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Timing of Adults' Utterances and Interpretation of Word Meanings in a Discrepant Labeling Situation

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Abstract

Previous studies demonstrated that young children are sensitive to the referential intentions of others and readily relate a novel label to an intended novel object. However, the movement of child's line-of-regard in establishing joint attention has rarely been closely examined. In the present study, 13 2- and 15 4-year-olds were videotaped in a modified discrepant labeling paradigm, in which the experimenter looked at an object and said the novel label, "Oh, muta!" immediately after the child took the other object and started playing with it. The child's line-of-regards were examined in a frame-by-frame method. The results showed that most children immediately looked at the experimenter's face. We compared the present data with our previous data of labeling the other object after 10 seconds elapsed. In those data, a substantial ratio of 4-year olds (nearly half) and that of 2-year-olds (nearly 40 percent) directly took the other object that was out of their attention without checking the experimenter's eye gaze. We interpreted these results that those children who directly looked at the other object made a correct inference of the intended object considering the flow of conversation. They may have thought that when the experimenter said "Oh, muta!" she must be focusing on the other object rather than the object the child was already focused on for more than 10 seconds. The present study showed that the timing of adults' utterances may help young children to interpret the adults' referential intentions.

Key words: Discrepant labeling situation; Timing of adults' utterances; Flow of conversation; Social pragmatic cues.

Introduction

Infants properly follow adults' gaze direction (Brooks & Meltzoff, 2002; Moll & Tomasello, 2004). Infants also have an ability to actively consult cues that speakers provide to know the reference of their utterances (Golinkoff & Hirsh-Pasek, 1999; Hirsh-Pasek, Golinkoff, & Hollich, 2000). Among different cues for word learning, cues of adults' social intent seem to be well established. For example, Hollich, Hirsh-Pasek, and Golinkoff (2000) examined the effects of competing perceptual and social cues on word learning in 12-, 19-, and 24-month-olds. Children were presented with novel objects, one interesting and one boring, and given the opportunity to explore each one. Then the objects were placed on the board and the

experimenter enthusiastically looked at, pointed to, and labeled either the interesting (coincident) or boring (conflict) object. Children were later tested to choose the referent of the novel object. The object-looking time of each child in each condition was examined. The results were that 19- and 24-month-olds looked at and chose the socially intended object as a referent even when the object was boring, but 12-month-olds tended to look at and choose the interesting object as a referent regardless of the existence of the social cue. Hollich et al. interpreted this result that children make a shift in word learning from relying on perceptual cues to relying on social intent cues.

In a discrepant labeling situation that Baldwin (1991, 1993) examined, infants would establish an incorrect word-object mapping if they failed to recognize the significance of cues such as line-of-regard for determining the speaker's reference. In this paradigm, an experimenter showed infants two equally attractive novel toys and gave one to the child to play with while the experimenter retained the other. When the infants' attention was focused on the toy, the experimenter looked at and labeled her own toy, the situation being a discrepancy between the infants' focus and that of the speaker at the time the label was uttered. Without the ability to consult the speaker for cues to reference, infants should fall prey to a mapping error because of time contingency that would lead them to link the new label with the toy of their own focus. On the other hand, if infants appreciated the relevance of the speaker's non-verbal cues such as line-of-regard and body orientation directed toward the speaker's toy, they could use these cues and establish the correct word-to-object link. According to Baldwin, infants readily glanced up at the experimenter when discrepant labeling occurred and followed her gaze to the object of her focus. In a comprehension test, infants of 18 months or older did not link the new label with the toy they were actually focused on when they heard the new label. Eighteen- to nineteen-month-olds seems to have established a stable mapping between the label and the object of the speaker's focus. These results suggest that infants have the ability to appreciate that speakers provide cues that are relevant to interpreting new words and consult these cues when faced with discrepant labeling. Baldwin's

studies successfully showed infants' sensitivity to know the others' direction of attention by confirming the nonverbal cues of eye gaze and face or body direction of others, but children seem to have abilities to use relevant cues that are beyond such physical cues.

In our previous study, Kobayashi and Yasuda (2007) tested two-, four-year-olds and adults in this discrepant labeling paradigm and were surprised with unexpected results. We expected that most 2-year-olds would readily check the experimenter's face in the experiment of the discrepant labeling paradigm. However, despite of our expectation, nearly 40 percent of the 2-year-olds who had previously looked at their chosen object at their hand (In-Attention-Object) immediately changed their focus of attention and took the other object that they did not choose (Out-of-Attention Object) WITHOUT looking at the experimenter. Among the 4-year-olds, this tendency was more distinct. About half of the children who previously looked at their chosen object similarly changed their focus of attention and took the other object that they did not choose without looking at the experimenter. We tested adults in virtually the same paradigm and found that about 70 percent of the adults similarly changed their focus of attention when they heard a label without checking the experimenter's face or body direction. Why these children and adults did not seem to check the direction of the experimenter's eye gaze? We speculated that they were likely aware that the experimenter may not necessarily say the name of the object the participant was attending. Even young children seem to think that the label must be the referent of the other object which is not the present focus of the child. If they heard the experimenter label something after they had already played with the object for 10 seconds, they seem to think that the object they have at hand is not the object the adult labeled. However, if the children heard the experimenter immediately labeled something after they took it, they seemed to think that they needed to check the adult's line-of-regard to know what was labeled. If this is the case, young children certainly rely on social pragmatic cues in a sense, with a more sophisticated way than simply checking the adults' line-of-regard.

A stronger test of this hypothesis may be to contrast children's responses in two alternative situations: modifying the amount of time elapsing between when the child began playing with object, and when the experimenter labelled the other novel object. Thus, in one situation, the child hears the novel word immediately after she touches the object she chose, and in another situation, the child hears the novel word after 10 seconds elapsing after her touching the object. If children look at the Out-of-Attention Object immediately after touching the chosen object only in the 10 second-elapsing condition, the social pragmatic explanation can be more strongly validated. In this study, we tested our hypothesis of social pragmatic cues in this more stringent test.

We used the same discrepant labeling paradigm that we used in Kobayashi and Yasuda's (2007) study, except for the timing of the experimenter's utterance. In Kobayashi and Yasuda's study and this study, a modified discrepant labeling paradigm was used. In these studies, an experimenter placed down two unfamiliar objects on a table, then asked the child to choose one of the objects and play with it for a while rather than the experimenter simply giving one of the objects to the child, a procedure used in the usual discrepant labeling paradigm. We assumed that children focus on the object of their choice more than the object that was simply given by the experimenter. Because focusing on one object and being concentrated on playing with it before hearing the experimenter's utterance were very important to test our hypothesis, we chose to use this modified discrepant labeling paradigm. Unlike Kobayashi and Yasuda's study, after the experimenter noted that the child took and started manipulating the chosen object, the experimenter of this study immediately said "Oh, (child's name), muta!" and looked at the other object that the child had not manipulated. We intended to test whether the timing of the adult's utterance about the Out-of-Attention object may affect the movement of line-of-regard of young children. To test this hypothesis, we compared the data of the two conditions of timing, 0 seconds or immediately after the experimenter's labeling, and after 10 seconds elapsed. The 10 second elapsing data were taken from Kobayashi and Yasuda (2007) and reanalyzed with a gesture analyzing software that we used in the present study.

Method

Participants

Thirteen 2-year-olds (range 2;0~3;4), and 15 4-year-olds (4;1~5;0) participated in the study. Children were tested at their preschool room in Saitama Prefecture in Japan that was a part of a greater Tokyo area.

Materials

Each participant saw four pairs of objects that were all unfamiliar to young children. One pair included a wrench and a white handle, the other pair included a float valve and a sponge grip. The criteria for selection of the objects were that the objects be novel, visually distinct from one another, balanced in salience within a pair, and manipulable for two-year-olds (Figure 1). Some of the materials were different between the two timing conditions due to the advice of the children's teachers who suggested safer materials for 2-year-olds. For example, a roller handle was replaced by a triangle wrench. We replaced some objects keeping the distinctness of the materials similar between the conditions. The novel labels used were *muta*, *heku*, *ruchi*, and *omi* that were used in Kobayashi (1998)'s study.



Figure 1: An example of a set of experimental objects

Procedure

Figure 2 shows the experimental situation. The child and the experimenter sat on a table face-to-face. An assistant recorded the experiment using two digital video cameras (29.97frame/sec). One of the video cameras focused on the table and the child's face. The other video camera took the experimental situation. On the table, the experimenter placed the two novel objects in front of the child. The two objects were at an equal distance from the child (Scene 1). The experimenter said to the child, "Which do you like? You can play with the one you like." Then the child took one of the objects and manipulated it (Scene 2). When it was confirmed that the child was focused on the chosen object, the experimenter immediately looked at the other object that the child did not choose and said, "Oh, (child's name), muta, muta!" (Scene 3). The child's response was noted. Immediately after each trial of labeling, the experimenter presented the two previously shown objects and asked the child, "Which is muta?" The child's responses, both verbal and nonverbal were noted. The experimenter accepted any kind of response from the child, saying "I see!" without any feedback of right or wrong.

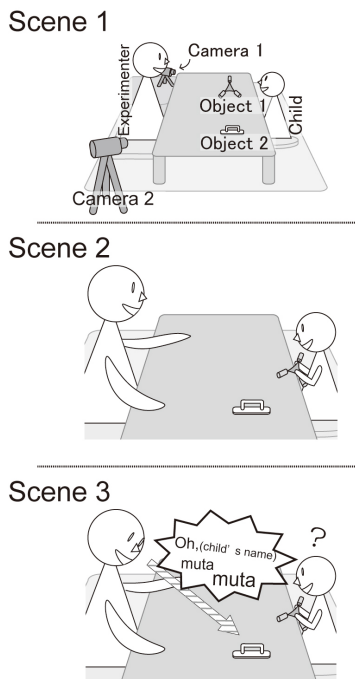


Figure 2: The experimental situation

An experiment video data were analyzed using a gesture analyzing software "Anvil" (<http://www.dfki.de/~kipp/>

anvil) with a frame-by-frame method at the rate of 29.97 frames per second. First, an experienced coder observed the direction of the child's gaze who looked at each of the objects during the selection period. The direction of the child's gaze was used for further analysis. The frame of the video data in which the first sound of "Oh, muta!" occurred was specified. Then the coder coded the object of the child's line-of-regard immediately before and after hearing the novel label. Two additional moves of the line-of-regard following the immediately-after-move were coded to provide more information about the movements of line-of-regard. The looked at object was coded into four categories; Experimenter, In-Attention Object, Out-of-Attention Object, and Other. The child's line-of-regard was coded Experimenter when the child looked at the experimenter's face or body. The child's line-of-regard was coded In-Attention Object when the child looked at the object that the child chose and was focused on. It was coded Out-of-Attention Object when the child looked at the other object that the experimenter looked at. It was coded Other when the child looked at anything that was not included in the already defined three categories, such as looking at other objects in the room or any part of the room such as the floor. Another coder independently coded 15% of the video data. The agreement between the two coding results was 91% and this was reliable enough (Cohen's kappa $\kappa=0.87$). The first coder's coded data was taken for further analysis. Kobayashi and Yasuda's (2007) data were used as the data in the 10 seconds elapsing condition.

Results

We first report the data of 0 seconds. The mean ratio of change of line-of-regard from one category to the other category was calculated for each movement. Figure 3-6 show the data of the young children for the two conditions. The moves that occurred in less than 5% of the all moves from one category to the other category were omitted as infrequent moves. In addition, moves after the child's eye gaze reached Out-of-Attention Object were also omitted assuming that the child recognized the intended object. These decisions were made to simplify the figures.

Figure 3 shows the movement of the line-of-regard of 2-year-olds when the novel label was heard immediately after the child-chosen object was taken. Immediately before hearing the novel label, 80% of two-year-olds looked at the In-Attention-Object. Among these children, 64% of them immediately looked at the Experimenter and then 77% of them looked at the Out-of-Attention Object. Whereas 33% of the children who previously looked at the In-Attention-Object immediately looked at the Out-of-Attention Object without checking the experimenter's eye gaze.

Figure 4 shows the movement of the line-of-regard of four-year-olds when the novel label was heard immediately after the child-chosen object was taken. Immediately before hearing the novel label, 96% of four-year-olds looked at the

In-Attention-Object. Among these children, 68% of them immediately looked at the Experimenter and then 82% of them looked at the Out-of-Attention Object. Whereas 27% of the children who previously looked at the In-Attention-Object immediately looked at the Out-of-Attention Object without checking the experimenter's eye gaze.

Figure 5 shows the movement of the line-of-regard of two-year-olds when the novel label was heard after 10 seconds of the child-chosen object was taken. Immediately before hearing the novel label, 75% of two-year-olds looked at the In-Attention-Object. Among these children, 59% of them immediately looked at the Experimenter and then 86% of them looked at the Out-of-Attention Object. Whereas 37% of the children who previously looked at the In-Attention-Object immediately looked at the Out-of-Attention Object without checking the experimenter's eye gaze.

Figure 6 shows the movement of the line-of-regard of four-year-olds when the novel label heard after 10 seconds of the child-chosen object was taken. Immediately before hearing the novel label, 71% of four-year-olds looked at the In-Attention-Object. Among these children, 48% of them immediately looked at the Experimenter and then 94% of them looked at the Out-of-Attention Object. Whereas 46% of the children who previously looked at the In-Attention-Object immediately looked at the Out-of-Attention Object without checking the experimenter's eye gaze.

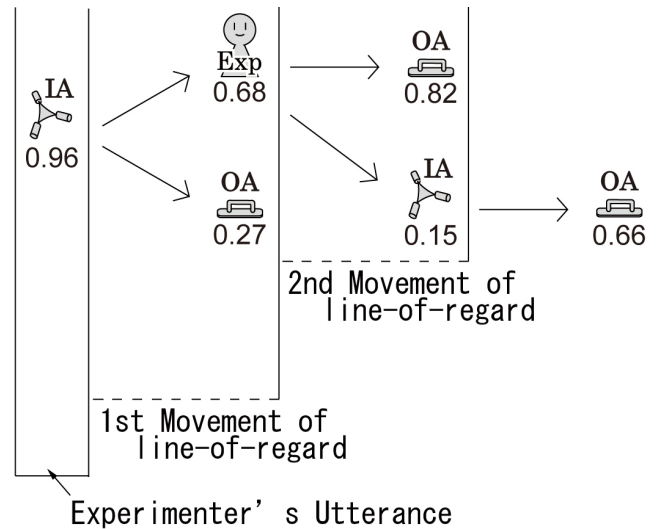


Figure 4: Movement of line-of-regard of 4-year-olds (0 sec condition)

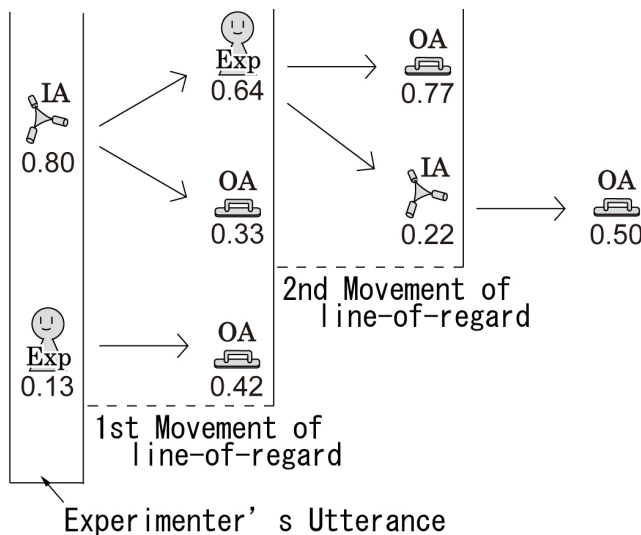


Figure 3: Movement of line-of-regard of 2-year-olds when the novel label was heard immediately after the child-chosen object was taken (0 sec condition)

Notes. Exp means the experimenter. IA means the In-Attention Object or the object the child attended. OA means the Out-of-Attention Object that the experimenter looked at and said "Oh, mutal!" Other means other objects (The frequency was small so not shown). The moves that occurred in less than 5% of the all moves from one category to the other category were omitted as infrequent moves. Moves after the child's eye gaze reached Out-of-Attention Object were also omitted.

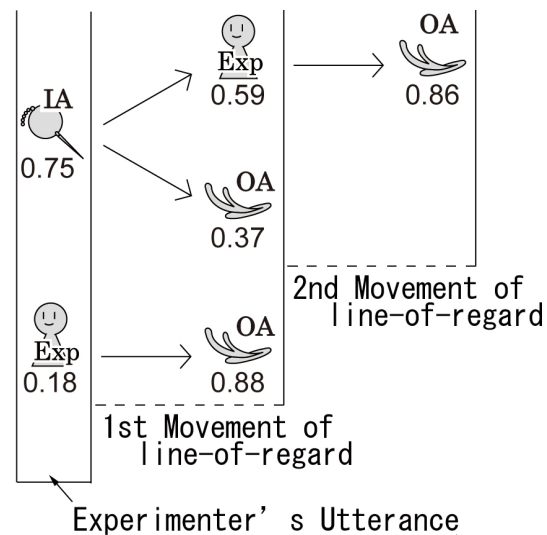


Figure 5: Movement of line-of-regard of 2-year-olds when the novel label was heard when 10 seconds elapsed after the child-chosen object was taken (10 sec condition)

Discussion

This study examined the movement of line-of-regard of 2-, and 4-year-olds in a discrepant labeling situation. Unlike the usual discrepant labeling paradigm, the children chose the first object of their own choice so that they could concentrate more on the first object. The experimental situation was videotaped and the movement of the participant's line-of-regard was recorded with a frame-by-frame method. We think the most interesting result of this study was the fact that the children did check the experimenter's eye gaze when the experimenter looked at and labeled the Out-of-Attention Object immediately after the child took the object of her choice. When we compare the present data of the 0 second condition and our previous data of 10 second condition, we can say that young children do not always check the direction of the line-of-regard when they hear a novel word, if they have a good reason to associate the given label to a certain object. If they hear the experimenter label something after they had already played with the object for 10 seconds, they seem to think that the object they have at hand is not the object the adult labeled. However, if the children hear the experimenter immediately label something after they took it, they seem to think that they need to check the adult's line-of-regard to know what was labeled. It may be argued that there are some alternative explanations for our findings. The child may detect the direction of the experimenter's voice or the child may see the direction of the experimenter's body by her peripheral vision even when the eye gaze is directed at something other than the experimenter. However, these alternative explanations hold both for the 0 and the 10 second condition, so they cannot explain the difference between the two conditions. Our interpretation of the phenomenon of the absence of direct look at the speaker is that the child had knowledge of the flow of conversation. If the speaker wanted to comment on the object that the child chose and manipulated, she should have commented earlier. Because she commented after 10 seconds had passed since the child had started to manipulate the object, she must have intended to make an inference about the object which had not been the already chosen object.

The result of this study supports the recent contention of the importance of the flow of conversation proposed by Tomasello and colleagues (Tomasello & Akhtar, 1995; Tomasello & Haberl, 2001). In several studies Tomasello and Akhtar demonstrated that young children have the ability to know the referential intentions of adults even when seeing an object and hearing the label of it do not occur simultaneously. One of the most important thing for children to know in learning object names is knowing the adult's desire and hopes and how such internal information may appear in facial expressions and tone of the voice. We think the present study added a new insight to this concept of the flow of conversation by examining the effect of immediate labeling and comparing immediate labeling and

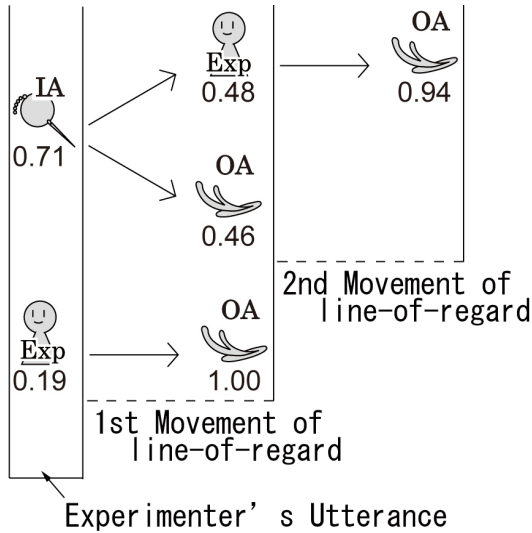


Figure 6: Movement of line-of-regard of 4-year-olds (10 sec condition)

A two-way ANOVA was computed with Age (two-year-olds or four-year-olds) and Timing (0 seconds or 10 seconds) as independent variables. Age and Timing were between-subjects variables. The dependent measure was the frequency of the child's line-of-regard from the In-Attention Object to the Experimenter after the child took the object (out of 4 trials). All responses that were not this movement (e.g. the child first looked at the Experimenter and then looked at the Out-of-Attention Object) scored zero. There was a significant main effect of Timing, $F(1,51)=6.895$, $p<.05$. The children looked at the experimenter's eye gaze more frequently in the 0 second condition ($M=2.392$, $SD=1.065$) than in the 10 second condition ($M=1.615$, $SD=1.061$). The main effect of Age and the Age x Timing interaction effect were not significant. Figure 7 shows the mean frequency of line-of-regard to the experimenter immediately after or after 10 seconds elapsed.

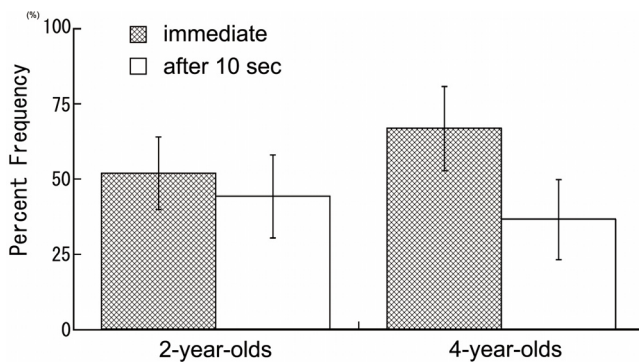


Figure 7: The mean frequency of the line-of-regard to the experimenter immediately after or after 10 seconds elapsed

labeling after 10 seconds elapsed. Even the consecutive manipulation of only 10 seconds may be enough for children to conclude that the already manipulated object must not be the object that the adult commented on with a nuance of excitement. The result of this study also partly supports the recent contention of a social shift in word learning proposed by Golinkoff, Hirsh-Pasek, and colleagues (Golinkoff & Hirsh-Pasek, 1999; Hirsh-Pasek, Golinkoff, & Hennon, 2000). They state that children come to rely on social intent as a more reliable cue than other cues such as perceptual saliency in word learning after around 18 months of age. This study provides evidence that children may further develop to use two different types of social cues depending upon the situation, i.e., line-of-regard of other people (a perceptual social cue) and timing of utterances (a pragmatic social cue). As children get older, this kind of sensitivity to social cues that reflect adult intent are sharpened and used for further word learning. Thus, we don't have to look at the face of another to know the direction of their attention when the flow of conversation provides sufficient cues. Here, looking at another's face may give some additional information such as the emotional states or exchanging emotional information, other than just knowing the direction of the others' attention.

Conclusion

Young children are equipped with the ability to know others' referential intentions without looking at their line-of-regard. Children seem to use the flow of conversation as an important cue to know the referent in the given situation. They do look at the adults' face if there are not sufficient cues to relate the label and the referred object. Children may develop this ability from early on and through childhood to quickly and correctly learn the meaning of words.

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