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Brief article

Windows to the soul: Children and adults see the eyes as the location of the self

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ABSTRACT

Where are we? In three experiments, we explore preschoolers' and adults' intuitions about the location of the self using a novel method that asks when an object is closet to a person. Children and adults judge objects near a person's eyes to be closer to her than objects near other parts of her body. This holds even when considering an alien character whose eyes are located on its chest. Objects located near the eyes but out of sight are also judged to be close, suggesting that participants are not using what a person can see as a proxy for what is close to her. These findings suggest that children and adults intuitively think of the self as occupying a precise location within the body, at or near the eyes.

1. Introduction

> *The 'Self'...when carefully examined, is found to consist mainly of. . .peculiar motions in the head or between the head and throat. (William James, 1890)*

Where is the self? Some Western adults would say that it is in the brain—either because they believe the self is the brain, or because they think of people as immaterial spirits that are somehow connected to the brain (see Bloom, 2004). Others might say the self resides in the heart, as Aristotle believed, or that it infuses the entire body, as argued by the Arab philosopher Ibn al-Nafis (Fancy, 2006). Buddhists espouse the concept of *anatta*, or 'not-self', which suggests that the question has no answer.

Such diversity might suggest that there is no common human experience of the location of the self. There is evidence, though, that at least some populations of adults converge on an answer when asked directly. Bertossa, Besa, Ferrari, and Ferri (2008) probed participants' phenomenological experience of the location of the self using a guided interview. The majority located themselves at a precise point inside the head, midway behind the eyes. In another study (Limanowski & Hecht, 2011), participants marked the location of their 'self' on an outline of the human body. Their responses fell into two clusters: a larger cluster located within the head, and a smaller cluster located within the chest. When participants were asked to mark a 'self' on a rectangle with its brain, heart, eyes, and ears in varying locations, they tended to mark the brain and eyes, but not the heart or ears.

Do these findings reflect an intuitive sense that the self is located in a particular spot in the body? Perhaps not. The adults in these studies were likely aware of the contemporary idea that the brain is responsible for producing mental states, and this might explain their responses. Consistent with a cultural account, even subjects blind from birth tended to locate the self in the head, despite their different everyday phenomenal experiences (Bertossa et al., 2008).

Young children have had less opportunity to acquire religious and scientific ideas about the self and have a limited understanding of the brain as the producer of mental life (Choe, Keil, & Bloom, 2011; Flavell, Green, & Flavell, 1995; Gottfried, Gelman, & Schultz, 1999; Johnson & Well-

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man, 1982; Lillard, 1996; see Bloom, 2004 for review). Where do they think that the self is? In the studies below, we explore the intuitions of preschool-aged children and adults. To access people's intuitive sense of the self, we developed an implicit method that asks when an object is closest to a person. If children and adults consider the self to be equally distributed across the body, or if they think the self has no spatial location, then they should judge that an object is equally close to a person regardless of where on her body it is positioned. However, if people have an intuition that the self is located in a particular part of the body, then they should judge that objects nearer to that part of the body are closest to the person.

2. Experiment 1

2.1. Method

2.1.1. Participants

Fifty 4- and 5-year-old children were recruited from local preschools (mean age = 4;8, 23 female). In addition, 52 American adult participants (35 female, aged 18–64, mean = 33 yrs) were recruited through Amazon Mechanical Turk (http://www.mturk.com/), and paid $0.50 for their participation.

2.1.2. Procedure

Each child was first shown two cartoons: a character named Mary, and a fly. The experimenter explained that the fly was buzzing all around Mary, and that she wanted the child to tell her which fly was closer to Mary. Children then saw 10 pairs of pictures, each showing Mary with the fly superimposed on her body in one of five locations: eyes, mouth, chest, stomach, or feet (see top row of Fig. 1). Each location was paired with all other locations exactly once, for a total of 10 trials. Each position appeared an equal number of times on the left and the right for each child, and pairs were reversed across children. For each pair, children were asked: "Which fly is closer to Mary?" Adults received the same instructions and stimuli as the children, and selected a radio button to indicate which fly was closer to Mary.

2.2. Results and discussion

Participants saw each position four times across the 10 trials, and were thus assigned a score out of four for each position. As shown in Fig. 2, both children and adults were more likely to say that the fly was closest as it moved to closer to Mary's eyes (Spearman's rank correlation, both r_ss = 1.0).

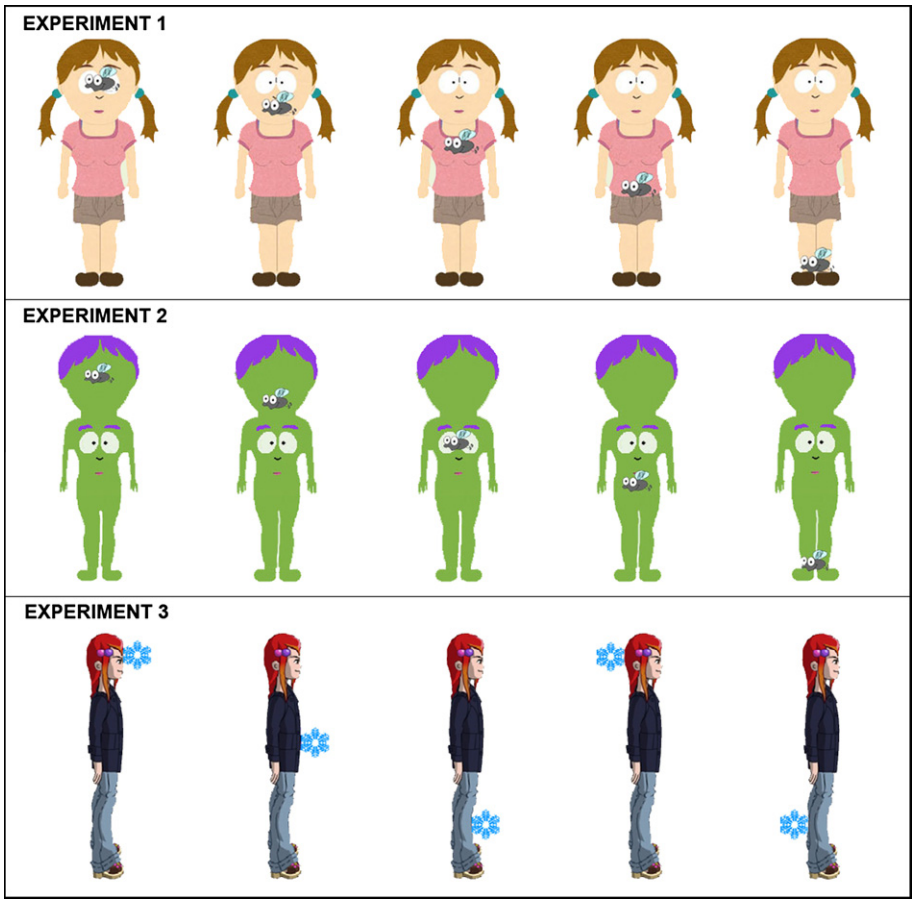

Fig. 1. Stimuli for Experiments 1, 2, and 3.

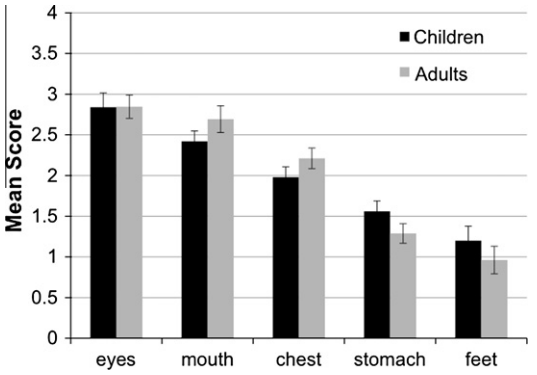

Fig. 2. Experiment 1. Mean number of trials in which each position was chosen as closer to Mary.

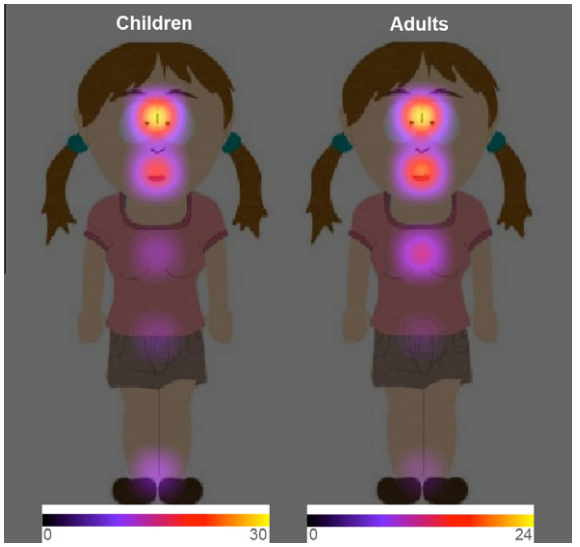

Fig. 3. Experiment 1. Number of children and adults who selected each position as their most frequent choice. Brightness increases with number of participants.

On the six trials that compared flies near Mary's head (i.e. the two leftmost flies in the top row of Fig. 1) to flies near Mary's lower body (the three rightmost flies in the top row of Fig. 1), both children (70%) and adults (76%) chose the flies near her head at rates exceeding chance (Binomial sign test, both $ps < .0001$, all tests two-tailed). Within the head, adults chose flies near Mary's eyes ($M = 2.85$) and mouth ($M = 2.69$) equally ($t(51) = .84$, $p = .40$), while children were more likely to choose flies near Mary's eyes ($M = 2.84$) than flies near her mouth ($M = 2.42$, $t(49) = 2.04$, $p = .05$).

We also examined the intuitions of individual participants by grouping them according to which position they chose most frequently. If two positions were chosen equally as often, the participant was counted in both categories. As shown in Fig. 3, the greatest number of participants in both age groups chose the fly near Mary's eyes as their most frequent response, but both age groups were also quite likely to choose flies near Mary's mouth. An approximately equal number of adults chose flies near Mary's eyes (46%) and near her mouth (37%, Fisher's Exact $p = .43$), while more children chose flies near Mary's eyes (60%) than near her mouth (40%, Fisher's Exact, $p = .07$). Both groups were more likely to choose one of the two positions on the head as their most frequent choice (children: 100%, adults: 83%) than one of the three positions on the lower body (children: 42%, adults: 37%, Fisher's Exact, both $ps < .0001$).

Thus in Experiment 1, both age groups favored the head over the body, but children were especially drawn to the eyes. To explore whether these responses were driven by a sense that the self is located near the eyes, or more broadly throughout the head, in Experiment 2 participants were shown pictures of the fly superimposed on an alien character whose eyes and head were located in distinct positions on the body.

3. Experiment 2

3.1. Method

3.1.1. Participants

Forty-one children (mean age = 4;11, 20 female) and 51 adults (35 female, aged 20–70, mean = 37 yrs) were recruited as in Experiment 1.

3.1.2. Procedure

The procedure was identical to Experiment 1, except that the Mary cartoon was replaced by an alien named Zafi, identical to Mary except that it was colored green and had its face on its chest. The fly was presented in the same five positions as in Experiment 1, however these now corresponded to different features of the body. Mary's eyes and mouth became Zafi's head, her chest became Zafi's eyes, her stomach became Zafi's mouth, and the feet were in the same place on both characters (see middle row of Fig. 1). Prior to the main study, participants were asked to point to Zafi's face and head. An additional three children and four adults were tested but excluded from analyses because they did not indicate Zafi's face to be on his chest and Zafi's head to be at the top of his body.

3.2. Results and discussion

As shown in Fig. 4, both age groups again showed a strong positive correlation between the fly's proximity to Zafi's eyes and the number of times it was chosen as closer to Zafi (Spearman's rank correlation, all $r_s s = 1.0$).

Paired t-tests revealed that adult participants chose flies near Zafi's eyes more often than flies in any other position ($M = 3.45$, all $ps < .0001$). Across all comparisons, adults were more likely to choose the position closer to the eyes as closer to Zafi (86%, $t(46) = 12.20$, $p < .0001$), and were equally likely to choose the lower head and the mouth, which were equidistant from Zafi's eyes ($t(46) = .95$, $p = .35$).

Children were more likely to choose pictures in which the fly was near Zafi's eyes as being closer to Zafi than they

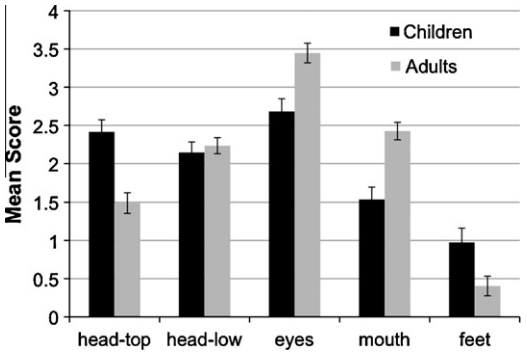

Fig. 4. Experiment 2. Mean number of trials on which each position was chosen as closer to Zafi.

were for any other position ($M = 2.68$, all $ps < .03$) except the upper head ($M = 2.41$, $t(40) = .95$, $p = .35$, see Fig. 4). Children were also more likely to choose positions closer to the eyes across all comparisons (63%, $t(39) = 3.79$, $p < .0001$), and were more likely to choose the lower head ($M = 2.20$) than the mouth ($M = 1.58$, $t(39) = -2.38$, $p = .02$), though both were equidistant from Zafi's eyes.

Grouping individual participants according to which position they chose most frequently reveals a similar pattern (see Fig. 5). The majority of adults (77%) chose the fly near Zafi's eyes most frequently, significantly more than chose any other location (Fisher's, all $ps < .0001$) More children also chose eyes as their most frequent response than any other position, however here there was no statistical difference between the number of participants whose most frequent choice was eyes (49%) and the number of participants whose most frequent choice was the upper head (39%, Fisher's, $p = .50$).

These results suggest that adults are tracking the eyes rather than the whole head as the location of the self. Children, however, seem to be torn between the eyes, which was their top choice, and the upper head, which they chose almost as frequently. One interpretation of this difference is that children may have a stronger intuition than adults that the self is located in the head, rather than near the eyes. However, if so, we would expect to see children choosing the fly on Zafi's lower head more often than the fly on Zafi's eyes, and this is not the case. What is more consistent with the data, then, is that children found it difficult to refrain from thinking of the eyes as being in the usual spot, especially since the alien Zafi is shaped like a human being except for this change.

In any case, the eyes clearly exert a strong influence on children's sense of where a person is located, since they chose the eyes on Zafi's chest far more often than they chose the same position on Mary's chest in Experiment 1. One explanation for these results is that the self is thought of as being located at or near the eyes. One alternative, however, is that having a fly very close to one's eyes is irritating, causing participants to be biased toward choosing flies in that location. It is also possible that participants found the question "Which fly is closer?" to be confusing, and reinterpreted it to mean "Which fly will this person see as closer?" or "Which fly will this person be more likely to notice?"

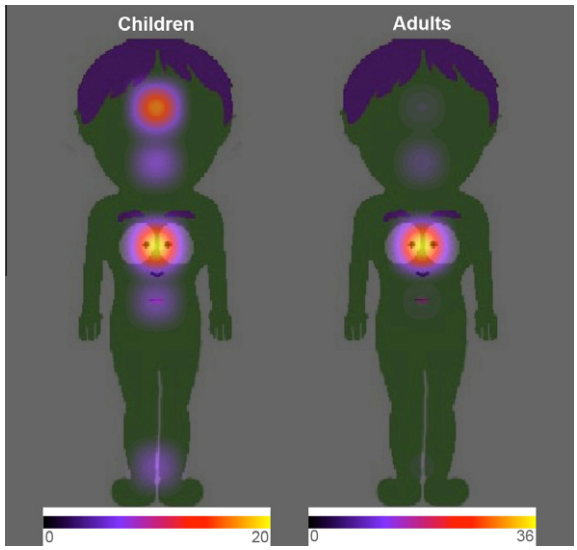

Fig. 5. Experiment 2. Number of children and adults who selected each position as their most frequent choice. Brightness increases with number of participants.

Experiment 3 explores these alternatives by changing the fly to a snowflake (to make it less irritating), proportionally reducing the size of the head and eyes (to make them less salient), and asking about positions behind the character's head. If participants' responses were in fact based on their intuitions about the location of the self, rather than simply the location of the sense of sight, then an object that is close to the eyes but out of sight should also be judged as being very close to the character.

4. Experiment 3

4.1. Method

4.1.1. Participants

Forty-two children (mean age = 4;11, 28 female) and 53 adults (31 female, aged 19–67, mean = 34 yrs) were recruited as in Experiments 1 and 2.

4.1.2. Procedure

The procedure was identical to the previous experiments, except here participants saw a new cartoon character named Erika, who had snowflakes falling down around her. After initially being shown a front view of Erika, participants saw a full-length profile of Erika, with a snowflake presented in one of five positions next to her body. The snowflake was presented in three positions at the front of Erika's body (head, stomach, and feet), and two positions at the back of Erika's body (back of head, and back of feet, see bottom row of Fig. 1).

4.2. Results and discussion

Overall, both age groups were again more likely to say that the snowflake was closest as it moved to closer to

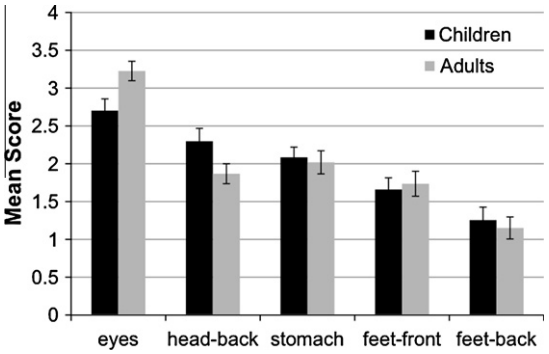

Fig. 6. Experiment 3. Mean number of trials on which each position was chosen as closer to Erika.

Erika's eyes (all r_ss > .9, see Fig. 6). Children and adults were more likely to choose snowflakes near Erika's eyes than any other location (adults: $M = 3.23$, all ps < .001, children: $M = 2.70$, all ps < .02).

If participants were choosing snowflakes that the character could see, then they should choose snowflakes near her stomach and at the front of her feet more often than the snowflake behind her head, because she can see the former but not the latter. Neither age group showed this pattern. In direct comparisons, both adults and children chose equally between the stomach and the back of the head (Binomial, adults: $p = .20$, children: $p = .14$), and both age groups chose snowflakes hidden from view behind Erika's head over those she could see at the front of her feet (Binomial, adults: $p = .05$, children: $p = .01$).

A similar pattern results from grouping participants according to which position they chose most frequently (see Fig. 7). The majority of adults (64%) and children (55%) chose the snowflake near Erika's eyes most frequently, significantly more than chose any other location (Fisher's, all ps < .05). There was no difference for either age group in the number of participants who chose the back of head most often (adults: 9%, children: 31%), and the number who chose the stomach most often (adults: 9%, children: 29%, Fisher's, both ps = 1.0).

If people have the intuition that the self is located throughout the head, then participants in Experiment 3 should have chosen equally between the eyes and the back of the head. Instead, both adults and children chose the snowflake near Erika's eyes most frequently. These results support the hypothesis that both children and adults are drawn toward the eyes, rather than the whole head, as the location of the self.[1] Importantly, these results also indicate that participants are not using what a person can see as a measure of what is close to her, since neither children nor adults chose snowflakes near Erika's stomach or in front of her feet (which she could see) over the snowflake behind her head (which she could not see).

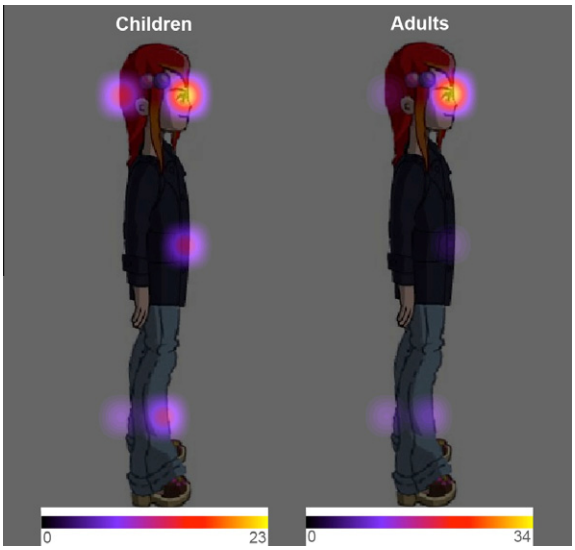

Fig. 7. Experiment 3. Number of children and adults who selected each position as their most frequent choice. Brightness increases with number of participants.

5. General discussion

Three experiments probed children's and adults' intuitions about the location of the self. In Experiment 1, both children and adults judged a fly to be closer to a person when it was near her head than when it was near her lower body. Experiment 2 found that when the eyes are moved to a new location on the body (the chest), both adults and children judge that the fly next to the eyes is the closest to the person—though children were also drawn to upper head, perhaps because this is where the eyes usually are. In Experiment 3, all age groups were again most likely to choose an object close to the eyes as the closest to a character, and did not show a preference for choosing an object the character could see (in front of her stomach or feet) over an object which she could not see (behind her head).

Together, these studies provide converging evidence that children and adults intuitively think of the self as occupying a physical location within the body, close to the eyes. The indirect nature of our method, and the fact that these judgments are shared by adults and preschoolers, suggests that our results do not reflect a culturally learned understanding of the role of the brain in producing mental states, but might instead be rooted in a more intuitive or phenomenological sense of where in our bodies we reside.

These findings might also shed new light on a curious pattern of results concerning children's egocentrism. Flavell, Shipstead, and Croft (1980) found that when 2.5–4-

[1] One might wonder, as suggested by an anonymous reviewer, whether both snowflakes and flies will be associated with the eyes because they are generally seen, rather than, say, eaten or manipulated. Our own intuition is that this is not always the case; flies are often heard and felt and snowflakes are often felt. To explore this, we showed subjects on Amazon Mechanical Turk an image of the fly or snowflake used in our experiments, followed by an image of the character from Experiment 1, and asked them to "Click on the part of the picture that you associate most with the fly", or "with the snowflake". In the fly condition ($N = 19$) participants chose randomly, with the greatest number ($N = 4$) choosing the nose. A similarly random pattern was found in the snowflake condition ($N = 22$), with the greatest number again choosing the nose ($N = 4$).

year-old children had their eyes covered, they judged that an experimenter could not see *them*, but *could* see their arm. Later studies found that 2- and 3-year-old children claimed that they could see a doll if its legs were occluded, but not if its head or eyes were occluded (McGuigan, 2009; McGuigan & Doherty, 2006).

Such results might suggest that young children have a different notion than adults of what it means to "see" a person, possibly misconstruing the concept of "seeing" a human target as an activity that requires mutual engagement (McGuigan & Doherty, 2006). However, there is another interpretation, first proposed by Neisser (1997): Perhaps children intuitively see the eyes as the location of the individual, and intend the claim that the experimenter "cannot see *me*" to mean the experimenter "cannot see *my self*". Our current findings lend support to this latter interpretation, and also suggest that the childish attempt to hide by closing one's eyes reflects an intuition children share with adults: the eyes are the windows to the soul.

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References

Bertossa, F., Besa, M., Ferrari, R., & Ferri, F. (2008). Point Zero: A Phenomenological Inquiry into the subjective Physical Location of Consciousness. *Perceptual and Motor Skills, 107*, 323–335.

Bloom, P. (2004). *Descartes' Baby: How the science of child development explains what makes us human*. New York: Basic.

Choe, K. S., Keil, F. C., & Bloom, P. (2011). Developing intuitions about how personal properties are linked to the mind and the body. *Infant and Child Development*. doi:10.1002/icd.755.

Fancy, N. A. G. (2006). Pulmonary Transit and Bodily Resurrection: The Interaction of Medicine, Philosophy and Religion in the Works of Ibn al-Nafīs (d. 1288), *Electronic Theses and Dissertations*, University of Notre Dame, pp. 209–210.

Flavell, J. H., Green, F. L., & Flavell, E. R. (1995). Young children's knowledge about thinking. *Monographs of the Society for Research in Child Development, 60*.

Flavell, J., Shipstead, S., & Croft, K. (1980). What young children think you see when their eyes are closed. *Cognition, 4*, 369–387.

Gottfried, G. M., Gelman, S. A., & Schultz, J. (1999). Children's understanding of the brain: From early essentialism to biological theory. *Cognitive Development, 14*, 147–174.

Johnson, C. N., & Wellman, H. M. (1982). Children's developing conceptions of the mind and brain. *Child Development, 53*, 222–234.

Lillard, A. S. (1996). Body or Mind: Children's categorizing of pretense. *Child Development, 67*, 1717–1734.

Limanowski, J., & Hecht, H. (2011). Where do we stand on Locating the Self? *Psychology, 2*, 312–317.

McGuigan, N. (2009). Does the direction in which a figure is looking influence whether it is visible? *The Journal of Genetic Psychology, 170*(3), 227–233.

McGuigan, N., & Doherty, M. (2006). Head and shoulders, knees and toes: Which parts of the body are necessary to be seen? *British Journal of Developmental Psychology, 24*(4), 727–732.

Neisser, U. (1997). The Roots of Self-Knowledge: Perceiving Self, It, and Thou. *Annals of the New York Academy of Sciences, 818*, 19–33.