

Yes or No: How children combine gestures and speech to express honest and deceiving attitude

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Samenvatting

Dit artikel rapporteert over een studie naar de manier waarop kinderen hoofdbewegingen maken die bedoeld zijn om hun appreciatie voor een getoond object uit te drukken, waarbij we een vergelijking maken tussen gevallen waarbij die hoofdbeweging wel of niet overeenkomt met hun echte waardering. Aan vierenvestig kinderen tussen vijf en acht jaar oud werd gevraagd om aan een experimentator te vertellen of ze een reeks getoonde objecten wel of niet als cadeau voor hun verjaardag zouden willen krijgen. In een eerste ronde deden kinderen die taak zonder extra instructie zodat hun antwoord overeenkwam met hun echte waardering van een object (congruent). In een tweede ronde werd hen gevraagd om een antwoord te geven dat tegengesteld was aan hun echte waardering (incongruent). Analyses van hun verbale antwoorden en reactietijden laten zien dat jongere kinderen het moeilijker vonden om incongruente antwoorden te produceren. Naast het feit dat het relatieve aantal hoofdbewegingen afneemt met leeftijd blijkt dat kinderen uit alle onderzochte leeftijdscategorieën meer bewegingen maken in de congruente conditie, en meer verticale dan horizontale bewegingen.

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. Forty-four children aged 5 to 8 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, children in all age groups produce more head gestures in the congruent condition, and produce more shaking gestures.

Keywords: head gestures, signs of attitude, child development

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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 lives, 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.

The head gestures introduced above are often viewed as a subset of so-called "emblems", sometimes also termed "autonomous gestures" or "emblematic gestures". Emblems are defined as conventionalized bodily movements of hand, arm or head used by members of the same community to convey specific meanings which can even be understood without accompanying speech (Kendon 2004). A typical example of such an emblem is the use of a straight index finger that is vertically positioned on a person's closed lips to indicate that one should be quiet or silent. While some of these gestures appear to be used universally, others are less wide-spread, and it is even possible that seemingly identical gestures can serve different functions in different communities. For instance, the "thumbs up" or the "ring" gestures have a positive meaning in many western societies, i.e., they signal the equivalent of "okay" or "good" for residents of the United States, but they can have negative connotations in other cultures (Knapp & Hall 2010; Kita 2009; Matsumoto & Hwang 2013).

Similarly, regarding head gestures, 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. In that respect, there are a few developmental studies that focused on the acquisition of head gestures, even when the results of these studies are somewhat at variance.

An early study by Dittmann (1972) dealt with what he called listener responses, which included head nods (as well as a number of other features such as verbal acknowledgments like “yeah”) that signal that an addressee is paying attention to what an interlocutor is saying. Interestingly, he found that children produce such responses to a far lesser degree than adults. It turned out that listeners responses were nearly absent in speech data of children in grades 1, 3 and 5, unless they were very explicitly urged by their conversation partner to signal some feedback. The relative frequency of such responses increases enormously by the time children are in grade 8, and becomes more adult-like by early adolescence. This pattern is reminiscent of claims regarding a more general development that a growing child changes from a largely egocentric individual to a person who is more socially aware of others (Saarni 1984; Swerts 2012). In other words, the work by Dittmann suggests that the use of head nods (i.e., as listener responses) becomes more frequent as a function of age, which would be related to an increased social awareness in a growing child.

However, more recent work suggests that developmental patterns in overt head gestures could be somewhat different, though those studies analysed a wider range of gestures (not only related to listener responses). 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 become 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 8. 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. 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, Kraemer & Swerts 2008; Swerts 2012), 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 when growing older 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 lying is a more mentally challenging task for people than simple 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; Walczyk, Roper, Seemann & Humphrey 2003). 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. 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 represents 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.

Given the three goals of this study, in the following sections, we first describe our method to elicit truthful and deceptive signs of appreciation in children of different age groups, and then we present and discuss the results of various analyses, both on overall behavior (e.g., verbal responses; reaction time) in those various contexts, and more specifically on differences in head gestures.

Method

Participants

44 children (20 girls) from the same school participated in the experiment. The mean age of children was 6 years and 6 months. 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. We decided not to include younger children (group 1), as we expected the task to be too difficult for them. 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 third 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 in which we checked whether pictures could easily be recognized, 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 in the presence of the experimenter would give a reaction to some trial objects that were not used in the actual experiment later on. During this practice session, the experimenter did not actively participate herself (so did not respond to the stimuli), but was simply there to check whether the child understood the task. 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. While this set-up was chosen to ensure experimental control, the disadvantage is of course that the child is not communicating anymore with a real person in a face-to-face setting. (We elaborate on this issue in the general discussion.) 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.

Annotation and measures

To better understand how adequately children could do the task to confirm or disconfirm information in a truthful or deceptive manner, and how quickly they were able to respond under various settings we coded the following aspects:

Responses: Children's affirmative and negative feedback cues were coded for each trial. In the incongruent (deceptive) condition, if a child failed to reverse the feedback, it was coded as an error. For instance, when a child in the congruent condition stated that it did not like a potato as a birthday present, we classified an identical reaction in the incongruent condition as an error.

Reaction time: Given the earlier findings by Walczyk and colleagues (Walczyk, Mahoney, Doverspike & Griffith-Ross 2009; Walczyk, Roper, Seemann & Humphrey 2003) that response 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). 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, also given their infrequent occurrence.

Head gestures: the third 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 and whether the gesture matched the required responses. A matching gesture was defined as a head movement that corresponded with the affirmative or negative status of the feedback (affirmative: nodding; negative: shaking). We did not perform detailed analyses of how the non-verbal gestures were aligned with the verbal responses.

Data Analysis

We used logistic regression (glmer in R environment, R Core Team, 2020) to analyze binary dependent variables (responses errors; proportion of nodding/shaking gestures, overall gesture use, matching gestures) and linear mixed effects models to analyze reaction times. Reaction times were log-transformed, following Whelan (2008).

Children's age, valence (affirmative, negative) and experimental condition (congruent, incongruent) were included as fixed effects, as well as their two-way and three-way interactions. To account for the individual differences of participants and item differences of target words, we included participants and stimuli as two grouping variables for the random effects structure of the models. For both participants and words, the structure consisted of a random intercept but not necessarily a random slope of condition or valence due to the model convergence.

When the model did not converge, we ran the models with different optimizers that allow convergence or reduced the model complexity or mean-centering independent variables before analyses. Data files in .csv format and all analysis scripts and R markdown output can be found at the OSF link: <https://osf.io/vbwgx/>.

Results

Overall distribution of responses

Overall, it turns out that children produced about 820 affirmative and 940 negative feedback cues. A binomial test indicated that the proportion of 0.466 for affirmative feedback was significantly lower than the expected proportion of 0.534 for negative feedback, $p = .0001$ (1-sided). The proportion of affirmative feedback was not significantly different over ages ($\beta = -0.062$, $p = .29$).

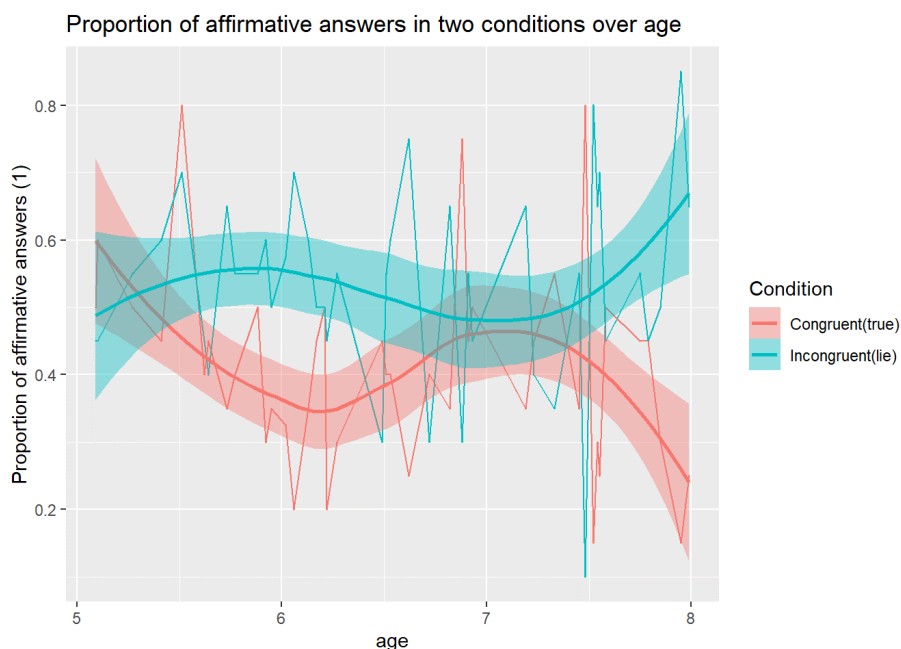


Figure 1: Affirmative answers in congruent and incongruent (lie) conditions over age.

In the “ideal” case where children would always manage to be deceptive about their true attitude, a proportion of an $x\%$ of affirmative (negative) reactions in the incongruent condition should present a proportion of $1-x\%$ of these reactions in the congruent condition, given that the former condition should literally reveal the opposite pattern of the latter one. Fig. 1 illustrates children’s affirmative answers in congruent and incongruent (lie) conditions at different ages. As can be seen, children of 5 or younger than 6.5 years may still find it more difficult to be deceptive about their appreciation, thus making “errors” (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).

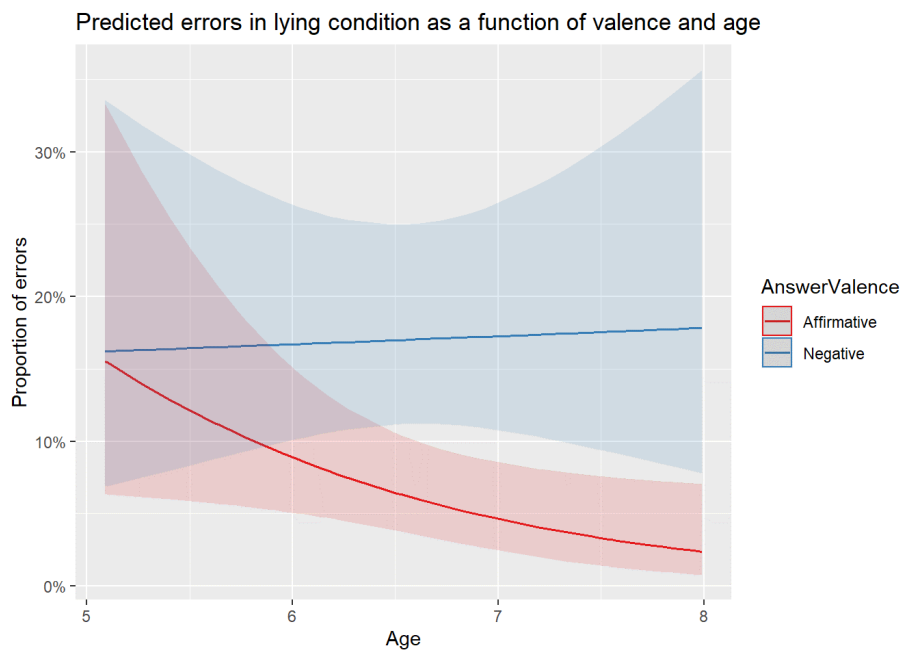


Figure 2: Percentage of errors in the incongruent condition as a function of response valence and age.

To examine this age effect, we studied whether the percentages of “errors” in the incongruent condition change as a function of children’s ages and responses valence (affirmative and negative responses). The results of a logistic regression showed that children made more errors when they deceive about negative valence than affirmative ($\beta = 1.24, p < .001$). That means it was harder to hide negative valence. Age was not significant ($\beta = -0.24, p = .38$), but there was an interaction between age and valence of responses ($\beta = 0.73, p = .006$). The interaction term revealed that an increase in age related to fewer errors in lying about affirmative valence ($\beta = -.70, p = .031$) but did not relate to fewer errors in lying about negative valence ($\beta = .04, p = .89$). This can also be seen in Fig. 2: while the youngest children made about an equal amount of errors for both the affirmative and negative actions, the errors appeared to be relatively more frequent for negative responses in the older children.

Reaction times

Table 1 presents the reaction times in seconds (means and standard error) for affirmative and negative responses as a function of age group and experimental condition. The analysis of a linear mixed-effects model revealed a main effect of condition ($\beta = .084$, $p < .001$), while the effect of age ($\beta = -.02$, $p = .99$) and valence (affirmative vs negative) ($\beta = -.0054$, $p = .55$), and their three-way interactions were all not significant ($\beta = .014$, $p = .51$). As shown in Figure 3, incongruent feedback was produced after a significantly longer delay than congruent. However, there was an interaction between age and condition ($\beta = -.047$, $p < .001$), such that the differences between conditions were larger in younger than older children ($\beta = .019$, $p = .02$).

Table 1: Reaction times in seconds (means and standard error) for affirmative and negative responses as a function of age group and experimental condition

Group	Condition	Response	
		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

Overall, children produced 223 shaking and 107 nodding head gestures. A binomial test indicated that the proportion of shaking of 67.58% was significantly higher than the expected nodding of 32.42%, $p < .0001$ (1-sided). Results of a logistic regression analysis showed that the proportion of noddings decreased (when compared to shakings) with increasing age ($\beta = -.37$, $p = .057$). There was a marginally significant effect of condition ($\beta = .48$, $p = .085$), resulting from the fact that the incongruent condition had a higher proportion of noddings (Figure 4).

Furthermore, we examined the overall use of head gestures (nodding and shaking) as a function of condition, response valence and age. The analysis revealed a main effect of valence ($\beta = 1.41$, $p < .001$) (negative responses lead to more gestures than affirmative; negative: 21.4%; positive: 12.5%), and marginally significant effects of condition ($\beta = -1.49$, $p = .069$) (congruent condition leads to more gestures than incongruent; congruent: 22.0%; incongruent: 12.4%) and age ($\beta = -1.32$, $p = .054$). There was a two-way interaction between answer valence and condition ($\beta = -1.30$, $p = .015$), indicating that for the negative valence

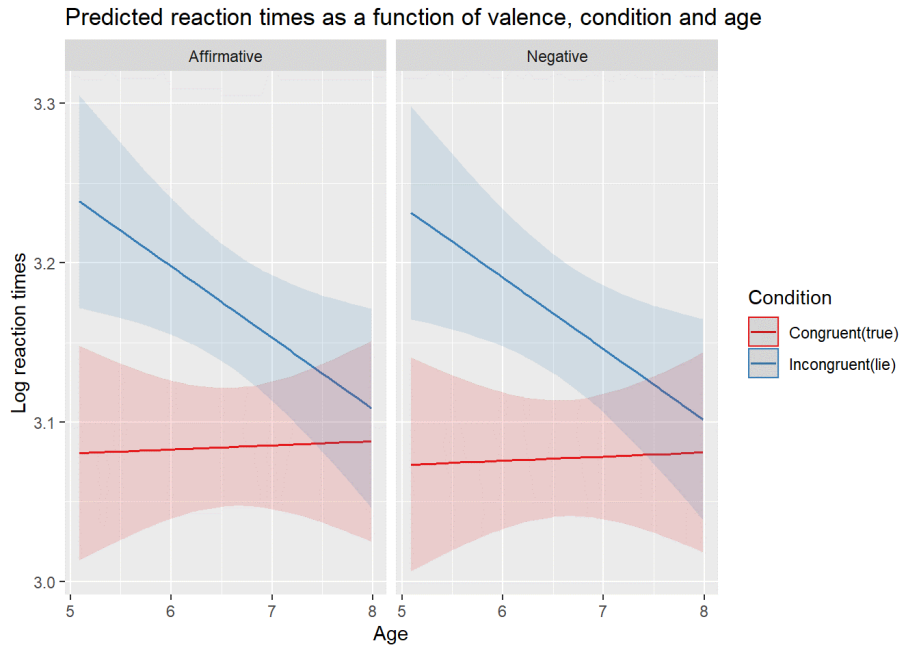


Figure 3: Predicted reaction times (log-transformed) as a function of response valence, condition and age.

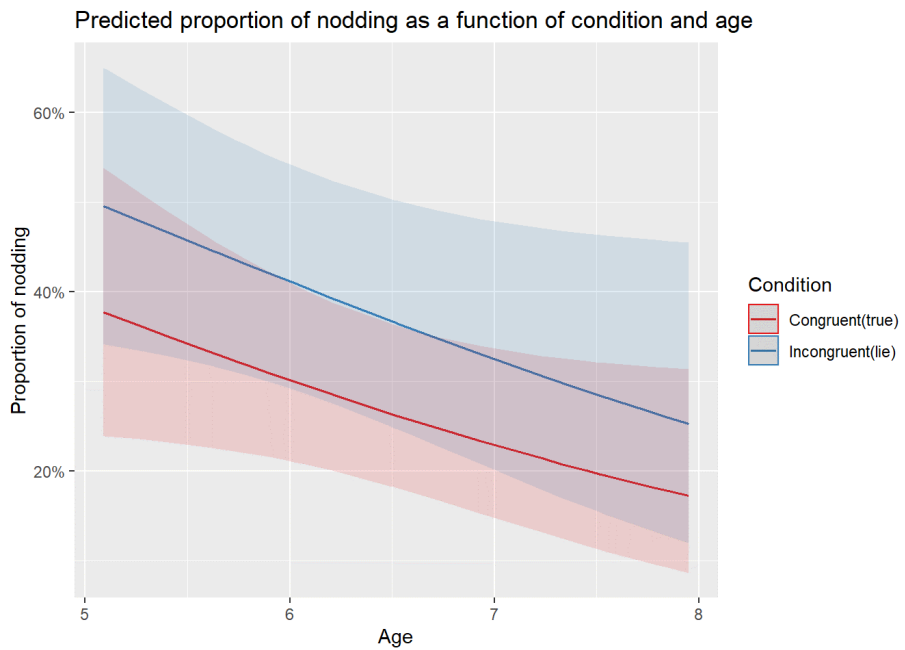


Figure 4: Predicted percentages of noddings as a function of response valence and age.

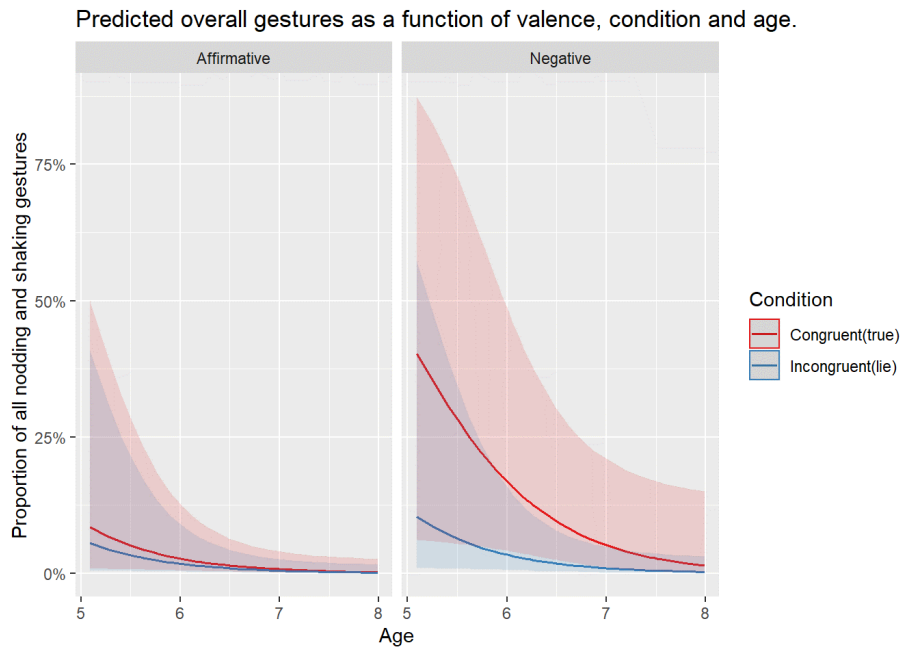


Figure 5: Predicted percentages of the overall use of nodding and shaking gestures as a function of response valence, condition and age.

congruent condition had more gestures than the incongruent condition ($\beta = 1.99$, $p < .001$) (see Fig. 5). There were no other two-way or three-way interactions.

The results were quite similar when we examined the proportion of matched head gestures as a function of valence, age and condition. There were main effects of response valence ($\beta = 1.48$, $p < .001$), marginally significant effects of condition ($\beta = -1.10$, $p = .0495$), age ($\beta = -1.20$, $p = .0755$), and an interaction between valence and condition ($\beta = -1.12$, $p = .04$).

Finally, there were 114 responses that were only produced head gestures. Analysis showed that there were main effects of age ($\beta = -5.53$, $p = .011$), condition ($\beta = 14.06$, $p < .001$) and an interaction between age and condition ($\beta = 16.18$, $p < .001$). It indicated that gesture-only responses declined when children were older but this only appeared in the congruent condition ($p = .0004$).

General discussion and conclusion

The present study has presented an analysis of verbal answers and gesture responses (nods and shakes) produced by children in different ages, 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. However, we found that such differences were smaller for older children.

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, and the overall number of gestures in the congruent condition decreases as a function of age (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, Kraemer 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). In our own previous work on deception in children (Swerts 2012; Swerts, Verhoofstad & van Doorenmalen 2013), where we used a computerized puppet show to elicit minimal pairs of children’s truthful and deceptive utterances, we found that observers can detect the deceptive utterances (in pairwise comparisons) from more marked settings of specific facial characteristics, even when these results were only slightly above chance level. Similarly, the relative absence of spontaneous head gestures in the deceptive condition of our current study could be due to the fact that the mentally demanding task had an inhibitory effect on the children’s natural expressive behavior in terms of head gestures.

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 the use of head gestures.

Next, it appears that there is an overall decrease in the use of head gestures and gesture only responses 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 shaking gestures are significantly 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).

Of course, there are different ways in which this research could be extended. In the future, it could be useful to investigate in more detail why there are more noddings in the incongruent condition than the congruent condition, and whether possible differences in gesture behavior could provide cues to observers as to whether a person is truthful or deceptive. Future work could also focus on more interactive contexts. Basically, even when the experimenter in the study described above was present in the same room (but silent and not visible to the child participant), the children were basically talking to the computer.

It is therefore interesting to see what would happen if the children would have to do a similar task where they have to convince a human partner. One reason why this situation could lead to different, possibly more marked expressions, is that the mere presence of a human dialogue partner may make the task more demanding, or may make the children more aware of their deceptive act, which has been shown to have repercussions for a person's nonverbal behavior (Vrij, Fisher, Mann, & Leal 2006; Swerts, van Doorenmalen & Verhoofstad 2013).

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