Empathy-Related Responding in Chinese Toddlers: Factorial Structure and Cognitive Contributors

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The critical role of the second year of life in the development of empathy is well accepted by psychologists. However, the developmental trends of the different components of empathy and the potential factors underlying these components during this critical period remain unclear. Eighty-four Chinese toddlers in the second year of life participated in the present study. Empathy-related responses were observed during three simulated procedures performed by each child's primary caregiver, the experimenter and a baby doll. An exploratory factor analysis was used to identify the different components of empathy. The shared representation of the self and others was measured using the Tasks for the Observation of Self-Concept, self/other awareness was measured with a series of mirror tests and inhibitory control was measured using the Cylinder Inhibitory Control Task. The results showed that the empathy of Chinese toddlers contains three factors: sympathy, personal distress and orientation. Potential cognitive factors contribute to the different components of empathy through both independent and joint effects. © 2016 The Authors Infant and Child Development Published by John Wiley & Sons, Ltd.

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Empathy, the capacity to feel and understand another individual's feelings in relation to oneself, is an important interpersonal function (Decety & Lamm, 2006; Preston & de Waal, 2002). Empathy helps individuals develop affective bonds with others, inhibits aggression and facilitates prosocial behaviours and cooperation (Farrant, Devine, Maybery, & Fletcher, 2013). Thus, empathy plays a critical role in social and emotional development. Researchers (Batson et al., 1997; Decety & Lamm, 2006) have differentiated between two empathic reactions: sympathy and

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personal distress. Sympathy is an other-oriented emotional reaction based on the understanding of another person's emotional state and/or living situation; it motivates individuals to take prosocial actions (Batson et al., 1997). In contrast, personal distress is defined as self-oriented and aversive emotional over-arousal. People who feel personal distress are more likely to escape a situation than to help another person in that situation (Eisenberg, 2011).

The Development of Personal Distress and Sympathy in the Second Year of Life

According to Hoffman's (1987) theoretical model of empathy development, the early years, especially the second year of life, are critical for empathy development. During the first 3 years, children become other-oriented rather than self-oriented when exposed to others' distress, and it seems that this transition takes place in the second year. Zahn-Waxler and colleagues conducted significant longitudinal research that examined a variety of empathy-related responses, and their studies also supported the idea that the second year is the most critical period for empathy development. They found that toddlers at this age are capable of displaying a variety of empathy-related behaviours, and there are significant individual differences in the development of empathy. On the one hand, toddlers may express personal distress in reaction to victims – they may feel sad or even overwhelmed by others' negative emotions. On the other hand, toddlers are capable of sophisticated behaviours that demonstrate sympathy, such as trying to comprehend cognitively what is happening and performing prosocial behaviours (offering verbal comfort and advice, sharing and distracting the person in distress) to alleviate the distress of another person (Zahn-Waxler, Radke-Yarrow, Wagner, & Chapman, 1992). In addition, Moreno, Klute, and Robinson's (2008) longitudinal study also found that individuals form a relatively stable functioning mode of empathy in the second year of life.

   However, there are inconsistencies in the categorization of these empathy-related behaviours into signs of personal distress or sympathy. One of the reasons for this inconsistency may be the manner in which researchers have conceptualized empathy and its subcomponents. When measuring sympathy, Strayer (1993) stated that 'true' sympathy occurred when children understood the cause of others' emotions and responded to others' situations appropriately. To some degree, this process requires perspective-taking; therefore, children do not exhibit sympathy until they are approximately 4 years old. On the other hand, researchers have used relatively loose standards for measuring sympathy (Spinrad & Stifter, 2006; Vaish, Carpenter, & Tomasello, 2009; Zahn-Waxler et al., 1992). Accordingly, many reactions have been considered evidence of sympathy: looks of concern directed at the victim, proximity to the victim and the exploration of the circumstances of distress. Using this method, these researchers found that infants and toddlers that are approximately 1 year old demonstrate various expressions of sympathy in response to the distress of another person. Regarding personal distress, there are also differences in researchers' definitions of related behaviours. For example, Geangu, Benga, and Stahl (2011) focus on the intensity of distress vocalizations, latency to signs of distress and the facial expression patterns characteristic of the 'contagious crying' reactions to the cry of another newborn as indicators of infants' emotional resonance. They found that personal distress decreased rapidly in the first year after birth. However, Strayer and Roberts (2004) took observed anger and aggression into consideration in measuring personal distress, and they found that personal distress is still easily observed in 5-year-old children.

Potential Factors Underlying the Development of Empathy

It is important to better understand the potential factors underlying the development of empathy in the second year of life to increase our understanding about the mechanisms involved in empathy development. Many researchers have emphasized the role of cognitive maturation in the development of empathy (Hoffman, 1987; Kärtner, Keller, & Chaudhary, 2010; Moreno et al., 2008). The key cognitive factors include a shared representation of the self and others, the self/other awareness and inhibitory control. As Decety and Jackson (2004) suggested, only when one allows the self and others to occupy the same psychological space one can feel the feelings of others. One also needs to discriminate oneself from others to avoid becoming overwhelmed by the others' emotions (de Vignemont & Singer, 2006; Decety & Michalska, 2010). Moreover, one has to inhibit one's own feelings and beliefs to understand and react appropriately to the others' feelings and thoughts (de Vignemont & Singer, 2006; Decety & Lamm, 2006).

First, empathy may abound because of a shared representation of the self and others. Though it possesses many different definitions, shared representation fundamentally means that the same representations are stimulated when an individual experiences emotions and when he or she perceives others expressing emotions (Preston & Hofelich, 2012). For this reason, when exposed to the actions or emotions of others, an individual may feel the actions or emotions as if they were his or her own (Carr, Iacoboni, Dubeau, Mazziotta, & Lenzi, 2003; Rizzolatti & Craighero, 2004; Singer et al., 2004; Wicker et al., 2003). From the perspective of developmental psychology, the shared representation depends on how and how much an individual includes others in their self-concept (Decety & Sommerville, 2003). Theoretically, an appropriate shared representation of the self and others may be a precondition for empathy (Decety & Lamm, 2006), whereas a complete overlap between representations of the self and others would induce personal distress (Batson et al., 1997). However, little research has examined the role of shared representation in empathy in young children, perhaps because this concept is relatively abstract and obscure. As far as we know, there are no operable methods for measuring shared representation of the self and others, especially for children who have limited introspection and language capabilities.

Another cognitive factor that affects empathy development is self/other awareness. One has to acknowledge the difference between the self and others to obtain a sense of self (Preston & Hofelich, 2012), which is crucial to successfully navigating shared representations of the self and others. Self/other awareness develops rapidly throughout the first three years of life (Hoffman, 1987). According to previous studies of infants (Geangu et al., 2011; Roth-Hanania, 2002) and toddlers (Bischof- Köhler, 1991; Zahn-Waxler et al., 1992), self/other awareness, which is usually measured using a mirror task or a photo task, is a good predictor of empathy. However, to date, it has been unclear how self/other awareness affects the development of empathy – does it facilitate empathy by suppressing personal distress or by promoting sympathy?

The third cognitive factor, inhibitory control, or the ability to inhibit predominant self-centred reactions, is an additional process that is necessary for successful empathy (Decety & Lamm, 2006). Among adults (Batson et al., 1997) and children (Young, Fox, & Zahn-Waxler, 1999; Valiente et al., 2004), individuals who can regulate their emotions are more likely to experience sympathy and to interact with others in morally desirable ways. In contrast, people who experience their emotions intensely, especially negative emotions, are prone to personal distress (Eisenberg, Hofer, & Vaughan, 2007). Although previous studies have shown that

inhibitory control emerges in a rudimentary form before the end of the first year (Cuevas, Swingler, Bell, Marcovitch, & Calkins, 2012; Sheese, Rothbart, Posner, White, & Fraundorf, 2008), to the best of our knowledge, the role of inhibitory control in the emergence and development of empathy in young children is unclear.

In addition, one point that has to be addressed is the role of age in the relationship between these cognitive factors and empathy. The developmental trajectories for the three cognitive factors are all very dynamic processes. For example, the development of shared representation between self and other starts early in infancy and forms a quite sophisticated pattern in early childhood (Preston & Hofelich, 2012). Similarly, although children have an implicit sense of the self and other in the first year of life (Geangu et al., 2011), they typically pass the explicit task of self/other awareness, the test of mirror self-recognition, when they are about 18 months old (Kristen-Antonow, Sodian, Perst, & Licata, 2015). Moreover, before children can pass the classic Day/Night task when they are 4 years old (Vendetti, Kamawar, Podjarny, & Astle, 2015), their inhibitory control emerges in a rudimentary form before the end of the first year (Cuevas et al., 2012; Sheese et al., 2008). Because these cognitive factors develop rapidly in individuals' early years (Cuevas et al., 2012; Decety & Lamm, 2006; Hoffman, 1987), the associations with empathy could potentially change with age.

Furthermore, beyond playing independent roles in empathy development, the three cognitive factors may also have joint effects on empathy development. For example, Todd, Hanko, Galinsky, and Mussweiler (2011) found that excessive representation without self/other awareness undermines the ability to distinguish one's own perspective from the perspectives of others. Shared representation is powerful in the very early years of life, while toddlers' self/other awareness skills are too brittle to effectively overcome the shared representation, which consequently causes personal distress (Decety & Sommerville, 2003; Decety & Lamm, 2006; Preston & de Waal, 2002). Orienting studies with infants have also found that even though personal distress can be reduced by infants' distracting or re-orienting attention, distress returns almost to baseline levels when the distraction stimulus is removed, as if there were an internal 'distress keeper' (Harman, 1994). However, the pathways that connect the cognitive factors with each other in predicting empathy development are not clear and need careful attention.

In summary, although they have been subjected to much theoretical reflection, the roles of cognitive factors in the development of empathy have rarely, to our knowledge, been studied empirically. To determine how cognitive abilities affect the emergence and development of empathy, we will investigate the roles that the three cognitive factors play in developing empathy during the second year of life.

The Present Study

The present study had three goals. The first goal was to classify the different components of empathy of Chinese toddlers in about the second year of life. We attempted to disentangle the different aspects of empathy development. The second goal was to explore the roles played by the potential cognitive factors in empathy development. Specifically, this study explored the roles of shared representation, self/other awareness and inhibitory control in the development of the different components of empathy. The third goal was to investigate the joint effects

of the three cognitive factors in predicting empathy development, as well as the potential role of age in moderating the relationship between the cognitive factors and empathy.

METHODS

Participants

Eighty-nine toddlers and their primary caregivers (87 mothers, 1 grandmother and 1 nurse) were recruited through flyers posted at a large childhood development centre in Beijing, China. Five toddlers were excluded from the sample. Two of these toddlers became distressed and fussy after beginning the experiment, and the other three toddlers did not complete the procedure. The final sample consisted of 84 toddlers between the ages of 10 and 26 months. All of the participants came from families of middle socioeconomic status. Family income ranged from ¥30 000 to greater than ¥300 000 ($M = 5.43$, $SD = 1.46$; 5 = ¥70–100 000, 6 = ¥100–200 000). The toddlers were rewarded with a small toy for their participation, and the parents received a brief report of their children's development and a disc with a video recording of the experimental procedure.

Measures

Empathy

In the present study, empathy-related responses were assessed using three simulated distress procedures. The scripts and guidelines for the procedures were partially based on the procedures used in previous studies of empathy in young children (Zahn-Waxler et al., 1992). The primary caregiver, an unfamiliar adult and a baby doll served as the 'victims' in an effort to make the simulations as realistic as possible. The three simulations were presented to each participant in the same order.

During the first simulation, the mother and child played with the provided toys. After 5 min, the mother picked up a cup and began to drink water. Suddenly, the mother 'choked' on the water. For the next 60 s, the mother displayed facial and vocal expressions of distress and coughed intensely. She said, 'I am choking; I feel terrible!' three times, after approximately 20, 40 and 60 s had passed.

In the second simulation, a female experimenter and the child played with the same toys for another 5 min. Then, as the experimenter began to play with a small car, one of its wheels 'accidentally' fell off. When repairing the car with a small hammer, the experimenter pretended that the hammer hit her finger. For one minute, the experimenter displayed facial and vocal expressions of distress and said, 'I am hurt!' three times at 20-s intervals.

The third simulation took place with the toddler and a baby doll. The child was playing with some toys on a table when the experimenter remotely triggered the sound of a cry coming from a player placed in the baby doll. If the child did not orient himself/herself to the sound of the cry, the experimenter asked him/her, 'Do you hear somebody crying?' Next, the experimenter took the crying baby doll out of a box and put it in front of the toddler. At that time, the baby doll cried again for approximately 30 s; the toddlers' responses were recorded during this time and for the next 30 s.

The toddlers' responses to the distressed mother, the experimenter and the crying baby doll were videotaped using two cameras placed in opposite corners

of the testing room. One camera was positioned to capture the interactions, and the other camera was focused on the toddler's face.

Coding and reliability of empathy

The final coding system consisted of 13 items. This coding system was primarily based on Robinson and Zahn-Waxler's (2005) coding of empathy behaviours , which originally included 13 items, 10 of which were used in the present study. Three items of Robinson and Zahn-Waxler's coding system were not analysed because they did not refer to a specific behaviour or were suitable for older children. The other three items were adopted from two recent studies; specifically, Geangu et al. (2011) suggested that fear and imitation also reflected certain aspects of empathy, and Strayer and Roberts (2004) suggested that very young children might deny and reject the victim's distress. Therefore, the final coding system in the present study was thought to cover the full range of behaviours that may be observed in toddlers' responses to displays of distress.

All of the behaviours performed in the three scenarios were coded by the first author. Inter-rater coding was performed on 24% of the videotaped scenarios (20 participants). The second coder was a psychology major who was trained in using the coding system and was blind to other data. Inter-rater reliability was established using Cohen's *kappa*. The levels of agreement between raters ranged according to category, and the *kappas* are listed following each code description below.

1 *Hypothesis testing* (0.81). Child is trying to cognitively comprehend what has happened, including exploring or attempting to comprehend the victim's distress both verbally and non-verbally. 1 = none, 2 = non-verbal gestures (e.g. child looks back and forth from victim's face to hurt part or to other adults), 3 = vocalizing or simple verbal labelling (e.g. 'What happened? Why?'), 4 = combining attempts to understand both verbally and non-verbally, 5 = repeated and/or relatively sophisticated attempts to understand the distress.

2 *Proximity to victim* (0.91). Child is trying to approach the victim. 1 = avoids victim, turns torso away; 2 = withdraws from victim, backs away, recoils, but does not turn torso away; 3 = stationary, child neither approaches nor withdraws; 4 = approaches victim, child leans towards or reach out hand to victim; 5 = gets very close to or touches the victim, pats or hugs the victim.

3 *Prosocial acts* (0.76). Presence versus absence of efforts to help or comfort victim (e.g. comforts or pats victim). 1 = does not occur, 2 = briefly assists (one pat or verbalization); 3 = moderate assistance (child repeatedly verbalizes prosocially, may engage in assistance for 3–5 s); 4 = prolonged assistance (takes more than 5 s).

4 *Aggression* (0.87). Child is hostile, judgmental, or blaming towards victim, could be physically or verbally. 1 = does not occur; 2 = child hits nearby object, throws it on floor; 3 = child is judgmental or hostile (e.g. 'You shouldn't have done that'), and child may hit the victim.

5 *Positive emotion* (0.82). Level of positive affect during victim's distress, including toddlers' smiling, positive vocal tone, squealing and laughing. 1 = does not occur; 2 = tenuous smile; 3 = broad smile, laughs briefly; 4 = broad smile, lusty laugh.

6 *Empathic concern* (0.85). Expressions of apparent concern for the victim, including facial, vocal, or gestural–postural expressions. 1 = absent, 2 = slight (fleeting or slight change of expression that includes brow furrow),

    3 = moderate (sustained sobering of expression that includes brow furrow), 4 = substantial concern (sustained sadness expressed in cooing or sympathetic vocal tones or sympathy face in which eyebrows are drawn down and brow drawn up over the nose).

7 *Distress* (0.87). Expressions of distress that include whimpering or crying. 1 = none, 2 = fear present for several seconds (eyes wide and mouth open), 3 = grimacing, teeth bared, 4 = whimpering and/or whining, 5 = full-blown crying.

8 *Anger* (0.91). Child displays angry facial expression or behaviour. 1 = does not occur; 2 = child has tight lips, frowning; 3 = child pouts and cries, may also bang or throw a toy.

9 *Ambivalence* (0.83). Alternation of affect expressions. 1 = none, 2 = a single alternation (i.e., base affect, new affect, return to base affect), 3 = two alternations, 4 = three or more alternations (extreme ambivalence).

10 *Fear* (0.79). Child is scared and avoids the victim. 1 = does not occur; 2 = fear present for several seconds (e.g. eyes wide, mouth open and/or wariness); 3 = facial grimace with eyes wide, teeth barred; 5 = full-blown crying.

11 *Arousal* (0.83). Score the peak moment of arousal. 1 = low arousal (child may ignore stimulus; play freely, occasionally glances at victim; little or no body tension at any time), 2 = moderate arousal (play is disrupted, alerting to stimulus; actions may be slowed down), 3 = high arousal (prolonged freezing and/or crying, child reaches out hands to mom or examiner with great tension).

12 *Imitation* (0.83). Child imitates sounds and/or gestures of victim (e.g. rubbing own finger or knee, silently mouthing 'ow' as the victim says 'ow'). 1 = none, 2 = once, 3 = twice, 4 = three or more times.

13 *Deny and refuse* (0.94). Child does not accept the fact that the victim is hurt. 1 = does not occur; 2 = child does not believe and say no ('you are lying' and 'you are not hurt.'); 3 = child speaks or cries strongly.

Shared representation of the self and others

    The Tasks for the Observation of Self-Concept (TOSC), developed by Pipp, Fischer, and Jennings (1987), demonstrates how and how much the toddlers include others in their self-concept and thus measures their ability to represent the relationship between themselves and others. The TOSC consists of two different levels: the baby's tasks and the mother's tasks. Each level consists of three scenes, and in the present study, all the six trials lasted for approximately 5 min.

    During the baby's behaviour task, the experimenter presented the child with a puppet, a corn bar and a baby bottle. Then, the experimenter acted out three simple behaviours (feeding, drinking and sleeping) with the baby puppet. The experimenter also gave verbal explanations. For example, 'The baby is hungry (thirsty, tired); let's feed (give a drink to, cuddle) the baby'. Next, the toddler was asked to imitate the three behaviours using the baby puppet.

    Similar to the baby's task, the 'mother's behavior task' included the addition of a mother puppet. Similar episodes were presented to the participant. However, this time, the mother performed the various activities with the baby. For example, the experimenter said, 'The baby is hungry, his/her mommy is going to feed him/her a corn bar'. After the demonstration, the child was asked to imitate the behaviours ('Can you make the mommy give the baby a corn bar?'). This task required the child to represent the triadic relationships among the baby puppet,

the mother puppet and him or herself. Every correct imitation was given a score of 1, and the total TOSC scores ranged from 0 to 6.

Self/other awareness

A gradual sequence of five mirror tasks, developed by Bertenthal and Fischer (1978), was used to observe the toddlers' behaviours related to their awareness of themselves and others. The toddlers were placed in front of a full-length mirror (approximately 40×60 cm), and the toddlers' responses to various stimuli viewed in the mirror were scored.

1 Tactual exploration task. The toddler passed this task if he or she attempted to touch his or her mirror image.
2 Hat task. The toddler wore a specially designed hat with a toy hanging on it. The toddler passed this task if he or she found the hat above his or her head by looking into the mirror.
3 Toy task. The investigator dangled a toy on a string behind the toddler who was seated in front of the mirror and asked the toddler to find it. The toddler passed the task if he or she turned around and found the toy after seeing its reflection.
4 Rouge task. The toddler passed if he or she looked in the mirror and then touched his or her forehead.
5 Name task. The mother pointed to the toddler's reflection in the mirror and asked, 'Who's that?' The toddler passed if he or she stated his or her own name or said 'me'.

The order of the tasks progressed from the most difficult to the easiest. If the toddler completed the most difficult task, the procedure stopped and he or she did not need to attempt the other tasks. If the toddler failed to complete the most difficult task, however, he or she attempted progressively easier tasks until a task was completed. Toddlers who completed the most difficult task were scored 5, while the toddlers who did not complete any of the tasks, including the easiest task, were scored 0. The range of the scores for the mirror tasks was 0 to 5.

Inhibitory control

The research on inhibitory control in very young children is sparse, and there are no well-accepted paradigms. The Cylinder Inhibitory Control Task (CICT; MacLean et al., 2014), which was originally designed to measure animals' ability to refrain from reaching directly at a desirable object through a transparent barrier, was used to measure the toddlers' inhibitory control.

The complete task consisted of two warm-up trials and eight experimental trials. In the warm up condition, a rubber toy was placed on a stationing block beside an apparatus (an opaque, plastic cylinder, length = 30 cm, diameter = 9 cm). As the participant was looking at the experimenter, the toy was placed inside the apparatus. The side from which the apparatus was baited was consistent within participants but counterbalanced across participants. Once the toy was positioned, the participant was asked to approach and retrieve the toy. After the toddler retrieved the toy and gave it to the experimenter, the next trial began. On every trial the experimenter coded whether the participant's first attempt to retrieve the item was through the front of the apparatus (incorrect) or from the side (correct). Participants were required to correctly retrieve the toy on the first attempt in both the two trials before advancing to the test procedure. In the present study, all participants passed the warm-up trials.

The test procedure was identical to the warm-up trials except that the apparatus used was a transparent cylinder. Eight trials with eight different toys were conducted, and the order of the toys was random. As in the warm-up trials, the experimenter coded whether participants first attempted to retrieve the item through the front (incorrect) or side (correct) of the apparatus. Every correct approach was given a score of 1, and thus, the range of the scores for the CICT was 0 to 8.

Procedure

After interacting with their mothers for 6 to 8 min, the participants experienced the first simulated distress procedure. Next, the experimenter played with the toddlers for an additional 5 min until the second simulated distress procedure, which was followed by a 5-min break so that the participants could relax. Next, the toddlers participated in the TOSC, the mirror task and the CICT. After another 5 min of rest, the participants experienced the third simulated distress procedure. The participants went through these six tasks in the same order. For each child, one caregiver was permitted to accompany the child into the playroom. During most tasks (besides the mirror tasks), some toddlers were seated on the laps of the caregivers; others were seated in a separate chair with their caregivers sitting behind them. The caregivers were also instructed not to speak or react unless being asked a question or prompted.

RESULTS

Three sets of analyses were conducted in the present study. The first set of analyses includes an exploratory factor analysis (EFA) to reveal the dimensions underlying empathy. In the second set of analyses, we investigated the contributions of the three cognitive factors to empathy by conducting a series of correlation and regression analyses. The third analysis examined the mediated effects of the cognitive factors on components of empathy.

Components of Empathy in the Second Year of Life

An EFA was used to identify the structure and the dimensions of empathy. The scores for all of the simulated distress situations were averaged, representing the participants' general level of empathy, and the 13 mean empathy scores were standardized. A *Principal Components Analysis* with an *Oblimin rotation* was performed.

Various indicators were used to determine the number of factors to retain and yielded different results. Kaiser's eigenvalue-greater-than-one rule indicated five factors, the scree test suggested four or five factors and the Parallel analysis (Horn, 1965) suggested three to five factors. Our criterion for tenable factors was at least two variables with loadings greater than or equal to 0.30 (Wegener & Fabrigar, 2000), and only the three-factor solution met this criterion. Both the four and five-factor solutions contained one or two factors which had only two variables with a loading above 0.30. Consequently, we chose the three-factor solution. Subscale loadings from the pattern matrices and the cumulative percentages for the remaining factor solutions are presented in Table 1.

In the three-factor solution, the first factor contained four items, *Hypothesis testing*, *Empathic concern*, *Proximity to victim* and *Prosocial acts*, which accounted for approximately 23.72% of the variance. The second factor in the three-factor

Table 1. Structure matrix of empathy in Chinese toddlers

Behaviour items	Five factor					Four factor				Three factor		
	1	2	3	4	5	1	2	3	4	1	2	3
Hypothesis testing	**.79**	−.04	−.19	.06	.19	**.78**	−.10	.15	−.11	**.78**	−.07	−.20
Empathic concern	**.79**	.06	−.16	−.15	−.07	**.78**	.03	−.18	−.11	**.78**	−.16	.14
Approaching	**.75**	−.14	.13	.08	−.13	**.76**	−.07	−.02	.05	**.74**	−.07	−2.97
Prosocial acts	**.70**	−.07	−.06	.05	−.11	**.71**	−.04	−.02	−.10	**.71**	−.11	−.04
Distress	.07	**.87**	.13	−.08	−.17	.06	**.85**	−.17	.14	−.02	**.80**	−.08
Arousal	−.06	**.85**	.17	−.05	.08	−.08	**.78**	−.01	.26	.13	**.79**	−.27
Fear	−.43	**.64**	.09	.07	−.02	−.43	**.63**	.05	.10	−.13	**.62**	.13
Deny and Reject	−.20	.12	**.86**	−.03	−.00	.00	−.14	**.82**	−.09	−.37	**.60**	−.03
Anger	−.08	.19	**.85**	−.01	.05	.08	.29	**.71**	−.31	−.17	**.57**	.09
Ambivalence	.05	.10	−.06	**.91**	−.08	−.08	−.10	**.52**	.26	.03	−.13	**.81**
Positive emotion	−.02	−.22	.02	**.79**	.30	−.11	−.38	**.48**	.31	.17	.11	**.59**
Imitation	−.04	.13	−.04	.07	**.84**	−.07	.23	.03	**.80**	−.16	−.14	**.58**
Aggression	−.08	−.21	.08	.06	**.76**	−.11	.18	−.02	**.78**	−.09	.08	**.57**
Cumulative %	70.88%					62.03%				52.30%		

Note: Factor loadings greater than .30 are in bold.

solution contained five items, *Distress, Arousal, Fear, Deny and refuse* and *Anger*, and this factor accounted for 16.47% of the variance. According to the previous studies, the above two factors can be named *sympathy* and *personal distress* (Hoffman, 1987; Eisenberg, 2011). The third factor, which accounted for 12.11% of the variance, contained four items, *Ambivalence, Positive emotion, Imitation* and *Aggression*. Although previous research did not find this factor, some research has suggested that these items may reflect toddlers' orientation and attendance to others' distress (Hoffman, 1987; Roth-Hanania, Davidov, & Zahn-Waxler, 2011). Therefore, this empathy factor in the present research was labelled as *orientation*. The alphas for the three factors were 0.76, 0.68 and 0.52, respectively.

The Contributions of the Cognitive Factors to Empathy

The descriptive and overall correlation analyses for age, components of empathy and the three cognitive factors are presented in Table 2. As the results indicate, while sympathy and the cognitive factors were positively related to age, there

Table 2. Descriptive and correlative statistics for empathy and the three cognitive factors

	M	SD	1	2	3	4	5	6
1 Age	20.08	4.34						
2 Shared representation	2.85	1.53	.29**					
3 Self/other awareness	3.43	1.25	.49**	.40**				
4 Inhibitory control	4.41	2.02	.23*	.21	.28**			
5 Sympathy	6.90	1.21	.22*	.29**	.21	.42**		
6 Personal distress	5.18	.96	−.03	−.15	−.29**	−.01	−.23*	
7 Orientation	5.22	.96	−.01	.05	.07	−.10	−.06	−.10

Note.
*p ≤ .05; **p ≤ .01.

were no significant relations between age and the other two components of empathy, namely personal distress and orientation. These results indicate that in the second year of life, sympathy and the three cognitive factors increase significantly with age. In addition, only sympathy and personal distress correlated with the three cognitive factors; orientation did not correlate with any of these cognitive factors. To investigate the pattern in which the cognitive factors contributed to the development of empathy and how the pattern changed with age during the second year of life, hierarchical regressions were carried out with sympathy and personal distress as dependent variables. In both regressions, age was entered at Step 1. Next, the three variables of the cognitive factors were entered at Step 2 to investigate their independent contributions after controlling age. Finally, as we wanted to focus on how the predictive value of the cognitive variables was moderated by age, we examined the interaction effects between age and the cognitive factors by entering three interactions between the cognitive factors and age at Step 3.

As Table 3 showed, in the first hierarchical regression for personal distress, the model with age was not significant, $p = .81$. The second model was significant, $F(4, 79) = 2.80$, $p = .03$, $R^2 = .12$, $\triangle R^2 = .12$; among the three cognitive factors, only self/other awareness negatively predicted the personal distress. The third model was also significant, $F(7, 76) = 3.78$, $p = .001$, $R^2 = .26$, $\triangle R^2 = .13$. The interaction effect between age and shared representation contributed significantly to the variance of the personal distress. *Simple-slopes* analysis showed that, in the earlier half of the second year of life, shared representation had a positive association with the toddlers' personal distress, $b = .19$, $t(37) = 2.16$, $p = .02$; while in the latter half of this period, children with higher shared representation exhibited lower personal distress, $b = -.19$, $t(43) = -2.48$, $p = .03$. The interaction was also followed up further using region-of-significance analysis (Preacher, Curran, & Bauer, 2006; $\alpha = .05$, two-tailed; Figure 1).

Table 3 also showed that, in the second hierarchical regression for sympathy, the model with age was significant, $F(1, 82) = 4.19$, $p = .04$, $R^2 = .049$, $\triangle R^2 = .18$, which means sympathy increased with month in the second year of life. The model with cognitive factors was also significant, $F(4, 79) = 5.76$, $p < .001$, $R^2 = .23$, $\triangle R^2 = .19$, as inhibitory control significantly predicted the toddlers' sympathy. In the third step,

Table 3. Hierarchical regressions predicting personal distress and sympathy

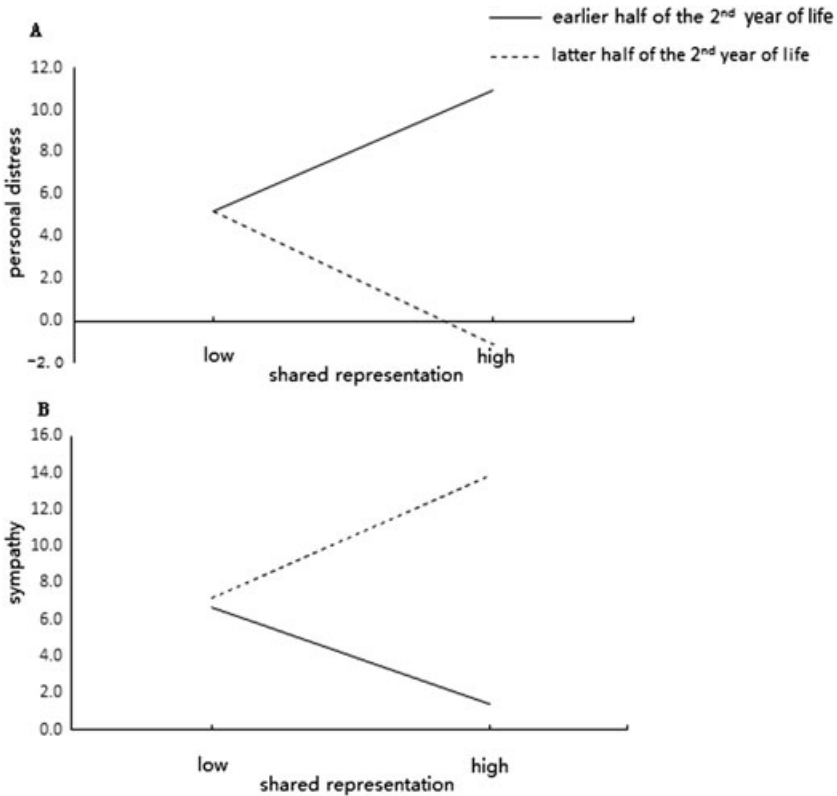|	Personal distress			Sympathy		
	β	T	p	β	t	p
Step 1: Age	−.03	−.24	.81	.22	2.05	.04
Step 2: Age	.17	1.36	.18	.09	.74	.46
Shared representation	−.08	−.73	.47	.19	1.73	.09
Self/other awareness	−.37	−2.91	.01	−.01	−.07	.95
Inhibitory control	.06	.57	.57	.37	3.51	.00
Step 3: Age	.16	1.31	.19	.09	.82	.42
Shared representation	.02	.21	.84	.08	.69	.49
Self/other awareness	−.39	−3.08	.00	.06	.51	.61
Inhibitory control	.06	.54	.59	.34	3.40	.00
Age × shared representation	−.34	−2.83	.01	.28	2.46	.02
Age × self/other awareness	−.10	−.80	.42	−.08	−.65	.52
Age × inhibitory control	.03	.28	.78	.18	1.57	.12

Figure 1. (A) Age as a moderator of the association between shared representation and personal distress. (B) Age as a moderator of the association between shared representation and sympathy.

the model was significant too, $F(7, 76) = 5.61$, $p < .001$, $R^2 = .34$, $\triangle R^2 = .28$. The analysis showed that the interaction effect between age and shared representation positively predicted sympathy. A *simple-slopes* analysis was used to examine this interaction effect between age and shared representation. Figure 1 shows that, in the earlier half of the second year of life, shared representation was negatively associated with the toddlers' sympathy, $b = -.16$, $t(37) = 1.80$, $p = .08$; while in the latter half of the second year of life, shared representation positively contributed to toddlers' sympathy. The interaction was also followed up further using region-of-significance analysis (Preacher et al., 2006; $\alpha = .05$, two-tailed, Figure 1).

The above analyses showed that shared representation shifted its role in the development of empathy. In the earlier half of the second year of life, it was positively associated with personal distress but negatively associated with sympathy; while in the latter half of this time, it was positively related to sympathy but negatively related to personal distress.

Mediated Effects of the Cognitive Factors on Empathy

We further examined whether the three cognitive factors predict empathy through mediated effects. We found that self/other awareness met the prerequisites for
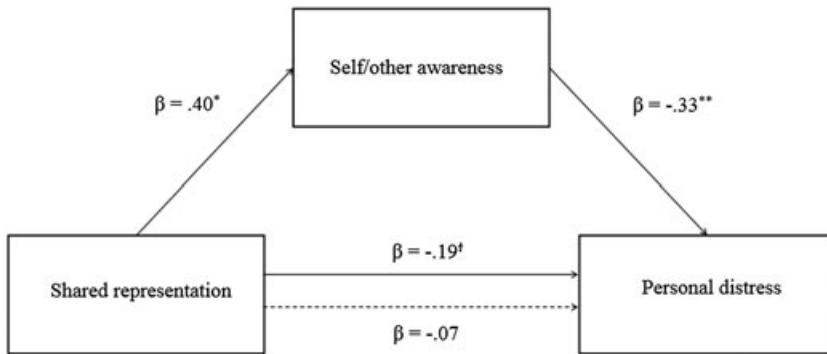
Figure 2. Mediator effect of self/other awareness on the relation between shared representation and personal distress. Initial Betas and the Beta weight following inclusion of the mediator variable are shown for shared representation. $p < .10$, $^{*}p < .05$, $^{**}p < .01$ (two-tailed).

mediation to be examined (Baron & Kenny, 1986). Self/other awareness was correlated with both the predictor (shared representation, $\beta = .40$, $SE = .08$, $p < .01$) and the criterion variable (personal distress, $\beta = -.33$, $SE = .09$, $p < .01$). Moreover, the predictor and criterion variable were correlated as required for a mediation analysis. To test the effects, a hierarchical regression analysis was performed. In the first step, we regressed personal distress on shared representation, and the model was marginally significant, $F(1, 82) = 3.18$, $p = .07$, as shared representation negatively predicted personal distress, $\beta = -.19$, $p = .07$. In the second step, we entered self/other awareness. The model was also significant, $F(2, 81) = 5.01$, $p < .01$, but the direct effect of shared representation decreased to non-significant, $\beta = -.07$, $p = .52$. A *Sobel* test (Sobel, 1982; Soper, 2015) showed a significant indirect effect, $Z = 1.72$, $p < .001$. Moreover, a bootstrapping procedure (Preacher & Hayes, 2008) simultaneously tested the mediator effect with $n = 1000$ resamples. The results showed a significant indirect effect of shared representation on personal distress via self/other awareness (see Figure 2), 95% bootstrap confidence interval (CI) = [.02, .30].

DISCUSSION

The present study examined the development of empathy in the second year of life, which is the most critical period for empathy development. The results suggested that empathy's three components show different developmental trends. While sympathy increases significantly, personal distress and orientation do not change obviously. The present study also investigated the roles of three cognitive factors – shared representation of self and others, self/other awareness and inhibitory control – in the development of empathy. The result showed that the three cognitive factors play different roles in the development of empathy's various components, and their roles also change with age during the second year of life. Besides, these cognitive factors predict empathy via mediated effects. The present study broadens our knowledge and understanding of empathy by examining the following two aspects.

Components of Empathy in Chinese Toddlers During the Second Year of Life

The results of the EFA in the present study indicated that toddlers between 1 and 2 years old, at least in China, typically respond to the distress of others along

behavioural dimensions that can be labelled as sympathy, personal distress and orientation. The result suggests both cultural consistency and potential cultural differences.

On the one hand, when exposed to others' distress, Chinese toddlers typically experience sympathy and personal distress. When exposed to the distress of others, a Chinese toddler may react with sympathy: the toddlers studied were curious and interested in other's sadness; they cared about and conducted some hypothesizing concerning others' distress; they approached the distressed persons, expressed concern for the victims by vocalizations and looking; and they also performed prosocial behaviours, such as sharing, comforting and helping. When exposed to the distress of others, a toddler may also experience the feeling of personal distress and show sadness, fear and arousal towards the victims. Chinese toddlers' above behaviours of sympathy and personal distress are in accordance with their western peers (Geangu et al., 2011; Hoffman, 1987; Knafo, Zahn-Waxler, Van Hulle, Robinson, & Rhee, 2008; Spinrad & Stifter, 2006; Vaish et al., 2009; Zahn-Waxler et al., 1992).

On the other hand, the present study also suggested cultural difference concerning toddlers' empathy. The EFA in the present study revealed a third factor, orientation, of Chinese toddlers' empathy. In the present study, orientation contained behaviours such as ambivalence, positive emotion, imitation and aggression, and this factor may reflect a preliminary attendance to others' distress (Hoffman, 1987; Roth-Hanania et al., 2011). Research in Western cultures has not identified this factor. However, according to the previous research, these behaviours may reflect the developmental pattern in the transition of empathy from global empathy to egocentric empathy, when individuals are 12 months old, which is much earlier than the age of children in the present study (18 months). These cultural difference may stem from the fact that individuals from different cultures have different relationships between the self and other (Han et al., 2012), which may in turn play differential roles in the prediction of empathy (Kärtner et al., 2010). Because individuals in Chinese culture tend to incorporate others into themselves, they consequently may have different self/other awareness, self–other shared representation and even inhibitory control, which may all contribute to the difference in the Chinese toddlers' empathy.

How Empathy Develops in the Second Year of Life

We further investigated the mechanisms that accounted for the developments of empathy, mainly sympathy and personal distress. Understanding how cognitive factors affect the development of empathy provides a rich context for assessing key theoretical issues about empathy. As the present study showed, during the second year of life, three cognitive factors – shared representation, self/other awareness and inhibitory control – predicted the development of empathy's different aspects (personal distress and sympathy) in distinct ways, both through independent and joint ways.

On the one hand, the three cognitive factors play independent roles in the development of empathy. First, self/other awareness was negatively associated with personal distress. This fact may explain why young infants are easily overwhelmed by others' emotions. Only when toddlers develop the ability to discriminate themselves from others, they develop empathy 'to' the other instead of 'with' the other (Geangu et al., 2011; Hoffman, 1987). Second, inhibitory control functions as a facilitator to sympathy, the advanced forms of empathy. This result

is reasonable because to orient towards others but not his or her own feelings, an individual should promote a focus on others rather than on the self (Eisenberg, 2011). Considering the limited inhibitory control in young infants and toddler, it is not strange that they are too preoccupied with their own frame of reference to cognitively empathize with others (Hoffman, 1987). That is may be why toddlers cannot react appropriately to others' distress, even when they have developed the ability to discriminate themselves from others. For example, when seeing his/her mother hurt her leg, a toddler may rub his/her own leg in response (Zahn-Waxler et al., 1992). Finally, shared representation is a fundamental factor in the development of both personal distress and sympathy. Our finding is in line with previous research that has shown that the shared representation of self and others not only promotes personal distress and resonant emotions (Stotland, 1969) but also facilitates perspective-taking (Adam, Shirako, & Maddux, 2010; Elfenbein & Ambady, 2002). Shared representation may function as a bridge between oneself and others and is linked to the perception-action model, which was promoted by Preston and de Waal (2002) to explain how an individual feels the emotions of others as if they were his or her own. In addition, because behaviours based on the perception-action mechanism can be observed in both human newborns (Harrison, Morgan, & Critchley, 2010) and animals (Bartal, Decety, & Mason, 2011), it is widely accepted that shared representation may emerge very early, both ontologically and evolutionarily (Preston & de Waal, 2002).

On the other hand, our research also found that the way in which the cognitive factors relate to empathy is complex. First, for both personal distress and sympathy, there are significant interactive effects between shared representation and age. Specifically, in the earlier half of the second year of life, shared representation was positively associated with personal distress and negatively associated with sympathy, while in the latter half of the second year of life, the role of shared representation reversed and became negatively associated with personal distress and positively associated with sympathy. Secondly, we also found patterns of mediation among the cognitive factors, as we found that self/other awareness mediated the relation between shared representation and personal distress. It seems that it is through the toddlers' developing ability to discriminate themselves from others that they develop empathy 'to' the other instead of 'with' the other. It is also possible that the role shift of shared representation with age is related to this mediation effect among the cognitive factors. However, the present research did not give direct support to this hypothesis, and further study is needed.

In sum, human survival relies on the presence of others and social interactions with others, in which empathy plays a crucial role. Empathy requires not only identifying with others but also distinguishing oneself from others. According to the results of the present study, both the independent and joint effects of shared representation, self/other awareness and inhibitory control build one's ability to balance a sense of self and others, promote the development of empathy from empathy 'with others' to 'to others' (Preston & de Waal, 2002), turn an automatic reaction into an intentional reaction (Valiente et al., 2004) and progress from a self-oriented perspective to an other-oriented perspective (Hoffman, 1987).

Values, Limitations and Future Directions

This study may represent an important attempt to integrate the potential factors of empathy using a developmental perspective, and we obtained important results that illuminate the nature of human empathy to some degree. The findings of

the present study also suggest potential practical importance, for they offer possible strategies to enhance sympathy and inhibit personal distress. These results may be valuable for teaching empathy to young children.

Despite the theoretical and practical significance, there remain some limitations in the present study. First, although the present study suggested some cultural difference in empathy and potential factors, this research did not compare the empathic related behaviours between Chinese and Western cultures. Future studies may further use cross-cultural comparison designed to confirm the roles of the potential factors in empathy. Moreover, the sample size in the present study is relatively modest. Finally, because most of the participants in this study were from middle-class urban families, the results may not be generalizable to other socioeconomic samples. A larger and more representative sample is needed in future studies.

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