

Research Article

Adults' Theory of Infants' Mind: A Comparison between Parents and Nonparents

Ikuko Shinohara¹ and Yusuke Moriguchi²

¹National Institute for Educational Policy Research, 3-2-2 Kasumigaseki, Chiyoda-ku, Tokyo 100-8951, Japan

²Department of Education, Kyoto University, Yoshidahoncho, Kyoto 606-8501, Japan

Correspondence should be addressed to Ikuko Shinohara; shinoiku@nier.go.jp

Received 2 August 2016; Revised 12 November 2016; Accepted 28 December 2016; Published 26 January 2017

Academic Editor: Elena Nicoladis

Copyright © 2017 Ikuko Shinohara and Yusuke Moriguchi. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

This study examined whether there were parental state differences in interpretations of infants' behaviours as associated with some mental states. Parents, nonparent women, and nonparent men were shown video clips that displayed several infant behaviours (e.g., playing with his/her mother). Then they were given two tasks. In a rating task, participants were asked to rate the likelihood of the filmed infant to have a mental state. On the other hand, in a description task, participants were instructed to explicitly describe the filmed infants' mental state in an open-ended manner. Importantly, all participants were asked to report the meaning of infants' behaviour in specific acts from the same set of infants' behaviours (e.g., the infants saw mother's face and smiled). The results revealed that parents and nonparent women significantly higher rated that infants were likely to express a mental state in the rating task than nonparent men did. On the other hand, parents were more likely to describe the filmed infants' mental states in the description task than nonparent women and nonparent men did. Results suggest that parents interpret more meanings from infants' behaviours compared to nonparents, even when both parents and nonparents equally focused on infants' behaviours.

1. Introduction

Theory of mind refers to the ability to attribute mental states such as intention, desire, and belief to ourselves and others, enabling an individual to predict and explain behaviour. Earlier research has examined the development of theory of mind in infants and young children [1, 2]; moreover, recent studies have examined adults' theory of mind. One important issue in adult research is how adults attribute state of minds to different agents [3–5]. Gray et al. [3] showed that adults attributed different mental states such as agency (cognitive mental states) and experience (emotional mental states) to different agents such as God (agency) and infants (experience).

This study specifically focused on adults' theories of infants' mind. In the literature, there is an ongoing argument regarding whether there are parental state differences in the interpretation of infants' behaviours [6–11]. In their pioneering study, Adamson et al. [6] examined the difference in interpretations of infants' intention between parents and nonparents. In this study, two types of infants' behaviours were

examined. The first behaviour, a communicative act, involved an agent's behaviour that has intentions to communicate truly, whereas the second behaviour, a meaningful act, does not necessarily contain intention, but a recipient perceives it as communicative. Parents and nonparents (students) were asked to watch the stream of infant behaviours on video and press a button on the recording device whenever they see the baby's actions in a way that is communicative or meaningful for them. Result revealed that parents and nonparents did not differ in their responses to communicative acts whereas parents noted significantly more meaningful acts than nonparents did.

The results may suggest that experience with infants might foster parents' complex schemata for infants' action and stretch the dimension of "meaningful." Therefore, Kamel and Dockrell [12] examined whether the definition of "meaningful" differed between parents and nonparents. In this study, mothers were asked to select infants' actions that were meaningful while watching a video, where they were interacting with their infants. After that, they were instructed

to explain how they interpreted infants' behaviour as meaningful. The results revealed that maternal criteria of meaningfulness contained not only intention but also other internal states (e.g., happy). Then, nonparents were provided with the definition and criteria of meaningfulness in advance and were asked to select infants' actions they interpreted as meaningful (e.g., intention, happy) while watching the video of mother-infant interaction. The results showed that there was still a difference among parents' and nonparents' selection of intentional acts. Thus, the differences in the definition of meaningfulness could not fully account for parental state differences in the interpretation of infants' behaviour.

In the previous studies, participants were presented with the stream of infant behaviours on video and asked to select the meaningful behaviours. It may be possible that parents and nonparents pay attention to infants' different behaviours. By this account (the "different act account"), parents might split a stream of infants' behaviours into more detailed acts; therefore, parents can select more meaningful acts than nonparents can. On the other hand, nonparents may pay attention to infants' outstanding behaviours and not focus on other less notable behaviours. For example, consider a scene where an infant stops operating a toy and approaches his mother with hands reaching toward her. Nonparents may focus on the infant's latter act and attribute some mental states (e.g., desire) to the act, but they may ignore the former act. In contrast, parents may attribute mental states to both the former and the latter acts.

Alternatively, both parents and nonparents may equally focus on each infant's behaviour, but parents may be more likely to evaluate meaningfulness in infants' behaviours than nonparents do. This account (the "different evaluation account") is consistent with evidence that parents uniquely attribute several different meanings to infants' immature behaviours [13–16]. Meins et al. [16] observed mother-infant interactions during free play and examined how often mothers described her own infants' mental states. Results showed that some mothers often refer to infants' mental states such as emotion, thinking, and intention. These maternal comments on infants' minds were considered as the index of "mind-mindedness," a maternal proclivity to treat an infant as an individual with a mind, even though the infants are still young. The maternal mind-mindedness can significantly contribute to parental appraisal of meanings in infants' behaviours and children's social development [16].

The present study tested the two accounts of the differences between parents and nonparents. We modified Meins et al.'s method in the following points to create a "description task." Meins et al. [16] observed interactions between a mother and her own children; however, nonparents do not have children. Thus, we created video clips of infants' behaviours, and parents (who were not parents of the infants on video) and nonparents were recruited. In addition, Meins et al. assessed whether mothers appropriately referred to infants' mind. In other words, how accurate mothers interpreted the meanings of infants' behaviours was examined. On the other hand, in previous studies described above [6, 12], researchers assessed the richness (or the number) of participants' interpretation irrespective of appropriateness.

Given that, we assessed how much participants described infants' mental states while viewing the video clips.

Although the description task was the main focus in the present study, participants were also asked to rate the intensity of meaningfulness about infants' behaviours. This task was inspired by Reznick [9]. In the study, mothers were shown a set of video clips, where infants were behaving more or less intentionally. Then, they were asked to rate on an 8-point scale that indicates how intentional the infants' behaviours were. Results showed that infants' behaviours such as goal-oriented actions and repetition of actions were rated as more intentional by mothers. However, in Reznick's study, mothers were asked to evaluate intentionality of infants' behaviours. Thus, we modified the procedure to assess whether participants evaluated meaningfulness of infants' behaviours. In this study, participants were asked to rate likelihood (or intensity) of the infants having any mental states in the rating task. We gave participants the rating task as well as the description task because nonparents may be aware that infants may have some mental states even though they did not explicitly describe specific ones.

In this study, unlike previous studies [6, 9], parents and nonparents were asked to report meaning in specific acts of infants' behaviours. That is, they had to respond to the same infants' acts. We used stimuli that included infants younger than 9 months old because previous studies suggested that infants under 9 months maximize the possibility of interpreting infants' behaviours [9, 12]. The meaning of older infants' behaviour could be easier to identify [9, 17]. Moreover, we explained the definition of meaning to parents and nonparents before the experiment based on Kamel and Dockrell [12].

If the different act accounts were correct, both groups would respond equally to the stimuli. However, if the different evaluation accounts were correct, parents would read more meaning from infants indexed by richness of mind-mindedness than nonparents. Further, we examined sex differences as well as parent-status differences in the interpretation of infants' behaviours. Regarding adults' responses to infants, it has been reported that women show more sensitivity to infants' faces and voices [18, 19]. It is likely that men and women had different mind attributions for infants.

2. Pilot Study

2.1. Materials. To measure adults' richness of mind-mindedness for infants, an original video-based measurement was developed with reference to Reznick [9] and Adamson et al. [6]. The pilot version was reported in Shinohara [20]. The set of video stimuli of richness of mind-mindedness needed to include natural and day-to-day infant's aspect. To create the set of video stimuli, the first author observed 8 mother-infant pairs at home for 30–60 minutes. These infants were typically developed 6- to 9-month-old children (4 boys, 4 girls).

Videos were analysed to categorize the infants' day-to-day activities. Each video was divided into episodes of 10 seconds and the episode was labelled by an experimenter. For example, one of the scenes was described as "mother-infant play interaction" or "infant's reaching for the toy."

TABLE 1: Scripts of video stimuli.

Rating task	Script
(1)	An infant holds a toy in each hand (one toy contained a bell) and <i>made a sound using the toys</i> .
(2)	An infant sucked his thumb on one hand while opening, closing, and <i>gazing at</i> the other hand.
(3)	An infant saw a glass door with his mother and the door reflected the infant and mother. <i>The infant saw the mother's face on the door and smiled</i> .
(4)	An infant was drinking milk with a feeding bottle. After the infant stopped drinking, the mother took the bottle. <i>The infant screamed</i> .
(5)	An infant was playing peek-a-boo with her mother. When the mother covered her face, <i>the infant gazed at her face</i> . When the mother revealed her face, the infant made a loud noise.
Description task	Script
(1)	An infant held and handled a toy. Then the infant stopped operating the toy and <i>approached his mother with hands reaching toward her</i> and hugged her.
(2)	The mother fed her infant with a spoon. After the infant chewed the food, <i>the infant closed his mouth, smiled, and chewed again</i> .
(3)	An infant saw that a TV was on. Then the infant approached the TV and <i>touched the screen while opening and closing both hands</i> .
(4)	The mother played with her infant by moving her hand back and forth above her infant's face. The infant gazed her mother's hand <i>and reached her own hands when mother's hand was just above her face</i> . Then, the infant gazed at her mother's hand that got away from the infant's face.
(5)	When an infant chased a ball rolling to under a table, the infant was covered with a table cloth. <i>The infant grabbed the table cross with her hands and vocalized</i> . The mother took the table cross off and the infant smiled at her.

Note. Each video stimulus was paused at the moment in the italic part of the script. Participants were asked to answer about the infants' behaviours in each video.

Regarding the context meaning, the infants' behaviour in each episode was classified into 7 categories: "object manipulation," "engagement in social interaction with mother," "expression of seeking for mother (e.g., crawling toward mother)," "sensory/physical/tactile stimulation (e.g., finger sucking)," "eating and sucking," "unexpected event (e.g., slip on the floor)," and "others." We considered two points to include the episodes as video stimuli. First, infants' activities that were observed for more than two infants were selected from each category. Second, the episodes where the observed mother commented on the infants' mental state spontaneously in the interaction were selected. The infants' sex and age were balanced, and 28 segments were selected as stimuli materials for mind-mindedness measurement. Some film clips included infants alone while others had infants with their mothers.

2.2. Prior Study for Stimuli Selection. Each video clip lasted 30 seconds in duration. To specify infants' behaviours, the video clips were modified to pause for 5 seconds at the target infants' behaviour. Sounds of the clips were typically not modified except that the mothers' utterances including some comments on the infants' inner states were erased.

In the prior study, 14 graduate and undergraduate students (7 women and 7 men) rated each of the 28 clips on the salience of infants' internal states underlying his/her behaviour. This rating method was used in Reznick [9]. Participants were asked to watch the video clips and to rate whether the infant had any mental states on an 8-point scale. The rating scales ranged from 1 (*definitely not*) to 8 (*very much*). We selected test stimuli from the video clips

according to the following criteria. For a rating task (for details, see Table 1), video clips that had a relatively large standard deviation (i.e., >3.40) and did not have too low or too high of a mean rating score (range 3.79–6.36) were selected as stimuli. For a description task (for details, see Table 1), video clips that had a mean score greater than 5.0 on an 8-point scale and a relatively small standard deviation (i.e., <3.30) were selected. It was considered that selecting the clips where infants had relatively stronger inner states made it relatively easier to answer about specific contents of infants' inner world. After sex and age of the infants in each video clip were balanced, five video clips were selected as stimuli for a rating task and a description task, respectively.

3. Main Study

3.1. Participants. Participants ($N = 115$) comprised 56 non-parents and 59 parents. Nonparent participants were undergraduate and graduate university students (20 men and 36 women, mean age = 21.29 years, $SD = 2.31$, and range 18–31). None of the students had experience with rearing infants. Participation was voluntary and written consent was obtained prior to participation. Parents were 59 mothers who had infants aged 6 to 8 months. This ensured that mothers had the same experience with infants as the mothers from the video stimuli. Mothers were recruited from Japanese middle-class communities. A local child-rearing meeting and nursery school were used to recruit the sample. All mothers were married and lived with their partners. Written informed consent was obtained prior to mothers' involvement in the study. The average age of mothers was 32.47 years ($SD = 4.57$,



FIGURE 1: An example of video stimuli (the picture was from the second stimulus in the description task).

range = 20–41 years). Thirty-two infants were first-born (54.5%), 26 were second- or third-born (44.1%), and one infant's birth order was unknown. All of the infants were healthy and developing normally.

Regarding maternal education, two mothers had graduated from junior high school (12.9%) and 23 mothers had graduated from high school (24.7%). The other mothers had higher education: 23 mothers (39.0%) had graduated from a career college, 19 mothers (32.2%) had an undergraduate degree, and three mothers (5.1%) had some graduate education. One mother's education history was unknown.

3.2. Experiment. Two types of measurement, a rating task and a description task, were composed to capture the dual aspects of adults' view on infants' mental state. All participants participated in both the rating and description tasks. Participants were asked to watch video clips of infants and answer questions. All video clips were shown on a PC monitor.

The rating task focused on adults' tendencies to attribute any mental states that were activated and elicited by exposure to infant stimuli. In the rating task, participants were asked to rate the likelihood that the filmed infant has some mental state. The introduction provided to participants was the following: "We are asking you to help us understand infants' mental states. You are going to see five video clips where infants are playing and interacting with their parents. Do you think that the infants you will see in the following filmed episodes have some mental state? Your task is to rate how likely it is that the infants have an inner mental state at the paused scene using an 8-point scale." The rating scales ranged from 1 (*definitely not*) to 8 (*very much*). In this task, each video clip was presented twice. Participants were asked to rate the video clips after watching each video clip (Figure 1).

In the description task, the adults' subjective interpretations of infant's inner states (hereafter, this tendency is referred to as "description") were measured. Participants were asked to watch another 5 video clips and describe what was going on in the filmed infants' mind. Each segment was shown twice and participants were interviewed regarding their perceptions of infants' mental states after the second viewing. Participants were asked the following questions: "Do you think the filmed infant have some mental state? If so, what

do you think went through the infant's head or mind at the paused scene? However, for some clips, you might think that the infant behaved without any particular mental state. If so, please let us know." For the open-ended question, participants were informed that they should feel free to talk about all things that came into their heads. All participants' speeches were recorded and transcribed verbatim.

In both tasks, participants were informed that "mental states" referred to infants' thinking and feeling (i.e., anything going through the infant's mind). Participants were instructed that the experimenters were interested in their opinions and that there were no right or wrong answers. The experiment took approximately 15–20 minutes to complete.

3.3. Coding. For the rating task, rating scores were determined by calculating the average rating point across 5 stimuli. This score provided an index of participants' general tendency to attribute mental states to infants.

Participants' description task answers were transcribed verbatim and the comments that referred to the infants' mental state were analysed (for details, see Table 2). Some participants talked about their own or the filmed mother's feeling and thoughts; therefore, these answers were excluded from analysis. Following previous studies [21–24], participants' use of mental state terminology that referred to what was going on in the infants' mind was counted. Participants' answers that described infants' emotions, preferences, interests, intentions, desires, and cognitions were coded as "mind-related" comments (see Table 2). In this coding system, use of explicit mental state terminology was counted as description task score; therefore, participants' comments such as "TV! TV!" were not counted as reference to an infant's mental state. It was possible that participants tried to describe infants' curiosity or interest using these comment; however, that comment was still too vague. The repetition of specific descriptions for one video clip was not counted separately. For example, a participant that used the term "like" twice in his/her answer ("He likes that ball, he really likes the one") was coded as one "like" in the description. Participants' descriptions that referred to infants' behaviour and perception, such as watching, looking, and laughing, or to context of episode were coded as "not mind-related" and excluded from counting. The total number of participants' use of internal state language during the task with five video clips was calculated as description scores. This study focused on overall richness in the description of infants' mental world; therefore, a frequency measure was adopted for analysis.

The first author coded all interviews in the description task. A random set of 27.83% of the transcription ($n = 32$) was also coded by an independent second coder who was blind to the aim of this study and to other participants' information. Interrater agreement for participants' use of mental states terms was $\kappa = .923$.

4. Results

4.1. Rating Task. The means of the rating scores are presented in Table 3. There were no significant differences in either the sex of the parent's own infant ($t(57) = .337, p = .737$, and

TABLE 2: Mental state terminologies that were included in the “mind-related” comment for description task score.

Category	Specific words
Emotion & preference	Happy, sad, scared, afraid, joyful, in a good/bad mood, surprised, disgusted, bored, angry, amaze, interested, like, dislike, do not like, prefer, and hate
Intention	Try to, going to
Desire	Want, want to do, do not want, I want you to, and I do not want you to
Cognition	Think, know, recognize, remember, recall, realize, and expect

TABLE 3: Mean and SD of the rating scores and description scores.

	Rating		Description	
	Mean	SD	Mean	SD
Mother	5.97	1.09	9.03	3.75
Nonparents (total)	5.48	1.04	7.34	2.84
Nonparent women	5.71	0.82	7.64	2.89
Nonparent men	5.04	1.28	6.80	2.74

$d = .08$) or birth order ($t(43.45) = 1.194, p = .239$, and $d = .32$). Parents’ education level was not related to the rating score toward filmed infant ($r = -.045, p = .738$).

There was a technical error for the rating task of one male participant; therefore, the participant’s data was excluded from the analyses. To identify that the rating scores significantly differed from 4.5 (the median of the 8-point scale), a one-sample t -test was conducted. The analysis revealed that parents and nonparents positively attributed mental states to infants (parents, $t(58) = 10.363, p = .001$, and $d = 1.91$; nonparents $t(54) = 6.981, p = .001$, and $d = 1.33$).

Among nonparents, women positively attributed mental states to infants ($t(35) = 8.83, p = .001$, and $d = 2.09$); however men did not ($t(18) = 1.85, p = .080$, and $d = .60$). The results suggested that women, even if they had rare experience with infants, tended to evaluate that infants behaved with mental states.

We investigated whether the rating scores differed between parents and nonparents. We conducted a one-way ANOVA using group (parent, nonparent women, and nonparent men) as a between-subject factor. We found a significant main effect of group ($F(2, 111) = 5.617, p = .005$, and $\eta^2 = .092$). Post hoc comparisons using Bonferroni method revealed that mothers rated the rating of filmed infants’ mental state higher than nonparent men did ($p = .003$). However, parental scores and nonparent women’s scores did not differ ($p = .755$). The mean of nonparent women’s rating score was marginally higher than men’s score ($p = .078$). These results indicated that sex rather than child-rearing experience was an important factor for the perception of the rating of infants’ mental states.

4.2. Description of Infants’ Inner States. The average description scores are presented in Table 3. Therefore, parents commented on infants’ internal states almost twice for each video clip. Description scores of daughter’s mother and son’s mother did not differ ($t(57) = 1.725, p = .090$, and $d = .449$).

Further, there was no difference among primiparous and multiparous mothers ($t(56) = .063, p = .950$, and $d = .016$). Therefore, mothers’ reference on infants’ inner world did not relate to mothers’ previous experience of parenthood nor her own infant’s sex. Education level was significantly related to maternal description scores ($r = .320, p = .01$).

We investigated whether description scores differed among parents, nonparent women, and nonparent men. Given that the education level was related to maternal description scores, we conducted an analysis of covariance (ANCOVA) with participants’ group as a fixed factor and education as a covariate. The results revealed that the main effect of group was significant ($F(2, 110) = 7.178, p = .001$, and $\eta^2 = .115$). Post hoc analyses using Bonferroni method indicated that mothers commented on infant’s mental states more than nonparent women ($p = .003$) as well as nonparent men ($p = .001$). Further, nonparent men and women did not differ in description score ($p = .278$).

Regarding the description of the infants’ internal state, we conducted further analysis on participants’ speech. Description score was the total number of participants’ comments that related to the infants’ mind and mental processes. However, participants made other comments on infants’ behaviour or context. Description score was a verbal index, and it was possible that a higher education level was associated with extensive vocabulary. In order to consider participants’ verbosity, all comments regarding filmed infants in description measurement were counted. The verbosity score was the total frequency of participants’ references to the infants’ mental state, behaviour, or the context of the video clips (total number of “mind-related” and “not mind-related” comments). The mean total comments of mothers, nonparent men, and nonparent women were 16.12 (SD = 8.27), 12.95 (SD = 6.35), and 15.06 (SD = 7.31), respectively. An ANOVA revealed that there was no difference among mothers, nonparent men, and nonparent women in total frequency of comments during the description task ($F(2, 112) = 1.272, p = .284$, and $\eta^2 = .022$).

Mother’s education level significantly correlated to the amount of total comments in description score ($r = .310, p = .018$). Comparable to description score, an ANCOVA was conducted on the total amount of comments with participants’ group as a fixed factor and education as a covariate. We found no significant group difference ($F(2, 110) = 2.709, p = .071$, and $\eta^2 = .047$). The results indicated that the difference in mind-related comments on infants between mothers and nonparent women was distinct from verbosity or education level.

5. Discussion

In this study, parents', nonparent women's, and nonparent men's theory of infants' mind were examined. They were shown video clips of infants and asked to rate the intensity of the infants having mental states (rating task) and to describe the infant's mental state in an open-ended manner (description task). The results revealed that parents and nonparent women showed significantly higher rating scores than nonparent men; no significant differences were found between parents and nonparent women. On the other hand, parents displayed significantly higher description scores than nonparent women and men. The higher description scores of parents may not be due to parental verbosity because the total number of the utterances during the videos did not differ across groups. The results taken together suggested that there might be sex differences in terms of the rating scores. Moreover, parents and nonparents may differ in terms of description and richness of proclivity to treat an infant as an individual with a mind.

The results contribute to our understanding of how parents and nonparents differed in interpreting infants' behaviours. Previous studies have shown that parents were more likely to select meaningful acts from infant on video than nonparents were [6, 12]. One possible interpretation of those results was that parents might split a stream of infants' behaviours into more detailed acts; therefore, parents can select more meaningful acts ("different act account"). Another interpretation was that both parents and nonparents might equally focus on infant's behaviours; however, parents may be more likely to read meaningfulness in each infant's behaviours than nonparents ("different evaluation accounts").

In this study, participants were asked to report the meaning of the infants' behaviour during specific acts of infants' behaviours. Therefore, if the different act accounts were correct, there should be no differences in the number of responses between parents and nonparents because participants were presented with the same behaviours and asked to evaluate the meaningfulness of the behaviours. However, the results revealed that parents were more likely to interpret meaning from infants' behaviours than nonparents, especially in the description task. Therefore, the results did not support the different act account. Rather, the results supported the different evaluation accounts, suggesting that parents can interpret more meanings from infants' behaviours.

The results were largely consistent with previous evidence that parents attributed some mental states to infants' immature behaviours. Indeed, Meins et al. [14] observed mother-infant interaction during free play and found that mothers often refer to infants' mental states such as emotion, which was used as the index of mind-mindedness. This study extended the findings in two important ways. First, these previous studies did not directly compare parental responses to nonparents' responses. Thus, we created video clips that contained a stream of infants' behaviours. This enabled us to directly compare parental responses to nonparents' responses. Second, Meins counted maternal comments that appropriately referred to infants' mental states; however, this

study assessed the richness of participants' mind-minded responses irrespective of whether parental responses were appropriate.

In addition to the description task, we assessed the intensity or adults' tendency to attribute any mental states that were activated and elicited by exposure to infant stimuli. The intensity measure was inspired by Reznick [9] who reported that mothers rated infants' behaviours such as goal-oriented actions and repetitive actions as intentional. Our results showed that there were significant differences in the rating scores between mothers and nonparent men, but not between mothers and nonparent women. Therefore, there might be sex differences rather than parental state differences in rating scores. We believe that the sex differences may be related to more biological mechanism. It has been reported that women show more sensitivity to infants' faces and voices [18, 19]; therefore, nonparent women may be more sensitive to infants' behaviours than nonparent men. However, their lack of experience with infants may lead to the failure to specify the meanings as measured by description task. Sprengelmeyer et al. [19] suggested that sensitivity for infants' faces was dependent on reproductive hormones; thus, it is possible that experience-related factors modified the response to infants. Particularly, we speculate that experience of parturition and nurturing influences the recognition of infants as agents with minds.

One limitation of the present study was that we did not assess male parents' responses. Several prior studies have examined the differences and commonalities between mothers' and fathers' childcare behaviours [25, 26]. It is necessary to focus on the fathers' impression about infants' mental state to reveal the sex and experience differences in mental state attributions. Although research focusing on fathers' interpretation was relatively scarce, Elias et al. [27] showed that mothers and fathers had a high level of agreement on what they interpreted as infants' communicative behaviour; however, there were some differences between parents' identification of the emergence of infants' intentional acts. Comparison between father and nonparent men could reveal sex or experience effects on responses to infants.

There are some issues that should be addressed in future studies. First, this study assessed the participants' perception and interpretation of infant's behaviours, but not how such interpretation directs the participants' behaviours toward infants in real interactions with infants. Thus, we need to observe the interactions between participants and infants and examine how parents' behaviours were different from nonparents' behaviours. We expect that parents, who attribute more meanings to infants' behaviours, can interact and communicate with infants more smoothly compared to nonparents. Moreover, there might be individual differences within parents. For example, parental' mental health, such as depression, may play an important role in how they interpret infants' behaviours and how they interact with infants.

Second, it may be of interest to examine whether the differences in mental state attributions between parents and nonparents were specific to infants or can be extended to adults or other agents, such as robots. Previous studies have shown that adult participants attribute state of minds to

different agents, such as God [3–5]. However, it is still unclear what kinds of factors may affect individual differences in the attributions. Our results showed that parental state affected adults' theory of infant minds, and this tendency can be generalized to other agents.

In conclusion, the present study showed that parents were more likely to describe the filmed infants' mental states than nonparents. The results suggest that parents can interpret more meanings from infants' behaviours compared to nonparents, even when both parents and nonparents equally focused on infants' behaviours.

Competing Interests

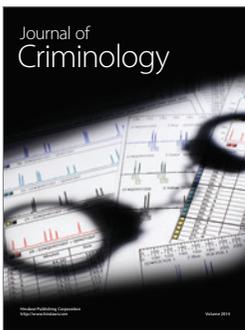
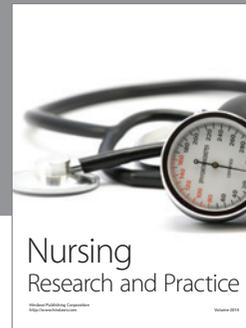
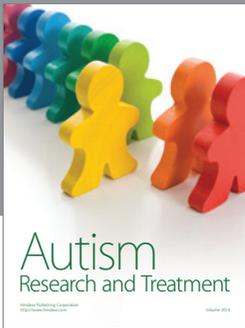
The authors declare that there is no conflict of interests.

Acknowledgments

This research was supported by the Japan Society for the Promotion of Science KAKENHI (Grants nos. 20830137 and 22730527 to the first author). The authors thank the students, parents, and infants who participated in this study.

References

- [1] K. H. Onishi and R. Baillargeon, "Do 15-month-old infants understand false beliefs?" *Science*, vol. 308, no. 5719, pp. 255–258, 2005.
- [2] H. M. Wellman, D. Cross, and J. Watson, "Meta-analysis of theory-of-mind development: the truth about false belief," *Child Development*, vol. 72, no. 3, pp. 655–684, 2001.
- [3] H. M. Gray, K. Gray, and D. M. Wegner, "Dimensions of mind perception," *Science*, vol. 315, no. 5812, p. 619, 2007.
- [4] K. Gray and D. M. Wegner, "Feeling robots and human zombies: mind perception and the uncanny valley," *Cognition*, vol. 125, no. 1, pp. 125–130, 2012.
- [5] N. Haslam, "Dehumanization: an integrative review," *Personality and Social Psychology Review*, vol. 10, no. 3, pp. 252–264, 2006.
- [6] L. B. Adamson, R. Bakeman, C. B. Smith, and A. S. Walters, "Adults' interpretation of infants' acts," *Developmental Psychology*, vol. 23, no. 3, pp. 383–387, 1987.
- [7] R. Feldman and J. S. Reznick, "Maternal perception of infant intentionality at 4 and 8 months," *Infant Behavior and Development*, vol. 19, no. 4, pp. 483–496, 1996.
- [8] S. L. Beaumont and K. Bloom, "Adults' attributions of intentionality to vocalizing infants," *First Language*, vol. 13, no. 38, pp. 235–247, 1993.
- [9] J. S. Reznick, "Influences on maternal attribution of infant intentionality," in *Developing Theories of Intention: Social Understanding and Self-Control*, P. D. Zelazo, J. W. Astington, and D. R. Olson, Eds., Lawrence Erlbaum Associates, Mahwah, NJ, USA, 1999.
- [10] D. Meadows, G. Elias, and J. Bain, "Mothers' ability to identify infants' communicative acts consistently," *Journal of Child Language*, vol. 27, no. 2, pp. 393–406, 2000.
- [11] G. Elias and D. Meadows, "Agreement between mothers and other female adults on infants' communicative behaviours," *First Language*, vol. 20, no. 59, pp. 125–139, 2000.
- [12] H. Kamel and J. E. Dockrell, "Divergent perspectives, multiple meanings: a comparison of caregivers' and observers' interpretations of infant behaviour," *Journal of Reproductive and Infant Psychology*, vol. 18, no. 1, pp. 41–60, 2000.
- [13] E. Meins, C. Fernyhough, B. Arnott, S. R. Leekam, and M. De Rosnay, "Mind-mindedness and theory of mind: mediating roles of language and perspectival symbolic play," *Child Development*, vol. 84, no. 5, pp. 1777–1790, 2013.
- [14] E. Meins, C. Fernyhough, E. Fradley, and M. Tuckey, "Rethinking maternal sensitivity: mothers' comments on infants' mental processes predict security of attachment at 12 months," *Journal of Child Psychology and Psychiatry and Allied Disciplines*, vol. 42, no. 5, pp. 637–648, 2001.
- [15] E. Meins, C. Fernyhough, and J. Harris-Waller, "Is mind-mindedness trait-like or a quality of close relationships? evidence from descriptions of significant others, famous people, and works of art," *Cognition*, vol. 130, no. 3, pp. 417–427, 2014.
- [16] E. Meins, C. Fernyhough, R. Wainwright, M. Das Gupta, E. Fradley, and M. Tuckey, "Maternal mind-mindedness and attachment security as predictors of theory of mind understanding," *Child Development*, vol. 73, no. 6, pp. 1715–1726, 2002.
- [17] M. S. Zeedyk, "Maternal interpretations of infant intentionality: changes over the course of infant development," *British Journal of Developmental Psychology*, vol. 15, no. 4, pp. 477–493, 1997.
- [18] E. Seifritz, F. Esposito, J. G. Neuhoff et al., "Differential sex-independent amygdala response to infant crying and laughing in parents versus nonparents," *Biological Psychiatry*, vol. 54, no. 12, pp. 1367–1375, 2003.
- [19] R. Sprengelmeyer, D. I. Perrett, E. C. Fagan et al., "The cutest little baby face: a hormonal link to sensitivity to cuteness in infant faces," *Psychological Science*, vol. 20, no. 2, pp. 149–154, 2009.
- [20] I. Shinohara, "The measurement of maternal mind-mindedness: its relation to mother-infant interaction in natural settings," *Japanese Journal of Psychology*, vol. 77, no. 3, pp. 244–252, 2006.
- [21] J. R. Brown and J. Dunn, "'You can cry, mum': the social and developmental implications of talk about internal states," *British Journal of Developmental Psychology*, vol. 9, no. 2, pp. 237–256, 1991.
- [22] E. Meins and C. Fernyhough, *Mind-Mindedness Coding Manual*, 2010.
- [23] A. Matsunaga, C. Saitou, and C. Oginio, "The development of young children's understanding of internal states," *Bulletin of the Yamagata University Educational Science*, vol. 11, pp. 371–391, 1996.
- [24] E. Meins, C. Fernyhough, J. Russell, and D. Clark-Carter, "Security of attachment as a predictor of symbolic and mentalising abilities: A Longitudinal Study," *Social Development*, vol. 7, no. 1, pp. 1–24, 1998.
- [25] M. D. Rutherford and M. Przednowek, "Fathers show modifications of infant-directed action similar to that of mothers," *Journal of Experimental Child Psychology*, vol. 111, no. 3, pp. 367–378, 2012.
- [26] B. L. Lundy, "Father- and mother-infant face-to-face interactions: differences in mind-related comments and infant attachment?" *Infant Behavior and Development*, vol. 26, no. 2, pp. 200–212, 2003.
- [27] G. Elias, D. Meadows, and J. D. Bain, "Agreement between mothers and fathers on the identification of infant communicative acts: use of a randomization procedure," *Infancy*, vol. 4, no. 2, pp. 219–234, 2003.



Hindawi

Submit your manuscripts at
<https://www.hindawi.com>

