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Tanya Broesch¹, Tara Callaghan², Joseph Henrich³,
Christine Murphy⁴, and Philippe Rochat¹

Abstract

Western children first show signs of mirror self-recognition (MSR) from 18 to 24 months of age, the benchmark index of emerging self-concept. Such signs include self-oriented behaviors while looking at the mirror to touch or remove a mark surreptitiously placed on the child's face. The authors attempted to replicate this finding across cultures using a simplified version of the classic "mark test." In Experiment 1, Kenyan children ($N = 82$, 18 to 72 months old) display a pronounced absence of spontaneous self-oriented behaviors toward the mark. In Experiment 2, the authors tested children in Fiji, Saint Lucia, Grenada, and Peru ($N = 133$, 36 to 55 months old), as well as children from urban United States and rural Canada. As expected from existing reports, a majority of the Canadian and American children demonstrate spontaneous self-oriented behaviors toward the mark. However, markedly fewer children from the non-Western rural sites demonstrate such behaviors. These results suggest that there are profound cross-cultural differences in the meaning of the MSR test, questioning the validity of the mark test as a universal index of self-concept in children's development.

Keywords

culture, mirror self-recognition, children

Self-oriented behavior in the mirror, after being surreptitiously marked on the face, is taken by many as an explicit index of self-concept, the objectified and identified sense of the embodied self (Amsterdam, 1972; Gallup, 1970; Lewis & Brooks-Gunn, 1979; Rochat, 1995, 2003). Although some have debated the meaning of self-guided action in a mirror (Heyes, 1994, 1998), many refer to the passing of the classic mirror mark test (i.e., the spontaneous direct touching of a mark on the body once discovered in the mirror) as an ontogenetic benchmark of self-concept.

¹Department of Psychology, Emory University, Atlanta, Georgia, USA

²Department of Psychology, St Francis Xavier University, Antigonish, Nova Scotia, Canada

³Department of Psychology and Department of Economics, University of British Columbia, Vancouver, British Columbia, Canada

⁴Department of Anthropology, Emory University, Atlanta, Georgia, USA

Corresponding Author:

Tanya Broesch, Department of Psychology, 36 Eagle Row, Emory University, Atlanta, GA 30322, USA.
Email: tmacgil@emory.edu

Numerous developmental studies of predominantly urban Western middle-class children suggest that children reach this milestone by 18 to 24 months of age. By 18 months, approximately 50% pass and by 24 months a significant majority of children (more than 70%) are reported to self-refer by touching or removing a mark from their own body (face or other body region) while exploring their mirror image (Amsterdam, 1972; Asendorpf, Warkentin, & Baudonnière, 1996; Bard, Todd, Bernier, Love, & Leavens, 2006; Bertenthal & Fisher, 1978; Lewis & Brooks-Gunn, 1979; Lewis & Ramsay, 2004; Nielsen, Dissanayake, & Kashima, 2003; Schulman & Kaplowitz, 1976). Here we report cross-cultural observations on the emergence of mirror self-recognition (MSR), using a simplified mark test, raising questions regarding the meaning and universal validity of this test as an ontogenetic benchmark of self-concept.

The basic rationale behind the mark test is that when a child is marked surreptitiously and attempts to touch the mark on the body, as opposed to doing nothing or trying to reach for it on the mirror surface, it indicates that the specular image stands for the child's own body. Self-oriented gestures are taken as the behavioral index of self-recognition, indicating that the embodied self is the referent of what is seen in the mirror (Rochat, 2003). In a different account, Nielsen, Suddendorf, and Slaughter (2006) claim that the mark test is passed by individuals who have a rapidly updatable image of themselves that they recognize in the mirror. Regardless of the relative validity of these accounts, the general consensus is that passing the mark test indicates that children recognize their image and that those who fail the test do not.

From a comparative perspective, chimpanzees, orangutans, dolphins, and Asian elephants are among the few nonhuman species reported to pass the mark test (Gallup, 1982; Plotnik & de Waal, 2006; Povinelli, 1995; Reiss & Marino, 1998). Nonhuman individuals passing the test typically have extensive prior experience with reflective surfaces. In contrast, research with humans suggests that children's relative familiarity with mirrors, which greatly varies across contexts, does not correlate with the age at which the mark test is passed (Priel & deShonen, 1986). Priel and deShonen (1986) tested Bedouin nomadic children with no previous mirror experience and compared them to same-age Israeli children familiar with mirrors. They found no significant difference in the developmental onset of MSR between mirror familiar and unfamiliar children.

However, more recent cross-cultural studies point to significant cultural variations in the onset of MSR. Keller and collaborators compared 18- to 20-month-olds from urban Greece, Costa Rica, Germany, as well as from a rural community in Cameroon, and they report a greater proportion of German, Greek, and Costa Rican children passing the test (more than 50%), compared to Cameroonian children (less than 4%) (Keller, Kartner, Borke, Yovsi, & Kleis, 2005; Keller et al., 2004). These authors correlate such variations to variations in parenting strategies that exist across these cultures, fostering more or less autonomy in the young child.

If such variability is validated with other cultures, testing children older than 18 to 20 months would allow us to determine whether this variability pertains only to a developmental delay, possibly resulting from variations in parenting styles (see Keller et al., 2005; Keller et al., 2004) or whether such differences persist throughout development. If the latter is the case, this would suggest that there may be culture-specific responses to the passing of the mirror mark test (i.e., greater occurrence of potential false negatives). To probe this alternative explanation, we performed two experiments testing (a) whether cross-cultural variability in the passing of the mirror mark test could be verified across more cultures and (b) whether such variability would persist beyond the age at which children typically are reported to pass the mirror mark test. In two experiments, we tested children 18 to 72 months old living in seven distinct cultural groups. Because of the exploratory nature of this work, aside from probing these questions, no specific hypotheses were made.

Method

General Procedure

We compared children from five non-Western rural communities—Kenya, Fiji, Grenada, Saint Lucia, and Peru—to children from two Western urban and rural communities, respectively, in the United States (Atlanta) and Canada (Nova Scotia). In all studies, a simplified and shorter version of the classic mirror mark paradigm was used with similar materials and props. The rationale for the simplified version was to ensure procedural homogeneity across field sites and to eliminate linguistic barriers. Children were recruited for participation either through pre-schools or local community groups. After obtaining consent, children visited the testing location: a quiet room in a house, an isolated outdoor area, or a laboratory. In Kenya, Peru, Fiji, and Grenada, testing was conducted in a quiet room in a house and an isolated quiet outdoor area. However, in the United States, Canada, and Saint Lucia, the testing was done either in a quiet room in a house (daycare) or a laboratory. Significant effort was taken to ensure that the testing locations were quiet and devoid of visual distractions.

Two adult experimenters and the child were present during the majority of the testing, however at times in Kenya, Canada, and the United States, one parent and one sibling were present but remained behind and to the side (out of view) of the child. The primary experimenter (E1) was a North American female adult. In Kenya, Fiji, and Canada, she lived in the community and was familiar with the children. In the United States, Grenada, and Peru, E1 was a short-time visitor and stranger to the child. She conducted the testing in either the native language of the child or the dominant language of the preschool. At all non-Western locations, a second experimenter (E2) from the local community assisted with the protocol and video recording.

A video camera (small digital Canon) was placed 3 to 4 meters away, above and behind E1 who faced the child. A 1-minute pretest phase was conducted whereby E1 engaged playfully with the child, “tickling” the child and tapping the “tummy,” shoulders, and forehead lightly. As she tapped the head of the child, she surreptitiously placed a yellow “post-it” mark (approximately 5×4 cm) on the child’s forehead at the hairline. “Post-it” marks at the hairline were used to control for any feedback that could lead the child to touch his or her face independent of self-recognition proper (Nielsen et al., 2006). Typically, marking is done with rouge, however many studies report using stickers as a successful substitution (Nielsen & Dissanayake, 2003; Nielsen et al., 2006; Povinelli, Landau, & Perilloux, 1996; Skouteris, Spatero, & Lazaridis, 2006; Suddendorf, Simcock, & Nielsen, 2007). A pretest phase followed the mark placement in which E1 engaged with the child for 15 to 30 seconds, checking that he or she did not notice that something was placed on his or her forehead. Any participant touching or removing the mark during pretest was not included in the final sample. Such occurrences were rare and are reported for each testing location.

Following the pretest, the MSR test began with E1 holding a mirror (40×25 cm) face down on her lap or a small table directly in front of her. She held the mirror with her right hand, which was covered with a puppet. The puppet was presented to the child as being asleep and the child was asked to “wake up the puppet” by touching it. After the child touched the puppet, E1 slowly lifted the mirror with the hand wearing the puppet and positioned it steadily in front of the child, approximately 0.5 meter away, allowing full head and torso reflection. While holding the mirror upright, E1 looked away and to the side of the mirror, maintaining a neutral expression. The session ended either when the child removed the mark from his or her forehead or 30 seconds passed. E1 then stopped the session by saying, “Look at that silly sticker there!” and removed it.

Note that the mirror mark paradigm used in this study is a simplified, nonlinguistic version compared to the original, in which the child is specifically asked who is in the mirror (Amsterdam, 1972). This simplified mirror mark test is similar to the one used in other studies with Western children (Nielsen & Dissanayake, 2003; Nielsen et al., 2003; Nielsen et al., 2006; Suddendorf et al., 2007).

Dependent Measure, Analysis, and Reliability

The video recordings of the test phase were coded for the presence or absence of self-oriented behavior and analyzed using a nonparametric, one-tailed binomial test with a threshold level set at .60 based on findings indicating that more than 60% of children older than 20 months will self-orient within this paradigm (see Amsterdam, 1972; Bertenthal & Fisher, 1978, Lewis & Brooks-Gunn, 1979). Self-oriented behavior was defined as any mirror-guided action toward the mark and was classified as either removing or touching the mark (and leaving it on). It should be noted that self-oriented behavior refers only to touching or removing the mark and not verbal self-labeling.

In addition, we coded for signs of marked behavioral inhibition in terms of freezing behavior. Freezing was operationally defined as the absence of any body movement or vocalization, while staring at the specular image, for more than 2 seconds. Note that children could exhibit freezing behavior and subsequently touch or remove the mark, or alternatively, they could exhibit none of the above, treating the image as another playmate or acting out without any self-oriented behavior (Amsterdam, 1972). Freezing behavior was analyzed using a nonparametric, one-tailed binomial test with a threshold level set at .50, to test our null hypothesis that children across cultures will not demonstrate significantly more freezing than what would be expected by chance. For reliability, 30% of the participants at each location were coded by an independent coder. There was 100% agreement on both measures.

Experiment 1—Kenya

In Experiment 1, we tested children from Kenya for self-referencing behaviors in the mark test following the procedure described above.

Participants and Setting

Eighty-two children ranging from 18 to 72 months of age ($M = 41.62$ months, $SD = 11.34$) were tested (36 males and 46 females). Although access to health care in the region is scarce, no children suffered from any illness at the time of the experiment to the best of the experimenters' knowledge. Eight additional children participated in the experiment but were excluded due to experimenter error or noticing the mark prior to test phase (4) or video malfunction (4).

All participants were from a district in the Western Province of Kenya on the border of Uganda. Currently, the population is approximately 1.3 million, with each village in the area comprised of less than 3,000 people. Agriculture is the main form of economic activity in the region, with 70% of households depending directly or indirectly on farming for income. All children are required to attend school and most attend preprimary school by 3 or 4 years of age. However, children are expected to contribute to household maintenance through participating in daily duties such as child care, fetching water, and herding cattle. For a variety of social and economic reasons, children are expected to do so without causing any disruptions (LeVine, 1988; Oburu & Palmerus, 2003). In addition, discipline strategies vary among households but range from physical punishment to verbal threats and behavior modification—with physical punishment or restraint being most prevalent (Oburu & Palmerus, 2003).

Procedure

The general procedure was modified slightly to adapt to the particular setting. Because toy artifacts were rare in the region, the puppet prop was not used in Kenya as part of the procedure.

In addition, because of the humidity of the region, "Post-It" notes did not stick to the skin and were therefore replaced with a white piece of tape (3×2 cm). We experimented with several materials before deciding that this particular material was lightweight, soft, resistant to humidity, and unable to be felt on the skin.

Results and Discussion

Of the 82 children tested, only two demonstrated any of the defined self-oriented behaviors when facing their "marked" image in the mirror (one-tailed binomial test, $p < .001$, with a .60 probability threshold). Of these two children, one removed the mark and one touched but did not remove the mark (both were 48 months of age; one male and one female). Coding of *freezing* behavior reveals that 80 of the 82 children (one-tailed binomial test, $p < .001$, with a .50 probability threshold) displayed such behavior, staring at their image in the mirror, without any attempt at either touching or removing the mark on their forehead. The two 48-month-olds that self-oriented did not freeze. These results are in sharp contrast with what is reported with Western children. For example, Lewis and Ramsay (2004), using a comparable procedure, report that over 80% of children by 21 months and 100% of children by 24 months of age pass the test by touching or removing the mark (see also Lewis & Brooks-Gunn, 1979). These findings cannot be explained in terms of a slight developmental lag as children were aged up to 72 months (6 years) and still showed no evidence of self-oriented behaviors.

Several methodological alternations did not change the findings. First, to determine whether the presence of E1 (North American female adult) or the presence of a camera influenced the children's behavior, an additional 13 children were tested (in addition to the 82 reported here) with E2 (Kenyan female adult) as the primary experimenter and E1 watching from a nearby window (and no camera present). None of these children self-oriented and they persisted in manifesting freezing behavior. In addition, 23 of the 82 children were tested in the home of E1. These children were familiar with E1 and with this setting, often visiting her daily. In all cases, independent of testing locations and experimenter, children overwhelmingly showed freezing behavior and no self-referencing behavior. It thus appears that the phenomenon needs an explanation beyond that of a developmental lag or procedural circumstances. Note also that E1 lived in the region for 6 months (with a Kenyan family for 2 months) and observed several instances in which children used mirrors spontaneously to inspect and manage their self-presentation. Compared to typical North American homes, mirrors are not as prevalent in Kenyan homes; however, they do exist and are used regularly.

It is possible but unlikely that these children, up to 72 months of age, did not recognize themselves in the mirror. Although the data presented here do not directly address the question of why they did not show signs of self-oriented behavior, we speculate that these are false negative responses. We speculate that children are recognizing their image with a distinct mark on their forehead but do not know the appropriate and acceptable response. The fact that these children respond with overwhelming inhibition by *freezing* suggests that they may be expressing social compliance rather than a lack of self-recognition. More research is needed to test our social compliance interpretation, by prompting the child "to get it" (Nielsen et al., 2006), by changing the kind of mark placed on the child's forehead (e.g., sticker or fake familiar vs. unfamiliar insect on the forehead for mirror mark testing), or by further investigating the extent to which social compliance varies between Kenyan and North American children. In the second experiment, using the same procedure and assuming, as a working hypothesis, that non-Western rural communities promote more social compliance in children compared to Western communities, we tested whether the Kenyan "paradox" could be generalized to other non-Western, small rural societies (Fiji, Peru, Saint Lucia, and Grenada). For control and comparison, we also tested same-age

Western children, from a small rural community in Canada as well as a group of children growing up in a large urban area in the United States.

Experiment 2—Six Cultures

Method

Participants and Setting. A total of 133 children participated in this experiment, aged 36 to 55 months ($M = 44.2$, $SD = 5.67$), from Fiji, Saint Lucia, Grenada, Peru, Canada, and the United States. The following is a brief summary of the demographics and socialization practices for each region.

Fiji. Eight Fijian children participated in this experiment (five male, three female), ranging in age from 36 to 53 months ($M = 44.6$, $SD = 6.45$). Children were recruited from families in a small village in the Yasawa Island chain, and data were collected as one part of an ongoing comprehensive study. The population ranges from 70 to 150 people per village, with each child well known to the adults in the village. Subsistence living is supported by horticulture, fishing, and marine foraging. Before children attend school at 5 years of age, they typically spend their time with immediate and extended family, playing outdoors with other children, or observing alongside adults as they perform their daily duties. There is minimal direct adult supervision after the child begins to walk, however there tends to be collective supervision that is supported by older children and adolescents. Although there are few objects and imported goods in the village, mirrors are present in nearly every household—typically large broken pieces of reflective glass situated against a wall, on the floor. Children have access to the mirrors as they are on the floor, and infants were observed by E1 exploring the reflected image.

Saint Lucia and Grenada. Twelve children (36 to 50 months; $M = 41.0$, $SD = 4.72$) were from Saint Lucia in the Caribbean (nine female and three male). These children were from a small coastal fishing village (Laborie) with a population of less than 8,000 people, located in the southwest coast of the island. The main source of income is tourism and banana exports, however due to recent competition from Latin America, banana exports have declined rapidly, leading to higher unemployment rates and reliance on slow developing tourism.

In addition, 35 children (36 to 55 months; $M = 44.7$, $SD = 5.91$) were tested from rural and semirural Grenada, in the Caribbean with comparable socioeconomic status to Saint Lucia (18 male and 17 female). All participants from both islands were tested at local preschool centers and had some experience with mirrors as well as other artifacts and toys.

Peru. Thirty-three children (39 to 55 months; $M = 45.7$, $SD = 4.20$) from small villages in the central Andean highlands of Peru, Junin region, in the province of Huancayo were tested. Eighteen were male and 15 were female. Socioeconomic levels were low in the region, relative to Peruvian standards, but private and public education programs were common in this region. Inhabitants depend primarily on agriculture and traditional crafts for their livelihoods. All children were tested in their preschools or in community meeting areas and had opportunities to encounter mirrors in their environment.

United States and Canada. The participants from the United States included 32 children (20 male and 12 female) aged 36 to 54 months ($M = 46.3$, $SD = 5.24$). All participants were from middle-class families of a large urban area of the United States (Atlanta). Finally, 13 children (eight male and five female), aged 35 to 40 months ($M = 36.7$, $SD = 1.25$), were tested from a small rural town in Nova Scotia, Canada. The main sources of income in the region are resource-based industries such as fishing and agriculture.

Procedure. The same general procedure was followed for each of the six locations (see above).

Results and Discussion

Of the children ($N = 133$) participating in this experiment, 80 (60%) demonstrated self-orienting behaviors ($p = .5469$, with a .60 probability threshold). As depicted in Table 1, the proportion of children self-referring in the United States (88%), Canada (77%), Saint Lucia (58%), Peru (52%), and Grenada (51%) was not significantly less than we would expect with children at 20 months of age (all binomial tests, $p > .05$, with a .60 probability threshold). In comparison, none of the Fijian children self-referred ($p = .004$). As the children in our sample were older than those reported in previous studies (36 to 55 months compared to 20 months on average), we expected significantly more than 60% would self-refer. We therefore performed further post hoc analyses using a one-tailed binomial test, setting the threshold at .88 to determine whether the probability distributions of children self-referencing in non-Western sites differed from that of American children. Our null hypothesis was that children across cultures will not differ significantly from same-aged American children, using a .88 probability threshold. The analyses revealed that the proportion of children self-referring in Saint Lucia ($p = .009$), Peru ($p < .001$), Grenada ($p < .001$), and Fiji ($p < .001$) were significantly less than the proportion of children self-referring in the United States. Canada did not differ from the United States ($p = .198$). These results point to significant cultural variations in spontaneous signs of MSR by 3 and 4 years of age, with 88% of children passing in the United States and significantly fewer in Fiji, Peru, Grenada, and Saint Lucia.

Further comparisons were made between cultures using two-tailed Fisher’s exact tests. The results of these tests are depicted in Table 2. Overall, significantly fewer Fijians self-oriented compared to all other cultures ($p < .05$). Fewer Peruvian ($p = .003$) and Grenadian children ($p = .002$) self-oriented compared to American children.

Table 1. Experiment 2: Number and Percent of Children Demonstrating (A) Self-Oriented and (B) Freezing Behavior in Each Culture

	N	Self-Oriented Behavior			Freezing
		Touch	Remove	Total	
Fiji	8	0 (0%)	0 (0%)	0 (0%)*	7 (88%)*
Saint Lucia	12	4 (33%)	3 (25%)	7 (58%)*	1 (8%)
Peru	33	5 (15%)	12 (36%)	17 (51%)*	11 (33%)
Canada	13	0 (0%)	10 (77%)	10 (77%)	1 (8%)
Grenada	35	9 (26%)	9 (26%)	18 (52%)*	14 (40%)
US	32	0 (0%)	28 (88%)	28 (88%)	1 (3%)

Note: One-tailed binomial test.

* $p < .01$ (probability threshold .88 for self-oriented behavior, .50 for freezing).

Table 2. Experiment 2: p Values for Fisher’s Exact Tests (Two-Tailed) for Self-Oriented Behavior Across Cultures

Culture	Fiji	Saint Lucia	Peru	Canada	Grenada	United States
Fiji	—	.015*	.013*	.001**	.013*	.000**
Saint Lucia	—	—	.746	.411	.747	.087
Peru	—	—	—	.184	1.00	.003**
Canada	—	—	—	—	.188	.394
Grenada	—	—	—	—	—	.002**
United States	—	—	—	—	—	—

Table 3. Experiment 2: *p* Values for Fisher's Exact Tests (Two-Tailed) for Freezing Behavior Across Cultures

Culture	Fiji	Saint Lucia	Peru	Canada	Grenada	United States
Fiji	—	.001**	.013*	.001**	.021*	.000**
Saint Lucia	—	—	.136	1.00	.071	.476
Peru	—	—	—	.074	.621	.003**
Canada	—	—	—	—	.040*	.499
Grenada	—	—	—	—	—	.000**
United States	—	—	—	—	—	—

Regarding the freezing behavior of children during the mark test (see Table 1), we also compared cultures using two-tailed Fisher's exact tests (see Table 3). These comparisons revealed that significantly more Fijian children exhibited freezing behavior while facing their specular image compared to children of all the other five cultures ($p < .05$). In addition, significantly more Grenadian children froze compared to Canadian ($p = .040$) and American ($p < .001$) children. In general, significantly fewer American children demonstrated freezing behaviors compared to Fijian ($p < .001$), Peruvian ($p < .01$), and Grenadian children ($p < .001$).

These results point to a distinction between Western North American children, whether living in large urban or small rural communities, and other non-Western rural and semirural children tested. These results confirm the Kenyan "paradox" of Experiment 1, generalizing our findings to other non-Western rural cultures that, according to our interpretation, promote more social compliance in children.

General Discussion

The aim of the research was to document evidence of early MSR across cultures, using a shorter and simplified version of the mark test. We found significant cultural variations across the seven cultures. The first experiment shows that only 2 out of 82 18- to 72-month-old Kenyan children manifested self-oriented behaviors toward the mark, most of them freezing while staring at their specular image. This result is in sharp contrast with the multiple studies reporting that by 20 months of age, 60% to 85% of Western middle-class children pass the mark test (Amsterdam, 1972; Bertenthal & Fisher, 1978; Lewis & Brooks-Gunn, 1979). The question is how to explain this Kenyan "paradox" in the context of our task.

If passing the mark test demonstrates that children recognize themselves in the mirror, providing some explicit evidence of self-concept, this does not necessarily mean that failing to pass the test is evidence for a lack of self-recognition or self-concept. Our results show that the low propensity of Kenyan children to demonstrate self-oriented behavior remains unchanged over a wide age span. Thus, a developmental delay is not a probable explanation of the Kenyan "paradox."

A recent study reports a drop in children's self-recognition when using live video instead of mirrors, with a developmental delay of about 1 year in the onset of self-recognition in the video condition (Suddendorf et al., 2007). The researchers speculate that children actually recognize themselves with a mark on the TV, not appreciating that the projected TV image corresponds to their current situation. These observations further validate the importance of considering the early expression of self-recognition in relation to context, whether cultural, social, or experimental. As pointed out by Keller et al. (2004), failure in MSR tests could be linked to a general lack of expressivity in young children, a trait exacerbated in some non-Western cultures. Another

possibility is that the simplified version of the mark test might have underestimated the capacity of the Kenyan children, particularly the fact that the experimenter did not provide any verbal prompts and directives to encourage actions. In 2006, Bard et al. compared spontaneous and prompted self-orienting behaviors of children in the mark test and reported that maternal prompting increased self-referential verbal labeling. Although no statistical tests were applied ($n = 4$), these findings do suggest that verbal prompts may be needed to encourage self-referential behavior and labeling (Bard et al., 2006).

During the testing and subsequent coding of the Kenyan participants, our impression was that they understood that it was themselves in the mirror, that the mark was unexpected, but that they were unsure of an acceptable response and therefore dared not touch or remove it. Once again, there was no sign of greeting or smiling when children viewed themselves in the mirror (as indicated by the coding of freezing behavior), as is the case in most young Western toddlers who do not pass the MSR test. The inhibition demonstrated by freezing of these children suggests that we may be assessing false negative responses to the test. Variations in the onset of MSR across cultural settings using the conservative criteria of the mark test would imply differences in the developmental trajectory of self-concept across cultures. However, if children are "passing" the test by demonstrating self-consciousness through inhibited behavior, this would suggest that rather than expressing a lack of self-concept, they might be very much aware of their own identity in relation to the adults that surround them. More tests are needed to confirm this interpretation, as freezing is not unambiguously indicative of self-concept. For example, one might choose to present children with a situation in which the child is encouraged either beforehand or during the test to remove "it," or in testing the marked child facing the mirror in the absence of others.

The second experiment demonstrates that a significant amount of variability exists across cultural contexts in children's behavioral response to this version of the MSR test that measures spontaneous self-recognition (see also Lewis & Ramsey, 2004). Consistent with past research, 77% to 88% of Western children (Canada and United States) pass this version of the MSR test by spontaneously displaying self-oriented behaviors. In contrast, only half of the children from Saint Lucia, Grenada, or Peru and none of the Fijian children of the same age showed any sign of such behaviors. Once again, the question is what might account for such striking cultural variations.

It may be important to note the general use of mirrors in each of the cultures. Although we did not include an independent measure of the extent and nature of mirror experience in these cultures, the experimenters visited many homes in these various communities. Although mirrors are present in most non-Western and all Western homes, their use varies considerably. It is more conspicuously and frequently used in the West, compared to any of the other cultures considered here. Western children are more likely to have shared mirror exposure with others or to have seen themselves in a mirror in the presence of others, a situation presumably unfamiliar to the non-Western children we tested. The unfamiliarity with public mirror exposure may be linked to the enhanced "freezing" behavior by non-Western children, particularly when discovering that their face is marked. This inhibition may correspond to the fact that children do not know how to behave, one way or another, in this context.

The non-Western children tested in the two studies were all immersed in close-knit communities, living in close quarters with three or more generations of family members and much of the childcare provided by siblings. These circumstances are different from the predominantly nuclear family context that is typical of middle-class children in North America (Whiting, 1963; Whiting & Whiting, 1975). In their cross-cultural studies, Keller et al. (2004) found that parenting style, in particular maternal contingent responsiveness to a 3-month-old infant, varies significantly across cultures (German, Greek, Costa-Rican, or Cameroonian) and was a good predictor of whether the child would pass the mark test at 18 to 20 months. Their interpretation is that

parenting strategies, which vary across cultures, determine particular pathways in children's development of self (Keller et al., 2005; Keller et al., 2004). In addition, the work of Schneider-Rosen and Cicchetti (1991) also demonstrates a complex interaction between self-recognition and early care-giving environment, reporting that children suffering from maltreatment respond with less positive and more negative and neutral affective responses in the mirror.

Interestingly, Keller et al. (2004) report that rural Cameroonian children who showed an absence of MSR also showed significantly more compliance to request and prohibition from an adult, expressing in general more obedience and submission to the authority of the adult compared to European and North American children. Enhanced compliance would be associated with the interdependent orientation of the socializing culture surrounding the child (LeVine & Norman, 2001). In the case of Cameroonian children, as for the non-Western rural children tested in the present research, this orientation would have a direct impact on how children respond to the mark test. If the compliance of the child is high, the child might be reluctant to either touch or remove the mark, assuming that it was surreptitiously placed on him or her by an adult for a "purpose."

Although our data do not yield definitive answers, we interpret our observations as expression of basic cultural differences in the way children construe the task, not in whether they are capable of recognizing themselves or not. Future research is needed to probe this interpretation further, framed by the rationale that obedience and compliance, as opposed to autonomy and self-initiative, tend to be more prominent in cultural environments that foster interdependence as opposed to independence and autonomy in the child (LeVine, 1988; LeVine & Norman, 2001). Further controls are necessary to supplement the simplified procedure used here, including verbal prompting, familiarity of the experimenter, nature of the mark, as well as its placement on the child's body.

Research suggests that in small-scale rural communities, young children tend to learn primarily via observation and imitation (Odden & Rochat, 2004; Rogoff, 1995). This is confirmed by detailed ethnographic studies in Fiji (Toren, 1990) and Tonga (Morton, 1996), all showing a strong emphasis for respect for adults and silent obedience in child rearing as opposed to the Western model of learning in which children are encouraged to take an active, participatory role. Children in these small-scale societies are constrained to learn mainly by watching and are not encouraged to ask questions and request one-on-one instructions as is typical in contemporary industrialized Western cultures (Morton, 1996; Rogoff, 1995).

Physical punishment is not uncommon in these contexts and questions directed toward adults are not encouraged. In Fijian culture, for example, there is no "why" phrase that children can use, and mothers who are overly permissive with their child are typically ridiculed by others. Children in these cultures are encouraged to be seen, not heard, with the overwhelming emphasis on compliance and respect for adults' and older siblings' authority (Rogoff, 1995, 2003; Rogoff, Matusov, & White, 1996).

Our findings suggest that compliance as a cultural value and norm might be an important factor in the way children express self-concept throughout development. In relation to the mark test used in the present studies, we think that compliance norms shape the way children manifest self-recognition, specifically by not touching the mark. This is in sharp contrast with the independence and self-initiative that tends to be encouraged and nurtured in the industrial West, especially in the middle- and upper-classes of the majority cultures.

Such findings have nontrivial implications for how we pursue building a comprehensive understanding of human psychology that takes seriously the breadth and depth of cultural variations. The MSR test emerged in the West and was constructed by Western scientists to be applied to Western children. Yet the task was viewed as sufficiently straightforward that it has been applied to argue both for self-concept in apes and against self-concept in monkeys. With the caveat that we used a simplified and shorter version of the MSR mark test, our findings suggest that negative results (whether in monkeys or humans) must be examined more closely and the results remind us

that transporting culture-specific tests among diverse human populations has the potential to lead to flawed interpretations of cognitive differences and developmental processes.

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Declaration of Conflicting Interests

The authors declared that they had no conflicts of interests with respect to their authorship or the publication of this article.

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Bios

Tanya Broesch is a PhD candidate in the Department of Psychology at Emory University. Her research interests are in early social-cognitive development across cultures as well as cultural learning in young children and adults.

Tara Callaghan is a professor of psychology at Saint Francis Xavier University in Nova Scotia, Canada. The focus of her research is on early cognitive development, specifically symbolic and cultural development early in life.

Joseph Henrich is a professor of psychology and economics at the University of British Columbia, Vancouver, Canada. His research interests are in cultural learning, development and cognition.

Christine Murphy is a graduate student in the department of anthropology at Emory University. Her research interests are in the evolution of emotion and the development of human social consciousness.

Philippe Rochat is a professor of psychology at Emory University. He received his PhD in 1984 from the University of Geneva, Switzerland. His research interests include the development of the perceived self, symbolic functioning, selective imitation, face recognition, and cross-cultural differences in the development of the sense of entitlement, ownership, sharing, and negotiation.