive speech was clearly a strategy designed for children.

6. Conclusions

The scope of this study was to investigate whether the speakers use verbal and visual deixis to make the information expressed in their iconic gestures more salient during a demonstration task. Moreover, the study was aimed at exploring the strategies of ostensive signal use implemented by the speakers when referring to different addressees, namely another adult or a school-aged child. The results are in line with the main hypothesis of the study and support the assumption that speakers use ostensive signals, namely ostensive speech, eye gaze and combination of both to augment the informative relevance of the iconic gesture during demonstration task and they do it differently according to the age of the addressee.

The fact that speakers highlighted their gestures shows that gesture can function as a main constituent of the message (rather than as co-speech), at least in the context of a demonstration task. We found that speakers use more ostensive signals to their gesture with children compared to adults. Eye gaze was the preferred type of ostensive signal in both conditions, followed by ostensive speech. Combination of eye gaze and ostensive speech was almost exclusively used with children. It is plausible that this multiple articulators strategy was used to ensure that the child attends to the gesture.

Furthermore, it was found that eye gaze as an ostensive signal to the gesture was used more with adults than with children. This finding shows the importance of maintaining the attention of the addressee during a face-to-face interaction. Considering that this is more difficult to achieve with children, speakers, when communicating with them, chose to mark their gestures by means of eye gaze and ostensive speech together. On the other hand, bringing attention to the relevant piece of information with adults is more easily achieved. Therefore, to direct the attention of the adults to the gesture, speakers used eye gaze alone.

Further research is needed to be able to extend our knowledge about the use of ostensive signals as markers of the communicative relevance of gestures in other communicative tasks such as narratives, conversation etc. Also, further research is needed to investigate the response of addressees of different ages to these signals and whether the strategy implemented by the speakers is actually efficient.

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8. References

[1] Levinson, S. C. and Holler, J., "The origin of human multi-modal communication", *Philosophical Transactions of the Royal Society of London B: Biological Sciences*, 369 (1651), 2014.
 [2] Streeck, J., "Gesture as communication I: Its coordination with gaze and speech", *Communications Monographs* 60 (4): 275-299, 1993.
 [3] Campisi, E. and Özyürek, A., "Iconicity as a communicative strategy: Recipient design in multimodal demonstrations for adults and children" *Journal of Pragmatics* 47(1): 14-27, 2013.
 [4] Schmidt, C. L., "Scrutinizing reference: How gesture and speech are coordinated in mother-child interaction" *Journal of Child Language* 23(2): 279-305, 1996.

[5] Wilson, D. and Sperber, D., "Linguistic form and relevance", *Lingua*, 90(1): 1-25, 1993.
 [6] Wilson, D. and Sperber, D., *Relevance Theory*. In L. Horn & G. Ward (eds.), *The Handbook of Pragmatics*, 607-632, Oxford, Blackwell, 2004.
 [7] Gullberg, M. and Holmqvist, K., "Keeping an eye on gestures: Visual perception of gestures in face-to-face communication", *Pragmatics & Cognition*, 7(1): 35-63, 1999.
 [8] Gullberg, M., "Giving language a hand: gesture as a cue based communicative strategy", *Lund Working Papers in Linguistics*, 44: 41-60, 2009.
 [9] Holler, J. and Stevens, R., "The effect of common ground on how speakers use gesture and speech to represent size information", *Journal of Language and Social Psychology*, 26(1): 4-27, 2007.
 [10] Brand, R. J., Baldwin, D.A. and Ashburn L. A., "Evidence for 'motionese': modifications in mothers' infant-directed action", *Developmental Science*, 5(1): 72-83, 2002.
 [11] Brand, R. J., et al. "Fine-grained analysis of motionese: Eye gaze, object exchanges, and action units in infant-versus adult-directed action", *Infancy*, 11(2): 203-214, 2007.
 [12] Csibra, G., "Recognizing communicative intentions in infancy", *Mind & Language*, 25(2): 141-168, 2010.
 [13] Csibra, G. and Gergely, G., "Social learning and social cognition: The case for pedagogy", *Processes of change in brain and cognitive development. Attention and performance XXI* 21: 249-274, 2006.
 [14] Gullberg, M. and Kita, S., "Attention to speech-accompanying gestures: Eye movements and information uptake", *Journal of nonverbal behavior*, 33(4): 251-277, 2009.
 [15] Beattie, G. and Aboudan R., "Gestures, pauses and speech: An experimental investigation of the effects of changing social context on their precise temporal relationships", *Semiotica*, 99(3-40): 239-272, 1994.
 [16] Holler, J. and Wilkin, K., "An experimental investigation of how addressee feedback affects co-speech gestures accompanying speakers' responses", *Journal of Pragmatics*, 43(14): 3522-3536, 2011.
 [17] McNeill, D., *Hand and mind: What gestures reveal about thought*, University of Chicago Press, 1992.
 [18] Kendon, A. *Gesture: Visible action as utterance*, Cambridge University Press, 2004.
 [19] Seyfeddinipur, M. and Kita, S., "Gesture as an indicator of early error detection in self-monitoring of speech", *ISCA Tutorial and Research Workshop (ITRW) on Disfluency in Spontaneous Speech*, 2001.
 [20] Holler, J. and Wilkin, K., "Communicating common ground: How mutually shared knowledge influences speech and gesture in a narrative task", *Language and cognitive processes*, 24(2): 267-289, 2009.
 [21] Sloetjes, H., & Wittenburg, P. (2008, May). Annotation by Category: ELAN and ISO DCR. In *LREC*.