Roles of Adults' Gestures and Eye Gaze in Whole or Object Part Presenting

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Abstract

We investigated the use of a caregiver's actions and eye-gaze in teaching whole or part names. The experimental material consisted of two everyday objects, a toothbrush (the whole name was "haburashi", the part name was "ke") and a ball-point pen. We coded 4 action type categories and 2 eye gaze type categories based on the video data of 19 4-year-old child-mother dyads using frame-by-frame method. Results of actions showed that when the caregiver uttered a whole object name such as toothbrush ("haburashi"), the caregiver tended to present the object to the child by showing it. When she uttered a part name to teach the part name such as brush ("ke"), she pointed at the object part. Results of eye gaze analysis showed whereas the caregiver tended to look at the child's face in teaching whole names, she tended to look at the object in teaching part names. We found that caregivers use different gestures and eye gaze directions to teach whole or object part names. The study suggests that caregivers help young children's word learning using appropriate gestures and gaze directions.

Keywords: gesture; showing; eye gaze; teaching part names.

Introduction

It is claimed that children acquire language with the ability of specifying adults' referential intentions. This study focuses on adults' referential actions when they were asked to teach about whole objects or object parts to examine whether they provide useful information for young children's guessing adult referential intentions.

It is necessary for young children to accurately understand adults' intentional actions and associate accurately referred objects and words (Zukow, 1990). Adamson, Bakeman, and Deckner (2004) presented a study that a caregiver looked at a young child's eyes using mutual gaze when she taught an object name for the child. It is also important for young children to know an adults gaze direction (Doherty & Anderson, 1999). Doherty, Anderson, and Howieson (2009) showed 3-year-old children understood adults' subtle gaze direction.

Children are sensitive to the referential intentions conveyed by pointing and looking and they use information they obtained for word learning (Tomasello, Carpenter, & Lizskowski, 2007; Kobayashi, 1998, 1999). Tomasello & Farrar (1986) contended that mothers' object references that follow into children's attentional focus may facilitate their lexical acquisition. However an adult may not always offer information that is unambiguous and right. Baldwin (1991, 1993) investigated how children know adults' referential intentions using a discrepant labeling situation. In the discrepant labeling situation, an adult's attention at objects does not agree with a child's attention at objects. The study showed that 18 months or older children checked an adult's eye gaze to know the object which the adult labeled. In the everyday life, maternal naming and labeling for children often includes discrepant labeling situations (Collis, 1977; Harris, Jones, & Grant, 1983). Children must be equipped with ability to know correct referential intentions of adults using eye gaze and other information even in discrepant labeling situations.

Caregivers seem to use specific ways to convey referential intentions to young children. Masur (1997) examined caregivers' natural interaction with their infants using novel, comprehended, and familiar toy animals. The results were that mothers virtually always named whole objects first. More importantly, in the first mention of novel object, they named it and designated it with physical contact such as pointing, holding, or manipulating, but such naming and actions did not occur on the first mention of comprehended or familiar toy animals.

Although these studies provided precious evidence on adults' referential actions, these studies all focus on caregivers' teaching about whole object labels. An object is composed of various parts, so in part name learning, children should find a specific object part in a whole object and associate the part with the part name. It is not known whether caregivers use any specific referential actions or eye gaze to teach children part names.

In the literature of word learning, learning part names has been more discussed in the use of linguistic cues rather than nonlinguistic cues (Markman & Wachtel, 1988; Saylor, Baldwin, & Sabbagh, 2002). Markman and Wachtel (1988) showed that children learned part names when they could use knowledge about a whole object name and by applying whole object assumption and mutual exclusivity. Saylor, Baldwin, & Sabbagh (2002) demonstrated that if an object is presented and its whole-name and one of its part names are juxtaposed, children could learn the part name of the object. However, on whether children can learn part names using nonlinguistic cues, the results are mixed. Examined nonlinguistic cues were general direction of pointing (Mervis, Golinkoff, & Bertrand, 1994), facial expression (Moll, Koring, Carpenter, & Tomasello, 2006), tracing the contour of an object part (Hansen & Markman, 2009), and

functional actions (Kobayashi, 1998). Some cues have been demonstrated to help young children, but whether children use gestures such as pointing in learning part names is not well known.

Kobayashi (1998, 2002, 2012) showed that in the task to associate novel labels with object parts, 2- and 4-year-olds accurately interpreted adults' referential actions such as moving object parts or simply touch-pointing object parts to know word meanings. Yasuda and Kobayashi (2010) reported effects of eye gaze direction in learning part names. Children learned part names accurately when the adult pointed and looked at the object part and named the object part. However, if the adult looked at child's face doing the same actions, children DID NOT associate the object part with the part name. The study suggested that children learn part names accurately when adult focused on the object part by looking at the object part in addition to pointing at the object part. We speculated that caregivers may actually use referential actions and referential gaze so that young children understand whether the whole object or the object part is named.

In this study, we examined caregivers' referential actions in teaching part names to their 4-year-old children. We examined 4-year-olds' mothers because our previous research (Yasuda & Kobayashi, 2010) showed that 4-year-olds' mothers used referential actions such as pointing in teaching object part names. In addition, our recent research (2012) shows that 4-year-old children are sensitive to adults' pointing with touching the part. We decided to examine mothers' teaching gestures in two conditions, whole object name teaching and object part name teaching.

In Analysis 1, we asked a caregiver to teach either a whole object name or object part name and analyzed the caregiver's referential actions when she uttered either a whole label or a part label. In Analysis 2, we compared the caregiver's eye gaze when she uttered labels in each situation. If the caregiver used different referential actions when she uttered a whole and a part label, and if they use different eye gaze simultaneously with labeling whole or part labels, it can be said that they actually provide different nonlinguistic information for young children to help they learn whole and part labels.

Method

Nineteen pair of 4-year-olds (Mean=56.25 SD= 3.455 Range= 52-63 months) and their caregivers participated in the experiment in the Greater Tokyo Area, Japan. This experiment was conducted in conformity with a privacy ethical code of Tokyo Denki University.

Material

The experimental material consisted of toothbrush and ball-point pen as familiar objects. We prepared the toothbrush ("haburashi" in Japanese) as the whole object and a brush (Ke in Japanese) as the object part. We prepared a ball-point pen ("bohrupen" in Japanese) as the whole object and a knock bottom ("nokka" in Japanese) as the object part.

These objects in each set had distinctive shapes, and had the same color and texture as the other parts of the material object.

Procedure

The child and the caregiver sat at a table corner face-to-face (Figure 1). The experimenter recorded the experiment by two digital video cameras (Sony, SR-60, 29.97frame/sec). One of the video cameras focused on the caregiver's face and hand, and the child's face. The other video camera took the whole view to the experimental situation. These two video cameras were appropriately synchronized.

Each pair of participants was randomly assigned to one of two conditions, whole object teaching: the caregiver teaches something about the whole object (e.g. whole object name: toothbrush or "haburashi") and object part teaching: the caregiver teaches something about the object part (e.g. object part name: brush or "ke"). In the whole object teaching condition in the brush session, the experimenter gave the toothbrush to the caregiver and said to the caregiver in Japanese: "Please teach about the toothbrush as you like." ("Jiyu ni haburashi ni tsuite oshiete kudasai."). When the caregiver finished the brush session, she return the toothbrush and received the ball-point pen and taught about the ball-point pen. In the part teaching condition, the procedure was identical with the whole object teaching condition except that the caregiver was asked to teach the object part instead of the whole object. The experimenter asked the caregiver in Japanese:"Please teach about this brush part of this object." ("Jiyu ni kono ke no bubunn ni tsuite oshiete kudasai.").
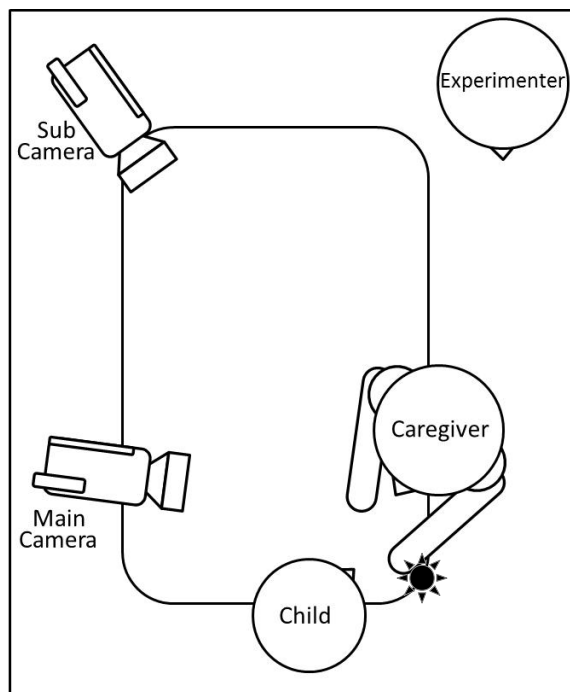

Figure 1. The experimental setting

Analysis 1

We examined whether the caregiver looked at the object or the child's face when the caregiver taught the whole object or the object part name. We categorized the caregiver's actions into four types (pointing, stroking, demonstration, and showing) based on video data (30 frame/sec) using frame-by-frame method. We coded the caregiver's actions when she uttered the first sound of either whole object name or object part name. We coded "pointing" when the caregiver pointed at the object. We coded "stroking" when the caregiver stroked the object contour. We coded "demonstration" when the caregiver demonstrated the function of the whole object or object part to present the child. We coded "showing" when the caregiver showed the object to the child. All caregivers' actions were categorized into one of these four categories. There were no caregivers who did not do any action when she uttered the first sound of whole object name or object part name.

We first calculated the frequency of each action type in each caregiver. Figure 2 shows the ratio of action type in each caregiver.
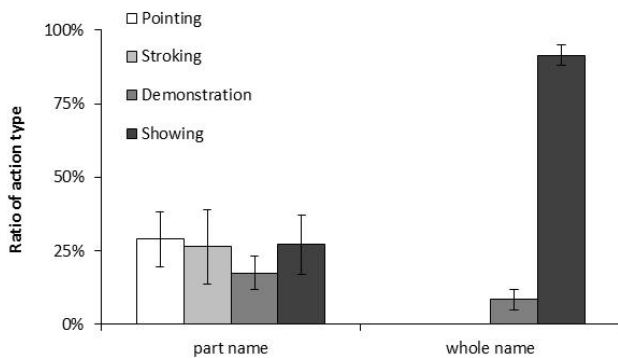

Figure 2. The ratio of action type in each caregiver.

Results of Actions

In order to analyze each caregiver's most representative referential action, we also calculated the propotion of each caregiver's action type based on the caregiver's most frequently occurred referential action observed in each teaching conditioon.

To test whether caregivers' actions varied across teaching types, a 2 (Teaching: whole label naming and part label naming) × 2 (Action: pointing, stroking, demonstration, showing) chi-square test was conducted. There was a significant effect of teaching type, $\chi^2(3)=9.6$, $p<.05$.

To explore the significant effect, we conducted residual analysis by computing adjusted residual. When the caregiver pointed at the object, the caregiver uttered more part names (r= 3.098, p<.05) than whole names (r= - 2.309, p<.05). When the caregiver presented the object using showing, the caregiver uttered more whole names (r= 2.498, p<.01) than part names (r= - 3.098, p<.01).

These results indicate that 1) When the caregiver uttered the whole label, she tended to present the object by showing. 2) When the caregiver uttered the part label, she tended to point at the object.

The caregiver seemed to use appropriate gestures to convey her referential intention on the object. Caregivers pointed at the part when she uttered a part label. Here, she specified the object part and taught part names. The caregiver DID NOT point at the object when she uttered a whole name.

Analysis 2

In Analysis 1, we examined whether a caregiver looked at the object or the child's face when caregiver uttered the whole object name or object part name. We categorized the caregiver's eye gaze into two types (object and child's face) based on video data (30 frame/sec) using frame-by-frame method. We categorized a gaze an object gaze if the caregiver looked at the object when she uttered an object name. We categorized a gaze a child's face gaze if the caregiver looked at the child's face or hand when she uttered an object name. We coded these gaze at the first sound of either whole or part names. No caregiver looked at the digital camera or others when she uttered whole or part labels.

We first calculated the frequency of each eye gaze type in each caregiver. Figure 3 shows the ratio of action type in each caregiver.
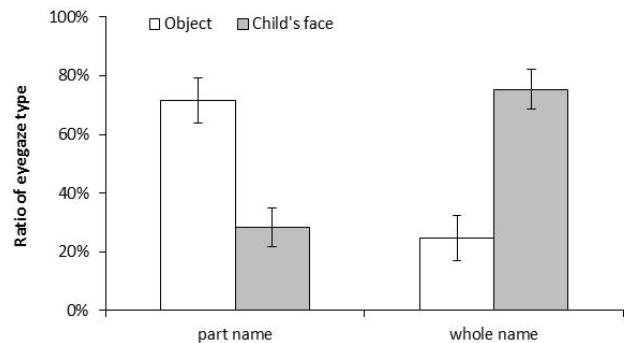

Figure 3. The ratio of gaze type in each caregiver

Results of Eye-Gaze

In order to analyze each caregiver's most representative eye gaze, we also calculated the propotion of each caregiver's eye gaze type based on the caregiver's most frequently occurred referential gaze observed in each teaching condition.

To test whether caregivers' eye gaze varied across teaching types, a 2 (Teaching: whole label naming and part label naming) × 2 (Gaze: Object, Child's face) chi-square test was conducted. There was a significant effect of teaching type, $\chi^2(1)=12.40$, $p<.01$.

To explore the significant effect, we conducted residual analysis by computing adjusted residual. When the caregiver looked at the object, the caregiver uttered more part names (r= 3.528, p<.01) than whole names (r= - 3.528, p<.01). When the caregiver looked at the child's face, the caregiver uttered more whole names (r= 3.528, p<.01) than part names (r= - 3.528, p<.01).

These results indicate that 1) When the caregiver taught the whole label, she looked at the child's face or hand. 2) When the caregiver taught the part label, she looked at the object. The caregiver looked at the object when she presented the object with a showing gesture. She rarely looked at the object when she taught the whole name with a showing gesture

Discussion

We investigated the relationship between a caregiver's actions and eye gaze in teaching whole or part object names. The experimental material consisted of two everyday objects, toothbrush (whole name is "haburashi", part name is "ke") and ball-point pen (whole name is "boru pen", part name is "knocker"). We coded 4 action type categories and 2 eye gaze type categories based on the video data using frame-by-frame method.

Results of action data showed that the caregiver presented the object by showing it when she uttered a whole object name such as toothbrush. However, the caregiver pointed at the object when she uttered a part name to teach the part name such as brush. Thus the caregiver taught part names using pointing at the object part. Caregivers may know their children can learn part names by observing adult pointing actions. Pointing at object part can appropriately attract the child's attention to the object part. That may be one reason why caregivers choose to use showing rather than pointing in whole object naming so that the child can appropriately focus on the whole object rather than any specific part of the object.

Results of eye gaze data showed that whereas caregivers tend to look at a child's face in teaching whole names, they tend to look at an object itself in teaching part names. Caregivers seem to know looking at the object part in addition to pointing the object part is important to teach children object part names.

It is suggested that the caregiver conveys referential intentions to teach whole or object part names using appropriate gestures and gaze direction. The results of this study accord with social-pragmatic approach to word learning (Clark, 2009; Tomasello, 2003). Children learn word meanings by guessing adult intentions provided by adult utterances. This study provided evidence that adult certainly provide nonlinguistic information through gestures and eye gaze to help children's understanding of adult referential intentions.

Acknowledgments

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