Head gestures as congruent or incongruent signs of children's attitudes

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Abstract

This study looks into children's use of head gestures to express their appreciation for objects, comparing cases in which the gestures match or do not match their true attitude. Children of about 5, 6 and 7 years old were asked to tell an experimenter whether or not they would like to have shown objects as presents for their birthday. In a first round, children were not given any additional instructions, so that their feedback matched their genuine attitude towards the objects. In a second round, they were asked to give feedback in a way that was the opposite of what they felt. Analyses of their verbal reactions and response delays suggest that the youngest children found it harder to produce incongruent feedback. While the relative use of head gestures decreases with age, all children produce more head gestures in the congruent condition, and produce more shaking gestures.

Keywords: head gestures, signs of attitude, child development

Introduction

Children, as part of their communicative development, not only acquire the phonology, words and syntax of a language, but also learn how to interact via nonverbal features. One particular case at hand is the use of head movements: speakers exploit such gestures to support their spoken interactions, while their addressees derive meaningful information from them (e.g. Maynard 1987; McClave 2000). Darwin already remarked in the 19th century that many cultures use head gestures as cues to confirm or disconfirm information, and the most commonly found pattern is one where people make a succession of vertical movements (nodding) as an affirmative feedback signal to their conversation partners, whereas a series of horizontal movements (shaking) is used to deny information. This association of vertical movements with positive and horizontal movements with negative feedback has been argued by Darwin to have a natural origin: he hypothesized that this specific use of gestures and their interpretation stem from early childhood, where nodding is produced by babies when they search for milk, whereas a head shake comes from refusing the milk (Darwin 1872). At later stages in people's lifes, the gestures get a more generic, or more symbolic, function of acceptance or refusal, and become used in a wider variety of contexts, not necessarily related to food.

Interestingly, it turns out that some cultures display a pattern which is the reverse of the more general trend, such as in Bulgaria where horizontal movements are being interpreted as "yes" and vertical movements as "no" (Andonova & Taylor 2012). The fact that the conventions about head movements may vary between communities and that their associated meanings can be opaque to members of a different culture suggests that their symbolic function needs to be acquired by children. That is, they cannot (or no longer) simply be derived from some intrinsic and natural form-function correspondence between a bodily movement and what this movement is supposed to depict, like is the case with a throwing gesture that people use to illustrate that specific act. One relevant question therefore is when and how children learn to use and interpret such emblematic gestures. In addition, analogous to what we know about other forms of linguistic or cognitive development, it is also interesting to explore how such gestures develop in growing children, i.e., whether people –with age- change in how they use emblems, just as they evolve regarding their lexical vocabulary and their use of syntactic structures.

Guidetti (2005) investigated French children at age 1;4, 2;0 and 3;0 while they were spontaneously interacting with their mothers, and specifically looked into refusal and acceptance messages which could be gestural, verbal or combinations of gestural and verbal. The study revealed that children in all age groups used nodding and shaking, often in combination with verbal messages, but the proportion of gesture-only messages turned out to be higher for younger children. Also, the study showed that assertions were more frequently expressed than refusals. Similarly, Fusaro, Harris and Pan (2012) studied child-mother dyads and observed children at 14, 20 and 32 months. They found that the frequency of these gestures increases with age, and that there is especially a rapid increase in nodding between 20 and 32 months, however mostly combined with speech. Additionally, children as they grow older more frequently begin to use such gestures in combination with speech, though isolated head nods continue to be used predominantly at 32 months. So both studies by Guidetti (2005) and Fusaro, Harris and Pan (2012) suggest that the absolute frequency of head gesture increases with age, but that the gestures becomes relatively less important, since proportionally speaking older children signal similar kinds of feedback more often with verbal messages.

In sum: developmental studies have brought to light that children fairly early in their life learn the "meaning" of nods and shakes, and also use them accordingly. However, the experimental studies by Guidetti (2005) and by Fusaro, Harris and Pan (2012) concentrated on fairly young children, so that it remains to be seen how a child's gestural behavior further develops at somewhat older ages. Also, to the best of our knowledge, child-directed research in this area has exclusively looked at contexts in which the child reactions in interactions with others are truthful, so that the horizontal and vertical head gestures are congruent with positive or negative messages that children intend to convey. To gain insight into the degree of automaticity with which such gestures are produced, the current study compares children's gestural behavior in truthful situations with situations where children are asked to express an attitude which is opposite to what they truly feel. We deal with Dutch children between the age of 5 and 7. Also, note that Dutch follows the general trend displayed in most cultures where nodding and shaking serve as positive or negative feedback signals, respectively.

Current study

Our current study has a number of goals. First, from the discussion of previous work it has become clear that typically-developing children fairly early during their life learn to associate head movements with symbolic meanings, and use them accordingly. So far, most child-directed studies of head gestures have focused on relatively young children and report that, with age, these children become more experienced users of such gestures. Not much is known, though, about developmental patterns in children who are somewhat older. From the literature, it is hard to predict what to expect regarding the development of head gestures in somewhat older children. On the one hand, one could argue that this relative use of head gestures will probably continue to increase, because the developing child becomes a more advanced user of these gestures, and becomes more knowledgeable about how to produce the gestures in a wider variety of situations as a function of a more developed socialization process. On the other hand, it has been shown that children between age 7 and 12, as they grow older, also become less expressive in terms of their nonverbal behavior (Shahid, Krahmer & Swerts 2008), even when this has mostly been shown for expressions of emotions. That is, older children tend to internalize their emotions more, and are better in controlling them and adapting them to specific social contexts. Based on this, and given that older children also have better developed verbal skills which could serve similar purposes as the nonverbal messages, it could be that children with age use head gestures less frequently.

Second, results from earlier work suggest that children exploit such head gestures almost automatically and spontaneously when they want to convey affirmative or negative feedback, especially given that earlier work focused on signals that are in line with the children's positive or negative attitudes. So when children are allowed to express their "true" internal state, this is very naturally and relatively frequently reflected in their head movements. That naturally begs the question as to whether such head gestures would still occur in cognitively more demanding contexts, such as when they would have to be deceptive about their attitude. Previous work has shown that lieing is a more mentally challenging task for people than simply telling the truth (Vrij, Fisher, Mann & Leal 2006; Gombos 2006). This has, for instance, been shown by experimental work in which adult participants were invited to give answers to a series of questions in either a truthful or deceptive manner, and then appeared to be faster in the former task (Seymour, Seifert, Shafto & Mosmann 2000; Walczyk, Mahoney, Doverspike & Griffith-Ross 2009). Because of the additional mental processing tasks, children may typically behave in a less instinctive manner when they have to express attitudes which are in conflict with what they "really" feel (Swerts, van Doorenmalen &Verhoofstad 2013). In a deceptive context, where there is a mismatch between the true attitude and what the head gesture displays, one could expect that the automaticity of gestures may get lost.

And third, developmental patterns in head gestures in growing children may be different for affirmative and negative head gestures. As we saw above, previous work on younger children has shown that, for them, acceptance and refusal gestures are quite distinct, in the sense that these children feel more inclined to signal affirmative than negative feedback (Guidetti 2005; Fusaro, Harris & Pan 2012). This may suggest that the latter type of gestures represent more marked behavior, even though it remains to be seen whether this also holds for older children. In addition, there is also a related, but more general finding that denying information is a cognitively more demanding activity than accepting information. From the point of view of comprehension, it has already been shown a few decades ago (Clark & Chase 1972; Wason 1959), as well as in many follow-up studies, that comprehenders find it harder to process sentences in which information is negated than sentences that contain affirmative information. For instance, if people are asked to verify whether the content of a sentence matches what is shown in a picture, then people are faster to respond to this task when the sentence is phrased in a positive (X is above Y) than in a negative manner (X is not below Y) (Clark & Chase 1972). While not going into the details of the proposed cognitive models that explain such results, this difference in verification latency has been interpreted as evidence that positive sentences represent a "simpler" code. So, even though previous studies were mostly perceptual/comprehensive in nature, and were not concerned with head gestures at all, they do suggest that affirmative and negative actions are mentally quite distinct, which may have repercussions on how participants display different kinds of feedback in a production experiment.

Method

Participants

44 children (20 girls) from the same school participated in the experiment. These children were distributed in groups 2, 3 and 4 of their primary school in the following way: 10 (7 girls) in group 2, 20 (8 girls) in group 3 and 14 (5 girls) in group 4, with average ages of 5 years and 2 months, 6 years and 3 months, and 7 years and 2 months, respectively. Children were allowed to participate only if the experimenters had received an informed consent from their parents and school. All children were given a small gift as a token of appreciation. Data from one child from the youngest group were not further analysed because that child did not manage to do the "reverse world" condition (see next session).

Procedure

Children were asked to inform an experimenter (the second author of this article) as to whether they liked or disliked objects that were presented to them as a series of pictures on a computer screen of a laptop positioned in front of them. While the experimenter was physically present in the same room, the children could not see her. In particular, they were instructed to signal whether they would love a specific object (like a swimming pool) as a birthday present or not. In order to make sure that this set-up would lead to both affirmative and negative reactions from children, we selected objects which presumably would be liked by quite a number of children, and presents (e.g. an onion) that would probably lead to opposite reactions. The selection of the objects was based on some pretesting, and we tried to design the list in such a way that we would likely get about an equal number of positive and negative responses from children. Also, we designed two lists that varied a bit, depending on whether the pictures would be shown to boys or girls, such that we, for instance, used a doll in the list for the girls, and a football for the boys. In this way, twenty objects in total were randomly presented to participating children in 2 conditions (see below). It is important to note that children were only instructed to inform the experimenter about their appreciation of the objects, and were not explicitly asked to use head gestures.

The procedure was such that we first elicited responses from children (in an individually performed experiment) in a truthful manner (congruent condition), whereby we did not present children with any specific instructions to them other than that they had to indicate whether or not they would appreciate a specific object as a present or not. After they had done this test, they were again presented with the same list of objects, but this time they were asked to do the task under a "reverse world" condition, which was explained to them as a condition in which they had to express the opposite of what they thought (incongruent condition). Both conditions were preceded by a short practice session, in which the children together with the experimenter would give a reaction to some trial objects that were not used in the actual experiment later on. After this practice session, the experimenter would disappear out of sight (to avoid that children would search for eye contact or would get influenced by the experimenter's behavior) but stayed in the same room, and the children would then do the actual experiment. The experimenter would remain silent during the actual experiment, though she could see and hear the participating children. It turned out that both tasks could easily be understood by the children, who also informed the experimenter afterwards that they thought it was a fun experiment. The whole procedure, including the practice sessions, took about 6 minutes on average per child.

The objects were presented as pictures to the children in a powerpoint presentation, the speed of which was paced by the experimenter via a remote control. She always showed a new slide immediately after a child had responded to a preceding slide. To facilitate the measurements of reaction times afterwards, a new picture was always presented simultaneously with a specific nonverbal computer sound. The presentation was shown on an Apple Macbook Pro versie 10.7.4. During the experiment, the participating children were video-recorded with a built-in FaceTime HD camera that had a 1280 by 720 resolution, so that children's responses and head gestures could be analysed at a later stage. Video recordings were saved as iMovie clips, and the audio streams were extracted from these recordings to enable the measurement of response delays in Praat.

Results

In this section, we present the results of a number of analyses. Before we give details on the distribution of different types of head gestures, we provide some statistics on other features of the children's responses, in particular on how adequately they could do the task to confirm or disconfirm information in a truthful or deceptive manner (subsection response types), and how quickly they were able to respond under various settings (subsection on reaction times).

Table 1: *Relative frequency (absolute number and percentages) for affirmative and negative responses as a function of age group and experimental condition.*

		Response	
Group	Condition	Affirmative	Negative
2	Congruent	94 (47%)	106 (53%)
	Incongruent	98 (49%)	102 (51%)
3	Congruent	156 (39%)	244 (61%)
	Incongruent	209 (52%)	191 (48%)
4	Congruent	105 (38%)	175 (63%)
	Incongruent	158 (56%)	122 (44%)

Overall distribution of responses

Overall, it turns out that children –as intended- produced about an equal amount of affirmative and negative feedback cues, with a slightly higher proportion of negative ones (negative: 941 (53.4%); positive: 820 (46.6%)). Table 1 tabulates the numbers and percentages of these two types of

feedback cues as a function of age and experimental condition (so whether children were being truthful or deceptive). This table also shows that the distributions are somewhat different for the different age groups. In the "ideal" case where children would always manage to be deceptive about their true attitude, the distribution of affirmative and negative reactions in the incongruent condition should present a mirror image of the distribution of these reactions in the congruent condition, given that the former condition should literally reveal the opposite pattern of the latter one. As can be seen, this only appears to be true for the distributions of the two older age groups, while the distributions for the two conditions appear to be more similar for the youngest group. These distributional differences already suggest that the younger children found it more difficult to be deceptive about their appreciation.

This is also reflected in table 2 which tabulates the percentages of "errors" regarding affirmative and negative responses for the different age groups in the incongruent condition only. Errors were operationalized as those cases in which a response to an object in the incongruent condition turned out not to be the exact opposite of what the child had responded in the congruent condition. For instance, if a child in the congruent condition would state that it did not like a potato as a birthday present, we would classify an identical reaction in the incongruent condition as an error. As can be seen, there is an overall decline in these errors as a function of the age group. Moreover, there is a difference in distributional patterns between the different age groups: while the youngest children make about an equal amount of errors for both the affirmative and negative actions, the errors appear to be relatively more frequent for negative responses in the two older groups.

Table 2: *Percentage of errors in the incongruent condition for affirmative and negative responses as a function of age group.*

	Response		
Group	Affirmative	Negative	Total
2	24.7%	24.1%	24.4%
3	7.1%	26.9%	16.6%
4	10.5%	24.8%	13.2%

Reaction times

Given the earlier findings by Walczyk and colleagues (Walczyk, Mahoney, Doverspike & Griffith-Ross 2009) that reponse time is a good indicator of whether people are being truthful or deceptive, we measured how long children took to produce an utterance after the picture had been shown (using the computer sound presented in the powerpoint as a reference). We only did these analyses for responses that contained speech. The large majority of the participants' responses were produced with speech, except for 4 children from the youngest group who regularly or always responded with a nonverbal head gesture only, so these "silent" responses were not taken into account in the current measurement. The analysis revealed main effects of condition ($F(1,36)=24.046$, $p < .001$) and age ($F(2,36)=3.290$, $p < .05$), while the effect of valence (affirmative vs negative), and none of the higher-level interactions turned out to be significant. Closer inspection of the averages revealed that incongruent feedback is produced after a significantly longer delay than congruent. Posthoc analyses using the Bonferroni method reveal that the younger age group is significantly slower than the middle one, while none of the other contrasts turned out to be significantly different.

Table 3: *Reaction times in seconds (means and standard error) for affirmative and negative responses as a function of age group and experimental condition*

		Response	
Group	Condition	Affirmative	Negative
2	Congruent	1.73 (.20)	1.65 (.14)
	Incongruent	1.95 (.21)	2.21 (.23)
3	Congruent	1.12 (.12)	1.31 (.09)
	Incongruent	1.77 (.13)	1.48 (.14)
4	Congruent	1.43 (.14)	1.40 (.10)
	Incongruent	1.61 (.15)	1.56 (.16)

Gestures

Given the previous findings, we now present data on the frequency and type of head gestures as a function of the various experimental factors. To this end, the second author of this article annotated all the responses of the children in terms of presence or absence of a gesture, and in case of presence, determined whether a gesture was of a vertical (nodding) or horizontal (shaking) type.

Table 4 presents the distribution of noddings, shakes and other behaviours (those cases that did not contain a nod or a shake) as a function of the age group, whether a feedback was affirmative or negative, and whether this was done in a congruent or incongruent manner. The table reveals a number of interesting patterns related to these various factors. First, it can be seen that the number of head gestures decreases as a function of age. Overall, the younger children of group 2 produce more instances of nods and shakes, and that number becomes lower for children in groups 3 and 4. Second, it can be seen that, for all age groups, negative reactions lead to more head gestures than affirmative ones. And third, there appears to be pattern, true for all age groups and for both confirmative and negative types of feedback, that the congruent condition leads to more gestures than the incongruent one. These observations are confirmed statistically by means of a 3X2X2 repeated measures anova with age group (3 levels: group 2, group 3, group 4) as between-subject factor, with valence (2 levels: affirmative, negative) and condition (2 levels: congruent, incongruent) as within-subject factor, and with the percentage of matching gestures for each child as dependent variable. A matching gesture was defined as a head movement that corresponded with the affirmative or negative status of the feedback (affirmative: nodding; negative: shaking). The analysis revealed main effects of valence ($F(1,41)=14.819$, $p < .001$) (negative responses lead to more gestures than

affirmative; negative: 25%; positive: 18%), and condition ($F(1,41)=4.840$, $p < .05$) (congruent condition leads to more gestures than incongruent; congruent: 26%; incongruent: 16%), and of age ($F(2,41)=6.736$, $p < .01$). Posthoc analyses using the Bonferroni method reveal that the younger age groups differs from the other, while the two older do not differ from each other, with a decreasing number of gestures as a function of increasing age (group 2: 41%; group 3: 6%; group 4: 17%). None of the interactions between the various factors turned out to be significant.

Table 4: *Percentages of nodding, shaking and other responses as a function of age group, type of response and experimental condition. Numbers in bold face represent percentages for matching gestures (further explanation in the text).*

Group	Action	Condition	Nod	Shake	Other
2	Affirm.	Congr.	**34.0**	0	66.0
		Incongr.	**29.6**	2.0	68.4
	Negat.	Congr.	0	**55.7**	44.3
		Incongr.	2.0	**45.1**	52.9
3	Affirm.	Congr.	**10.3**	0	89.7
		Incongr.	**6.2**	0.5	93.3
	Negat.	Congr.	0.4	**18.0**	81.6
		Incongr.	0	**9.9**	90.1
4	Affir.	Congr.	**9.5**	0	90.5
		Incongr.	**2.5**	0.6	96.8
	Negat.	Congr.	0	**26.3**	73.7
		Incongr.	0	**3.3**	96.7

General discussion and conclusion

The present study has presented an analysis of nods and shakes produced by children in different age groups, when they were asked to indicate their appreciation for various objects that were shown to them as a series of pictures. There were two experimental conditions: a congruent one in which children could express their true attitude, and an incongruent one, in which children were asked to signal the opposite of what they really felt. Overall, we found that the latter condition appeared to be the more "demanding" condition, and that the experienced difficulty of the task decreased as a function of age. Overall, younger children made more errors than older ones when they had to give their appreciative feedback in the incongruent condition. In addition, while the proportion of errors was about the same for affirmative and negative responses in the youngest group, the older groups made relatively more errors for the negative feedback cases. Also, in line with earlier work, it turned out that children overall took significantly longer to respond to a shown picture in the incongruent than in the congruent condition.

When we look at their actual gestural behavior, it was found that the relative use of gestures depends on whether they are used in a congruent or incongruent manner. More specifically, we found that gestures are more frequently used in the congruent condition, which appears to be true for all age groups, albeit that the overall number of gestures decreases as a function of age as well (see below). Possibly, this result is related to the fact that the incongruent condition is cognitively demanding, as also became clear from the results of the response latencies above. In general, it has been found that people find it more difficult to express nonverbal expressions when these are not consistent with the internal states of a speaker. In a study on the expression of emotions, for instance, Wilting, Krahmer and Swerts (2006) found that spontaneous expressions of negative or positive feelings appear more natural and less marked, compared to acted versions of these emotions that are not "felt" as such by the speakers. Along the same lines, it may have been harder for the children to produce head gestures when these are not in line with their true attitude towards an object. Other studies on deception also revealed that producing a lie may have consequences for a person's nonverbal behavior, even when studies vary regarding the extent to which alleged nonverbal correlates of deception are consistent and reliable (DePaulo, Lindsay, Malone, Muhlenbruck, Charlton & Cooper 2003; Swerts, van Doorenmalen & Verhoofstad 2013).

These results about differences between congruent and incongruent settings on head gestures are also in line with earlier findings on cognitive, "natural" associations between overt head gestures and negative or positive connotations. Overt head gestures are not only relevant for an interlocutor who observes these gestures from his/her conversation partner as feedback cues about the ongoing interaction, but, in addition, such gestures may also positively or negatively affect the attitude of the person who is producing them. Experimental studies in which participants were invited to either nod (affirmative) or shake (negative) their heads while doing specific tasks showed that the former type of movements led these participants to become more positive about a product or an idea, while the reverse appeared to be true with the latter type of gestures (Wells & Petty 1980; Briñol & Petty 2003). These results are consistent with a self-validating hypothesis which predicts that gestures have a biasing effect that can enhance or inhibit specific attitudes of people. The current study analyses participants' behavior when this natural link is being disrupted, i.e., when people are asked to express their appreciation for objects in a deceptive manner, so signaling the opposite of what their real attitude is, this less likely leads to using head gestures.

Next, it appears that there is an overall decrease in the use of gestures as a function of age. This is reminiscent of earlier work on children, though those studies focused on younger children than the ones investigated in the current study (e.g. Guidetti 2005). It is also in line with earlier work that showed that children display fewer nonverbal correlates of their emotions as they grow older (e.g. Shahid, Krahmer & Swerts 2008). The difference in the relative frequency of head gestures between younger and older kids could be related to the fact that the verbal skills of children develop with age. Young children learn fairly early what the symbolic, emblematic meaning is of head gestures, especially as these have been argued to have a natural origin (Darwin 1872). While younger kids may over-use nonverbal

gestures to communicate particular things, the older children gradually rely more on verbal language for their messages, and exploit head gestures in a more controlled manner so that they suit specific social contexts.

And finally, if we compare the nodding and shaking gestures, it appears that shaking gestures are more frequently used than nodding gestures, and this appears to be true for every age group that we analysed in this study. At first sight, this seems to be in conflict with earlier studies (Guidetti 2005; Fusaro, Harris & Pan 2012) with their reported findings that nodding occurs more frequently than shaking. However, this appears to be true only when we consider absolute frequencies, where it was indeed found that children more often signal acceptance than refusal. Looking more closely at the data by Guidetti (2005), however, reveals that the proportion of those acts that contain a gesture (either nodding or shaking) is actually higher for the refusals, which finding is in line with what we have found. In other words, while it may be true that positive feedback signals predominate in natural interactions of young children, the relative usage of head gestures to support such acts is higher for refusals. One possible explanation for this is that children feel a higher need to signal denials by means of (additional) gestures, because these kinds of feedback cues represent more marked cases. In that sense, the results are in line with earlier work on positive vs negative feedback cues that showed that the latter type tend to be produced with more prominent prosodic features (e.g. higher pitch, slower tempo, longer delay), as it is often more crucial for communication partners to detect negative feedback than positive feedback because they signal a (potential) problem in the ongoing interaction (Shimojima, Katagiri, Koiso & Swerts 2002).

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