# Cultural differences in self-recognition: The early development of autonomous and related selves?

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Research Highlights

1. This study describes different patterns in rural Zambian, urban Scottish and urban Turkish 15 to 18-month-olds' performance in two established self-awareness tasks. Scottish infants performed best in mirror self-recognition task, whereas Zambian infants performed best in a body-as-obstacle task. Turkish infants' performance patterned in between the other nationalities.

2. This can be interpreted as a cultural difference, such that one of the tasks is better suited to an autonomous perspective of self (the mirror mark test of self-recognition), and the other appears better suited to a related perspective (body-as-obstacle test).

3. In support of this idea, associations between distal/autonomous and proximal/related parenting practices and performance in the tasks are reported.

4. This novel data highlights the importance of designing culturally sensitive tests of 'universal' cognitive developments, as exemplified for tasks measuring self-awareness in young children.

Abstract

15 to 18 month-old infants from three nationalities were observed interacting with their mothers and during two self-recognition tasks. Scottish interactions were characterized by distal contact, Zambian interactions by proximal contact, and Turkish interactions by a mixture of contact strategies. These culturally distinct experiences may scaffold different perspectives on self. In support, Scottish infants performed best in a task requiring recognition of the self in an individualistic context (mirror self-recognition), whereas Zambian infants performed best in a task requiring recognition of the self in a less individualistic context (body-as-obstacle task). Turkish infants performed similarly to Zambian infants on the body-as-obstacle task, but outperformed Zambians on the mirror self-recognition task. Verbal contact (a distal strategy) was positively related to mirror self-recognition and negatively related to passing the body-as-obstacle task. Directive action and speech (proximal strategies) were negatively related to mirror self-recognition. Self-awareness performance was best predicted by cultural context; autonomous settings predicted success in mirror self-recognition, and related settings predicted success in the body-as-obstacle task. This novel data substantiates the idea that cultural factors may play a role in the early expression of self-awareness. More broadly, the results highlight the importance of moving beyond the mark test, and designing culturally sensitive tests of self-awareness.

Self-awareness can be defined as the capacity to reflect on the self as an object in the environment. The development of self-awareness is typically measured using the mirror mark test of self-recognition (Amsterdam, 1972; Gallup, 1970). In this test, infants are surreptitiously marked on the forehead and a mirror is introduced. To pass, the infant must take self-directed action, reaching for, or trying to remove the mark. This behavior indicates that the infant has inferred a relationship between the mirror-image and themselves, and is conscious of the self as a physical object. Confirming that mirror self-recognition (MSR) is indicative of a wider sense of self-awareness, passing the mark test has been correlated with self-other differentiation in language (Courage, Edison & Howe, 2004; Lewis & Ramsay, 2004), emotion (Kochanska, Gross, Lin & Nichols, 2002; Lewis, Sullivan, Stanger & Weiss, 1989) and social interaction (Bischof-Kohler, 1991; Johnson, 1982; Nielsen & Dissanayake, 2004; Zahn-Waxler, Radke-Yarrow, Wagner & Chapman, 1992).

It has been established that the majority of infants achieve MSR by the age of two years (Courage et al., 2004; Lewis & Brooks-Gunn, 1979). This timeline is largely based on Western populations. An early paper by Priel and de Schonen (1986) showed that although infants from a Bedouin tribe had no prior experience with mirrors, they passed the mark test at the same age as Israeli infants with mirror experience. This influential paper is often cited in support of the universality of MSR. The implication of Priel and de Schonen's (1986) finding is that cultural and environmental factors have little impact on the development of self-awareness. However, newer data suggests that performance on the MSR does vary between countries. Specifically, Keller and colleagues found that Greek, German and Costa Rican infants were more likely to self-recognize early (at 18-20 months) than infants from the Nso tribe of Cameroon (Keller, Kärtner, Borke, Yovsi, & Kleis, 2005; Keller et al., 2004). Further, Kärtner, Keller, Chaudhary and Yovsi (2012) report higher MSR rates in 16 to 21-month-olds in urban contexts (within Germany and India) than rural contexts (within India

and Cameroon). Most controversially, Broesch, Callaghan, Henrich, Murphy and Rochat (2010) report that in a sample spanning 18-72 months, rates of spontaneous self-directed behavior were sometimes at floor in several non-Western locations. Rather than indicating a lack of MSR, Broesch et al. (2010) speculate that these 'failures' may be indicative of the cultural variations in autonomy. Although children in Western cultures are encouraged to be independent, and so are disposed to explore the mark, non-Western cultures often encourage compliance. This may dispose them to ignore the mark, since they may infer it was placed there purposefully by the experimenter. The implications of Broesch et al's (2010) observations for the infant MSR task are difficult to interpret due to their use of a non standard procedure and population (the majority of participants were over the age of three). However, their explanation for MSR failure in older children highlights the practical disadvantage of relying on one dependent variable to qualify the onset of self-awareness cross-culturally.

Moreover, there is a broader theoretical reason to question the acceptance of self-directed behavior as the best universal indicator of self-awareness. As reflected in Broesch et al.'s (2010) explanation, it is well established that mature conceptions of self can be differentiated according to the emphasis placed on independence versus interdependence (Markus & Kitayama, 1991). Independent (often geographically Western) cultures conceive of self as a distinct and autonomous individual, whilst interdependent (often geographically non-Western) cultures conceive of self in relation to others. This fundamental difference in orientation may well underlie the Western bias in MSR performance, for which recognition of the self as distinct from others is necessary. Indeed, whereas Broesch et al. (2010) treat cross-cultural variations in MSR performance as an artificial effect stemming from cultural conventions in social situations, Keller et al. (2005; 2004) suggest that cultural variations on the mark test may be indicative of true variations in the quality of early self-awareness.

Specifically, Keller et al. (2005; 2004) describe how early parenting practices aimed at emphasizing autonomy (e.g. face-to-face contact) as opposed to relatedness (e.g. physical contact) may scaffold infants' conception of self as a distinct individual. Keller et al. (2005; 2004) suggest that this encourages the process of self-awareness to onset earlier in independent cultures, as highlighted by German infants' precocious passing of the mark test. However, the MSR task defines and measures self-awareness as a process of 'individualization'. Might other measures be better suited to establishing the onset of objective self-awareness in interdependent cultures?

The current study sought to identify an established measure of self-awareness in which infants who see the self as an integrated object might have the advantage. Using an established test was important as the measurement of self-awareness is notoriously controversial (Mitchell, 1997). The methodology chosen has a longer, though far less active, history than MSR. Piaget (1953/1977) reported observing his 18-month-old daughter trying unsuccessfully to pick up a rag that she was standing on, apparently not understanding that her body weight was the cause of the resistance. However, she was soon able to solve this self-related problem, stepping off of the rag in order to retrieve it. This ontogeny was later replicated under experimental conditions. Bullock & Lutkenhaus (1990) and Geppert & Kuster (1983) report that infants tend to pass the "mat task" at around 18 months. Most recently, Moore, Mealiea, Garon and Povinelli (2007) developed a novel apparatus for the 'body-as-obstacle' test, designed to rule out the possibility that infants learn to pass through trial and error. Infants were placed on a mat which was attached to the axle of a toy shopping trolley and encouraged to push the trolley towards their mother. Moore et al. (2007) found that significantly more 21-month-olds appreciated the need to step off of the mat than 15-month-olds. Moreover, this developmental lag was specific to self; there was no age difference in solving the task when a heavy object was placed on the mat rather than the

infant, and only the self version of the task correlated with MSR performance. Brownell, Zerwas and Ramani (2007) confirm that self and non-self versions of the obstacle task do not correlate. These results establish the body-as-obstacle test as a measurement of objective self-awareness. However, having observed only a moderate correlation between MSR and body-as-obstacle performance, Moore et al (2007) suggest that the tasks may tap different but related aspects of the objective self. Specifically, they suggest that whereas MSR measures awareness of the self as an object with a differentiated identity (based on visual appearance), the body-as-obstacle task requires recognition of the self as an object like other objects, with physical properties that have a causal impact on the environment.

By our estimation, both the body-as-obstacle task and MSR involve reflections on causality and the relation between self and objects. In the MSR the infant must consider their body to 'cause' the reflection in order to appreciate its relevance. This self-recognition can be achieved either by recognition of contingency (when I move the image moves) or by concrete representation of one's own features. In western samples, the available evidence suggests that contingency detection may provide an important support for concrete feature recognition, since infants achieve MSR before accurately self-recognizing in photographs (Courage, Edison & Howe, 2004). However, we know that passive 'agency' is insufficient to pass the task, since infants can detect disruptions in the normal contingency between felt and seen movement from as early as three months (Bahrick & Watson, 1985; Morgan & Rochat, 1997; Rochat & Morgan, 1995). Whether an understanding of having 'caused' the mirror image is supported by contingency detection or feature identification, mark directed behavior is the crucial step needed to indicate that the infant has made an explicit, cognitive connection between the mirror image and their own body. The ability to reason about causality and the self is also required to solve the body-as-obstacle problem; infants must appreciate that their own body weight is preventing movement of the object. However, unlike the mirror task,

there is no self-reflection inherent in the set up of the test (the object's movements do not display themselves to be directly connected to the infant's movements or features). As a result, the infant must arrive at the 'idea of me' without processing an external representation of their identity. Instead, the relevance of self is completely embodied. The dependent variables of the tasks can also be contrasted. As argued by Broesch et al (2010), having an 'idea of me' might not be sufficient to motivate mark directed behavior in the MSR task. For this to occur spontaneously, infants must be self-motivated to attend to their physical appearance. On the contrary, the dependent variable in the body-as-obstacle task is both other-focused and explicit; the child is asked to deliver the object to another person. Thus, although both the MSR and body-as-obstacle tasks measure objective self-awareness, the context in which they do so has some important differences.

Following the above assessment of task demands, and in keeping with previous research, we hypothesize that infants from independent cultures may pass the MSR task precociously in comparison to infants from interdependent cultures (Broesch et al, 2010; Kärtner et al, 2012; Keller et al. 2005; 2004), whilst the opposite pattern may hold for the body-as-obstacle task. The MSR task presents infants with a representation of their outer appearance, and expects them to be motivated to act on it. This may provide a natural test of self-awareness in individualistic cultures. However, MSR is a less important developmental milestone in other cultural settings, where self-representation is built on the relation between people and individualistic reflection on self is less encouraged. Thus, although we might accurately consider MSR universal infant achievement, this does not imply that the test measures the aspect of self-awareness most relevant, and most nascent, in all cultures (though see Rochat, Broesch, & Jayne, 2012 for an interesting adaption of the MSR which emphasizes other's perspectives on self). The body-as-obstacle task is introduced as an established measure of cognitive self-recognition which avoids an emphasis on individualistic

self-reflection, providing an embodied test of self-awareness which might be better suited to capturing the earliest onset of self-awareness in interdependent cultures by virtue of a) avoiding a focus on appearance and b) making explicit demands of the infant to complete a goal in a social context.

In addition to highlighting the interaction between culture and different measures of self-awareness, we aimed to explore the mechanism by which culture might shape the experience of self. This topic has arguably been given short shrift by Western developmental psychology. Although there has been considerable interest in parenting practices and their cultural variation, with the exception of the studies reviewed above (Broesch et al., 2010; Keller et al., 2005; 2004; Priel & deSchonen, 1986), few authors have explicitly linked early socio-environmental factors to developing self-awareness. One reason for this omission may be the dominant view of self-awareness as a universal cognitive process, leading some to argue that although the content of self-awareness may vary cross-culturally, its onset is impervious to social or environmental influence. However, the universality of self-awareness does not preclude its developing through different developmental pathways or to different schedules. See work concerning the development of theory of mind as a case in point (Shahaeian, Peterson, Slaughter & Wellman, 2011). Thus, although it is generally accepted that the quality of self-awareness varies cross-culturally in adulthood (as captured by terms such as independence and interdependence), very little thought has been given to the ontogeny or phylogeny of these differences.

To address this research gap, we use a cross-sectional design to assess the concurrent relationship between parenting practices emphasizing autonomy and relatedness and self-awareness, as measured by MSR and the body-as-obstacle test. To achieve this we collected data from three countries; Zambia, Turkey, and Scotland. It is well established that the dominant perspective on self in rural Africa is interdependent, whereas the dominant

perspective on self in Europe is independent (Hofstede, 2001). However, this dichotomization of self is increasingly criticized as simplistic, and for implying that autonomy and relatedness are incompatible (Kagitcibasi, 2005; 2012). Indeed, several cultures show 'mixed' forms of self-awareness, where autonomous and related perspectives on self interact. For example, although Asian countries are traditionally interdependent, the Westernization of urban areas has led to an increasing emphasis on individualistic values (Hofstede, 2001). These areas are more clearly categorized as having an autonomous-related model of self; in contrast to the autonomous-separate self dominant in Europe, and the heteronymous-related self dominant in Africa (Kagitcibasi, 2005; 2012). Further, there is of course intra-national variation in cultural experiences. For example, whereas urbanization and education are associated with ideas, customs and social behaviors which support an experience of autonomy, rural settings are more likely to lead to a related model of self (see Kärtner et al, 2012). Indeed, culture has the potential to vary on an inter-individual level, as implied by Keller et al's (2004) emphasis on the role of parenting practices in the transmission of culture in infancy.

Importantly, 'mixed' cultural settings may allow a finer test of the hypothesis that parenting practices are key factors in the socialization of different perspectives on self. Keller et al. (2004) demonstrate that urban Costa Rican infants experience aspects of both distal and proximal parenting. These infants profiled between urban Greek and rural Cameroonian infants on tests of MSR. Likewise, Kärtner et al (2012) report that urban German mothers prioritized autonomous socialization goals; whereas rural Indian and Cameroonian mothers prioritized the socialization of relatedness and urban Indian mothers prioritized a mixture of autonomous and related goals. MSR rates varied accordingly, with the strongest performance in urban settings. Taking a similar approach, we selected a group of rural Zambian, urban Scottish and urban Turkish infants to complete the two self-awareness tasks. We expected urban Scottish participants to show precocious MSR, in line with their parent's distal

socialization strategies, and the dominant cultural perspective of autonomous-separateness. In contrast, given the dominant cultural model of heteronymous-relatedness in rural Africa, we expected the typical parenting style for Zambian mothers to be proximal, and for these infants to show precocious performance in the body-as-obstacle task. Finally, we expected urban Turkish infants to profile between these cultures. Specifically, in keeping with an autonomous-related model of self, we expected urban Turkish infants to experience both distal and proximal parenting practices, and show intermediate or mixed performance in the self-awareness tasks. Intermediate performance could be expressed as performing between urban and rural samples in MSR, as found by Keller et al (2004). Alternatively, Turkish infants might show a mixed profile by performing similarly to other urban infants in the MSR test (as found by Kärtner et al, 2012), but more closely to the rural (related) sample in the body-as-obstacle task.

The parenting practices selected for encoding in the current study (body contact, verbal contact, mutual eye gaze and physical and verbal direction) build on and extend previous research. We share Keller et al's (2004) idea that self-awareness is socialized, and that parents are likely to be the primary socialization agents. Although making concurrent as opposed to longitudinal projections concerning the link between parenting and self-awareness, we take a similar approach to Keller et al (2004) by sampling behavioral interactions between mother and infant to qualify parenting. We also draw on Keller et al's (2004) argument that distal parenting practices can be related to the scaffolding of autonomy, whereas proximal parenting strategies are likely to facilitate relatedness (as measured by self-regulation in their study). Indeed, selection of body contact and mutual eye gaze as potentially important factors impacting on the socialization of self-awareness are drawn directly from Keller et al's (2004) study; the inclusion of verbal contact is a natural addition to address key features of interaction in our older population. More recently, Keller and

colleagues have constructed an empirically and theoretically sound rationale for how early face-to-face interaction and contingent responsiveness could lead to an increased awareness for internal mental states, which then leads to earlier MSR development (see Keller & Kärtner, 2013 or Kärtner, 2015 for a review). However, we also wished to provide data that would extend previous studies by providing a test of objective self-awareness suited to related contexts, and linking performance in this test with proximal parenting. Specifically, we built on Keller et al's (2004) idea that social compliance is an important indicator of the related self, by introducing the idea that directive contact might scaffold relatedness.

When direction is physical, infants' actions literally become an extension of their mothers' goals. Thus high levels of physical direction, together with supportive bodily contact, may be best suited to shaping heteronymous-related perspectives on self, and less conducive to autonomous-separateness. The proximally supported infants' typical experience of self emphasizes body over mind, and the boundaries between self and other are blurred. Although verbal contact and eye contact also establish a connection between self and other (and may be directive) the distal nature of these strategies means that a separation between self and other, and own and other's goals is maintained (the infant has a choice as to whether to adopt their mother's direction). For this reason, reliance on verbal contact and mutual eye gaze may be more supportive of autonomous-separateness than heteronymous-related perspectives on self. The distally supported infants' typical experience of self is as an autonomous, distinct agent. Nonetheless, we might expect the quality of speech within heteronymous-related cultures to be adapted to their socialization goals. In other words, directive speech might be relatively common in heteronymous-related relative to autonomous-separate cultures; since directive speech can be used as a strategy to encourage compliance, and create shared goals.

Although these ideas concerning how socialization might foster different perspectives on self are speculative, they are parsimonious in that they describe how distal and proximal parenting can influence self-awareness even without the mediating factor of mind mindedness. On this reading, infants typically given an autonomous-separate perspective are expected to excel in MSR precisely because the test requires taking an autonomous-separate perspective to pass. On the contrary, infants raised with experiences of heteronymous-relatedness might excel in the body-as-obstacle task precisely because this task does not require them to adopt an individualistic perspective.

## Methods

### *Participants*

86 mother-infant dyads participated, 33 from Ikelenge, Zambia (16 male), 31 from Dundee, Scotland (17 male) and 22 from Istanbul, Turkey (12 male). Since no significant results for gender were found, gender is not reported as a factor in analyses. Infants were aged between 15 and 18 months (Zambian $M$ = 16.79, Scottish $M$ = 16.55, Turkish $M$ = 16.14) and able to walk unsupported. This stage was chosen as it encompasses the earliest period at which MSR and body-as-obstacle tasks may be passed, allowing us to measure precocious performance (Courage et al., 2004; Moore et al., 2007). As is common in rural cultures, mothers reported that Zambian infants started to walk earlier (49% walked prior to 12 months) than Scottish (22%) and Turkish (36%) infants. Although short of significance ($\chi^2$ (2, $N$ = 86) = 4.65, $p$ = .09, $\Phi$ = .23), this is potentially important as previous research has identified the earlier onset of walking as a potential factor in passing the body-as-obstacle task (Brownell et al., 2007). However, a univariate ANOVA including nationality and early/late walking (median split 12 months) as fixed factors confirmed no main effect of early walking on body-as-obstacle performance ($F$ (*1, 69)* = .50, *MSE =.23, p = .48,* $n_p^2$ = .01); and no significant interaction

between early walking and nationality impacting on performance ($F$ ($2$, $69$) = .92, $MSE$ = .23, $p$ = .40, $n_p^2$ = .03). Scottish and Turkish infants were living in an urban, densely populated environment with mothers from a variety of employment settings/educational backgrounds. In contrast Zambian infants lived in a rural village setting, and the majority of mothers had limited educational backgrounds and worked in farming. Scottish and Turkish data were collected by researchers native to the country (authors two and five) travelling alone, whereas Zambian data were collected by a Scottish researcher (author four) with the aid of a translator/local guide. Participants were identified through word of mouth. In Scotland, testing took place in dyads' homes. In Zambia, testing occurred outside in a private area of the grounds of a local school, close to where mothers and infants typically congregated. In Turkey, testing took place either at home (12 infants) or in a private area of the infant's nursery, according to the mother's choice. Although testing environments varied, the unifying factor was that all dyads were tested in a location where they indicated they would feel most comfortable. In following this sampling method, we hoped to facilitate natural interactions.

Over 90% of Scottish and Turkish infants had regular experiences of interacting with the mirror, compared to 15% of Zambian infants. Moreover, none of the Zambians had experience of the toy shopping trolley used in the body-as-obstacle task, whilst approximately half of Turkish and Scottish infants had played with similar toys in the past. Perhaps as a result, nine Zambians would not engage with the body-as-obstacle task (refusing to approach the trolley to play in the familiarization phase), compared to one Scottish and one Turkish infant (one Scottish infant also declined to participate in the MSR test). All mothers and children reported being comfortable and familiar with the concept of stacking cups introduced to facilitate social interaction. In the field, we allowed mothers to signal an end to the play rather than setting a minimum or maximum time limit in order to capture the most

natural interactions. However, a time limit on the amount of interaction coded was used to ensure comparability between dyads. Ultimately, this meant that interactions from one Zambian, four Scottish and five Turkish dyads were excluded from analysis due to their brevity.

*Materials*

Testing was filmed using a digital video recorder. Verbatim transcriptions/translations of mother's speech during cup play were also produced. On site task materials included multi-colored stacking cups, a toy supermarket trolley (height 59.5cm) with an attached mat (74cmX36cm), and a large mirror (59cmX90cm).

*Procedure and coding*

Mother-infant interactions were measured separately from self-awareness tasks to allow independent assessment of the two. After providing consent and relevant background information, mothers were asked to play with their infant with stacking cups. This toy was introduced to provide parity of focus for the interactions. Although mothers were given no instruction on how to play with their child, the stacking cups naturally afforded the opportunity for stacking and/or tower building activities, and these activities characterized the majority of cup play interactions. The quality of social interaction during the first 1.5 minutes of cup play was coded for key markers of distal (verbal contact, mutual eye gaze) and proximal (body contact, directive contact) parenting strategies. Following Keller et al.'s (2004) time-sampling method, body contact and mutual eye gaze were coded in 5 second intervals, giving a count of up to 18 intervals in which these behaviors might be present. Directive action (where the mother physically controlled the infant's action) was scored according to the same system. Verbal contact was coded by counting the number of discrete phrases (e.g. well done!) uttered by the mother, and further broken down to compute the proportion of directive phrases (e.g. put this here!) spoken. Although the period of interaction

was brief, it was sufficient to identify large differences in mother-infant interaction between nationalities which were indicative of the expected differences in parenting style.

Following cup play, the mothers were invited to play in front of the mirror with their infant. Although mothers were given no instruction on how to play with their child, the majority of interactions were characterized by encouraging the child to engage with their reflection. This period of familiarization was important given several infants had limited experience of the mirror. The mirror was then removed and the infant was given a toy supermarket trolley to play with. This was necessary to ensure the infant could push the trolley to their caregiver under normal circumstances, and to familiarize the infants with the stimulus, since several had no experience with shopping trolleys (see *Participants*). Mothers were then asked to remain silent for the testing phase.

During the testing phase of the body-as-obstacle task, a mat was attached to the axle of the trolley and the infant placed on top of the mat. The researcher encouraged the infant to push the trolley to their mother, who was approximately two meters away. However, the infant's bodyweight prevented the trolley from being pushed. To successfully move the trolley to their mother infants had to stop standing on the mat, instead moving to the side or front of the trolley. Infants who spontaneously stepped away from the mat and moved the trolley were considered to pass. The task was stopped when the infant passed, became distressed, or after five failed attempts at pushing the trolley whilst standing on the mat. The mat was then removed and a further period of free play with the shopping trolley ensued.

During this second period of free play a sticker was discreetly applied on the infant's forehead by the mother, in preparation for the testing phase of the mirror task. No infant reached for the sticker prior to introduction of the mirror, indicating that the marking event was not felt. During the test phase, dyads were invited to play again in front of the mirror.

Infants who spontaneously reached up to touch within 2cm of the sticker were considered to pass.

*Inter-rater reliability*

Performance was coded by authors two, four and five for their own geographical setting. To ensure reliability and provide training the first 20% of participants from each nationality were also coded by the first author. For this subsample, intra-class correlation (ICC) analyses indicated strong agreement for all social interactions variables (Body contact ICC = .99; Directive action: ICC = .95; Mutual eye gaze: ICC = .80; Verbal contact: ICC = .99; % Directive speech: ICC = .98). Initial body-as-obstacle scores were in moderate agreement (k = .57), and MSR scores were in almost perfect agreement (k = .87). Initial disagreements in coding success in the body-as-obstacle task arose from the situation where infants moved one or part of their feet from the mat as though by accident, whilst focused on applying physical force to the trolley. Although the trolley moved in this situation, we reasoned that those who had solved the problem insightfully (including self-representation) would more likely have stepped away from the mat entirely and purposefully (e.g. visually monitoring the movement). Since we wished to reward only insightful solutions, the coders subsequently agreed to count this unanticipated situation as a fail.

Results

*Mother-infant interaction*

As shown in Table 1, Zambian interactions were characterized by high levels of body contact and directive action, and low levels of verbal contact, indicating a preference for proximal parenting. When verbal contact was used by Zambian mothers, it was almost all used for direction. Scottish interactions showed the opposite pattern, indicating a preference for distal

parenting. High levels of verbal contact were used, around a quarter of which was directive. Turkish dyads showed a mixed pattern, using low levels of body contact, but relatively high levels of directive action and speech (over half of mother's phrases were directive). Perhaps due to a focus on the cups, rates of mutual eye gaze were very low for all groups, though they were highest for Scots. Multivariate ANOVA confirmed a significant effect of cultural group on the quality of social interaction for all variables aside from mutual eye gaze (verbal contact $F\ (2, 75) = 40.48$, $MSE = 108.24$, $p < .001$, $n_p^2 = .53$; % directive speech $F\ (2, 75) = 112.99$, $MSE = .026$, $p < .001$, $n_p^2 = .76$; mutual eye gaze $F\ (2, 75) = 2.18$, $MSE = 1.07$, $p = .12$, $n_p^2 = .06$; body contact: $F\ (2,75) = 27.39$, $MSE = 42.37$, $p < .001$, $n_p^2 = .43$; directive action: $F\ (2, 75) = 12.37$, $MSE = 23.65$, $p < .001$, $n_p^2 = .26$). Post hoc Bonferroni comparisons run for significant results indicated that each culture profiled significantly differently ($p < .05$) for body contact, verbal contact and directive speech. However, Turkish and Zambian mothers exhibited equivalent levels of directive action ($p = .65$).

Table 1 The quality of mother –infant interaction, split by cultural group

| | | Cultural group | | |
|---|---|---|---|---|
| Parenting strategy | | Rural Zambian | Urban Scottish | Urban Turkish |
| 1. | Verbal contact | $M = 7.8$, $SD = .8$ | $M = 31.9$, $SD = 2.7$ | $M = 19.5$, $SD = 2.3$ |
| 2. | % verbal direction | $M = .91$, $SD = .03$ | $M = .27$, $SD = .03$ | $M = .57$, $SD = .03$ |
| 3. | Mutual eye gaze | $M = .6$, $SD = .2$ | $M = 1.1$, $SD = .2$ | $M = .57$, $SD = .3$ |
| 4. | Body contact | $M = 14.6$, $SD = 1.2$ | $M = 6.7$, $SD = 1.5$ | $M = .6$, $SD = .4$ |
| 5. | Directive action | $M = 9.9$, $SD = .9$ | $M = 3.6$, $SD = .4$ | $M = 8$, $SD = 1.5$ |

*Notes:*
*1. Number of phrases spoken to the infant during 90 seconds of play*
*2. % of phrases which direct the infant to do something (e.g. put this here!)*
*3. Number of five second intervals (of 18) including mutual eye gaze*
*4. Number of five second intervals (of 18) including body contact*
*5. Number of five second intervals (of 18) including directive action i.e. mother physically guides play*

*Self-awareness performance*

Figure 1 shows the pass rate of each cultural group on the self-awareness tasks. 3 x 2 Fisher's exact tests confirmed that performance in the MSR ($\chi^2$ (2, $N$ = 85) = 7.15, $p$ = .03, Φ = .28) and body-as-obstacle tasks ($\chi^2$ (2, $N$ = 75) = 6.95, $p$ = .03, Φ = .30) differed depending on cultural group. Individual comparisons between cultural groups were made using 2 x 2 Fisher's exact tests (Scottish x Zambian; Scottish x Turkish; Turkish x Zambian). As shown in Figure 1, Scottish and Turkish infants' MSR performance was similar ($\chi^2$ (1, $N$ = 52) = .31, $p$ = 1.00, Φ = .02), in comparison to Zambian infants who achieved MSR less often than Scottish ($\chi^2$ (1, $N$ = 63) = 6.25, $p$ = .02, Φ = .31) and marginally less often than Turkish infants ($\chi^2$ (1, $N$ = 55) = 4.56, $p$ = .05, Φ = .29). In contrast, Turkish and Zambian infants' performance in the body-as-obstacle task was equivalent ($\chi^2$ (1, $N$ = 45) = .23, $p$ = .77, Φ = .07), and Scottish performance was the outlier (in comparison to Turkish: $\chi^2$ (1, $N$ = 51) = 6.01, $p$ = .02, Φ = .34); and Zambian infants: $\chi^2$ (1, $N$ = 54) = 4.18, $p$ = .04, Φ = .27).

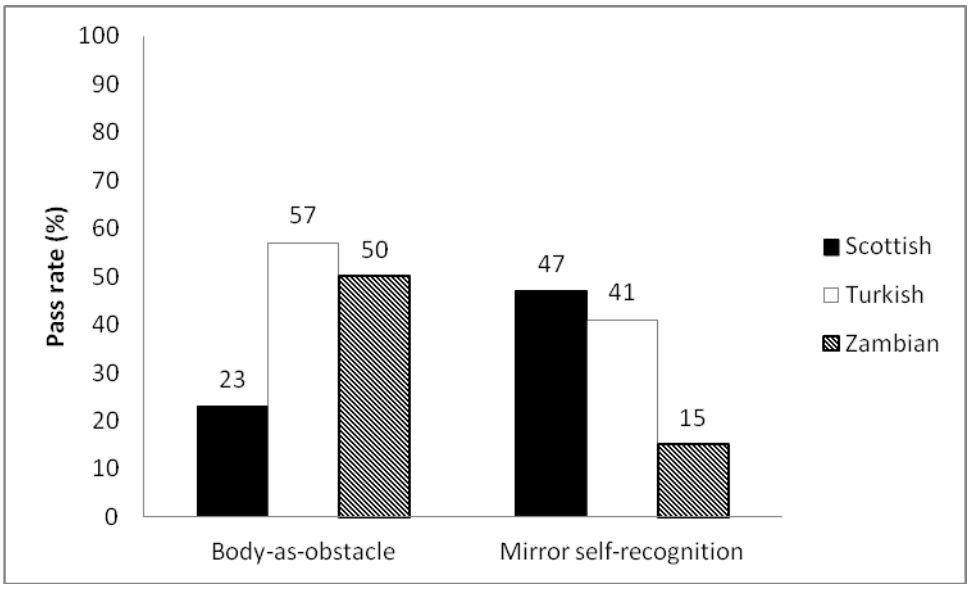


Figure 1 Self-awareness performance, split by task type and cultural group.

*Associations between the quality of mother-infant interaction and self-awareness performance*

Table 2 shows the results of correlation analyses testing the relationships between distal and proximal parenting strategies, and between these variables and self-awareness performance.

Pearson's correlations indicated that verbal contact was significantly negatively related to body contact ($p$ <.001), indicating that mothers tended to prioritize either distal or proximal parenting. The proportion of directive speech was significantly negatively related to overall levels of verbal contact, and positively related to body contact and directive action (all $p < .001$). This implies that those prioritizing proximal parenting (using higher levels of physical than verbal contact) typically used high levels of direction.

Spearman's correlations indicated that performance in the MSR task was significantly positively related to verbal contact ($p$ = .03) and negatively related to directive action ($p$ = .02) and directive speech ($p$ =.01). In contrast, performance in the body-as-obstacle task was significantly negatively related to verbal contact ($p$ = .03). Thus, MSR was positively associated with distal parenting, and negatively associated with direction. On the contrary, the body-as-obstacle task was negatively associated with distal parenting.

Table 2 Association between parenting strategies and self-awareness performance

| | | | Correlation | | | | |
|---|---|---|---|---|---|---|---|
| Parenting strategy | | | 1. | 2. | 3. | 4. | 5. |
| | 1. | Verbal contact | | | . | | |
| | 2. | % verbal direction | -.69** | | | | |
| | 3. | Mutual eye gaze | .22ǂ | -.20ǂ | | | |
| | 4. | Body contact | -.32** | .47** | -.15 | | |
| | 5. | Directive action | -.20ǂ | .40** | -.22ǂ | -.18ǂ | |
| Self-awareness task | 6. | Body-as-obstacle | -.27* | .21ǂ | .09 | -.07 | -.02 |
| | 7. | Mirror self-recognition | .25* | -.28* | -.04 | -.14 | -.25* |

ǂ p <.10, * p <.05, **p<.01

*Notes:*
*1. Number of phrases spoken to the infant during 90 seconds of play*
*2. % of phrases which direct the infant to do something (e.g. put this here!)*
*3. Number of five second intervals (of 18) including mutual eye gaze*
*4. Number of five second intervals (of 18) including body contact*
*5. Number of five second intervals (of 18) including directive action i.e. mother physically guides play*

*Association between self-awareness tasks*

Fisher's exact tests confirmed that performance in the MSR was not related to performance in the body-as-obstacle task ($\chi^2(1, N = 74) = .003$, $p = .96$, $\Phi = .006$). This dissociation held when computing the concordance separately for each cultural group (Zambian $\chi^2(1, N = 24) = .1.20$, $p = .29$, $\Phi = .22$; Turkish ($\chi^2(1, N = 21) = .58$, $p = .37$, $\Phi = .17$; Scottish ($\chi^2(1, N = 29) = .97$, $p = .29$, $\Phi = .18$).

*Using culture and parenting as predictors of self-awareness performance*

Hierarchical logistic regression analyses were used to assess the extent to which cultural groups and/or parenting variables could be used to predict self-awareness performance. Cultural group was represented by two effect coding variables entered in block one. The first cultural variable coded the rural Zambians as zero, and the urban Scottish and Turkish infants as one; corresponding to the hypothesized cultural dimension of autonomy versus

heteronomy. The second cultural variable coded the Scottish infants as zero, and Zambian and Turkish infants as one; corresponding to the hypothesized cultural dimension of relatedness versus separateness. Guided by the significant associations observed between distal and proximal parenting practices and self-awareness, relevant parenting variables were entered alongside the cultural variables in block two. Distal parenting was represented by verbal contact and proximal parenting by direction (directive action and % directive speech). Regression analyses were computed separately for each self-awareness task. These analyses ask whether cultural context can be used to predict self-awareness performance (step 1), and whether this variance can be attributed to parenting (step 2).

Results of the regression analyses are summarized in Table 3. Cultural context predicted a significant 13.80% (Nagelkerke $R^2$) of the variance in MSR performance. However, only the autonomous/heteronymous (urban/rural) variable could be used individually to predict success. Further, although the variance predicted increased to 18.6% when parenting was added to the model, none of the parenting variables made an individually significant contribution; an autonomous context continued to be the only individually significant predictor.

The opposite pattern held for the body-as-obstacle task. Culture predicted a significant 16.00% of the variance in body-as-obstacle performance. However, only the relatedness/separateness variable could be used individually to predict success. Although the variance explained increased to 23% when parenting was entered, none of the parenting variables made an individually significant contribution to the model; a related context continued to be the only individually significant predictor.

Together, these analyses confirm that cultural variables can be used to predict self-awareness performance, and that different dimensions of culture predict performance in MSR versus body-as-obstacle performance.

Table 3 Logistic regression using culture and parenting as predictors of self-awareness performance

| | *B* | Wald | exp (*B*) | *p* |
|---|---|---|---|---|
| **Predicting mirror self-recognition** | | | | |
| Step 1: Culture | | | | |
| $\chi^2$ (2, N =76) = 7.94, *p* = .02* | | | | |
| 1. Autonomy-Heteronomy | 1.57 | 5.20 | 4.80 | .02* |
| 2. Relatedness-Separateness | .10 | .03 | 1.11 | .86 |
| Step 2: Culture and parenting | | | | |
| $\chi^2$ (5) = 10.93, *p* = .049* | | | | |
| 1. Autonomy-Heteronomy | 1.51 | 4.20 | 4.55 | .04* |
| 2. Relatedness-Separateness | 1.06 | 1.35 | 2.90 | .24 |
| 3. Verbal contact | .10 | .28 | 1.01 | .60 |
| 4. % verbal direction | -1.31 | .59 | .27 | .44 |
| 5. Directive action | -.09 | 2.28 | .91 | .13 |
| **Predicting body-as-obstacle performance** | | | | |
| Step 1: Culture | | | | |
| $\chi^2$ (2, N = 66) = 8.36, *p* = .01* | | | | |
| 1. Autonomy-Heteronomy | .42 | .41 | 1.53 | .52 |
| 2. Relatedness-Separateness | 1.76 | 6.47 | 5.83 | .01* |
| Step 2: Culture and parenting | | | | |
| $\chi^2$ (5) = 12.39, *p* = .03* | | | | |
| 1. Autonomy-Heteronomy | -.02 | -.00 | .98 | .98 |
| 2. Relatedness-Separateness | 2.45 | 5.39 | 11.64 | .02* |
| 3. Verbal contact | -.03 | .98 | .97 | .32 |
| 4. % verbal direction | -1.90 | .77 | .15 | .38 |
| 5. Directive action | -.08 | 1.90 | .92 | .17 |

**p < .05*

*Notes:*

*1. Rural Zambians coded as zero, and the urban Scottish and Turkish infants as one; corresponding to the hypothesized cultural dimension of autonomy versus heteronomy.*

*2. Scottish infants coded as zero, and Zambian and Turkish infants as one; corresponding to the hypothesized cultural dimension of relatedness versus separateness.*

*3. Number of phrases spoken to the infant during 90 seconds of play*

*% of phrases which direct the infant to do something (e.g. put this here!)*

*5. Number of five second intervals (of 18) including directive action i.e. mother physically guides play*

## Discussion

In keeping with an autonomous-separate perspective on self, urban Scottish mothers used more distal parenting practices than rural Zambian mothers. The opposite pattern held for proximal parenting strategies, as might be predicted given the heteronymous-related model of self dominant in rural cultures. Urban Turkish mothers used both distal and proximal contact, as predicted by an autonomous-related model of self. Supporting the idea that infant's performance in the self-awareness tasks may reflect these distinct perspectives on self, MSR scores were highest in the Scottish sample, and lowest in the Zambian sample. Body-as-obstacle scores showed the opposite pattern. Providing support for the importance of individual parenting experiences, infants whose mothers used high levels of verbal communication (in keeping with a distal parenting preference) were more likely to pass the MSR task, and less likely to pass the body-as-obstacle test. In contrast, infants whose mothers tended to physically and verbally direct their actions (in keeping with a proximal parenting preference) were less likely to achieve self-other differentiation, as measured by the mark test. These significant relationships are important as they confirm that performance in self-awareness tasks is subject to cross-cultural variation, and are in line with the predictions made concerning the construction of culturally distinct selves.

However, our parenting variables had limited value in explaining the cross-cultural variance in self-awareness performance. Of the proximal parenting variables measured, body contact varied between groups as predicted, but was not related to task performance; only direction could be associated with self-awareness. However, rather than being positively related to performance in the body-as-obstacle test, directive action and speech was negatively related to MSR. Of the distal parenting variables measured, only verbal contact could be related to performance in self-awareness tasks, since mutual eye gaze occurred only at very low levels across all dyads. High levels of verbal contact were positively associated

with passing the MSR task and negatively associated with passing the body-as-obstacle task. . Moreover, although parenting variables could be combined with culture to model self-awareness performance, cultural setting was ultimately the strongest predictor. Specifically, whether the infant lived in a setting known to emphasize autonomy over heteronomy predicted success in MSR, whereas passing the body-as-obstacle task was predicted by whether the infant lived in setting known to value relatedness over separateness. In other words, culture as measured at a macro level by location was more informative than culture as measured at a micro level by specific parenting practices.

The superior predictive value of location might be considered damaging to the argument that the quality of self-awareness is socially constructed through parenting. However, it is reasonable to find that super-ordinate variables have more explanatory power than subordinate variables. Our groups were chosen from different settings known to support different cultural perspectives of self in adulthood. The behavioral variables measured were advanced as potential exemplars of how different cultural models of self might be transmitted through parenting; they were not considered exhaustive measures. Indeed, numerous social factors which may contribute to the early development of self-awareness are left unmeasured. For example, Kärtner et al (2012) speculate that responding contingently to infant's actions in face-to-face interaction may foster a sense of agency, whereas joint attention, imitation and mother's reference to infant's mental states may build a sense of autonomy.

Given the difficulty of adequately capturing the multitude of behavioral variables that may contribute to the socialization of self-awareness, Kärtner et al (2012) take a different approach to the problem of quantifying culture. Instead of observing mother-infant interaction directly, they ask mothers the extent to which they endorsed socialization goals aligned to autonomous versus related perspectives. These endorsements ultimately offered a more powerful predictor of MSR performance than the locations to which the dyads belonged

(urban German, urban or rural Indian, rural Cameroonian). Thus, Kärtner et al (2012) were able to pinpoint more precisely that different attitudes to self are associated with differences in MSR. However, Kärtner et al (2012) are left to speculate what the important behavioral correlates of mother's socialization goals may be, in other words, how these attitudes change infants' experience of self. For this reason, we suggest that future studies might usefully adopt a combination of behavioral and attitudinal data to pinpoint the social factors associated with performance in the self-awareness tasks. The combination of attitudinal and behavioral data might also help to navigate issues concerning the interaction between culture and the testing context raised by Broesch et al (2010). Here, we find rural mothers to be very directive and to maintain relatively close physical contact with their infants. However, the Zambian sample was the only sample to be observed by a non native researcher (in addition to a local guide), and so these dyads may have been the least comfortable with the testing situation. Although the rural preference for proximal parenting can also be established by self-report, and is therefore unlikely to be reducible to testing context, it is nonetheless important to acknowledge this limitation. Data concerning the socialization of self-awareness will only be accurate to the extent that we can take natural observations and measurements of social interaction.

It is also important to consider alternative explanations for the cross-cultural differences in self-awareness found. In the current sample, Scottish and Turkish infants were more familiar with mirrors than the Zambian infants, and it is possible that this environmental difference led to the urban groups' advantage in MSR. Although intuitively plausible, there is no evidence to suggest that increased familiarity with mirrors plays an important role in passing the mark test. In addition to Priel and DeSchonen's (1986) observation that MSR requires only brief exposure to mirrors, longitudinal research implies that repeated exposure to the MSR test does not result in earlier self-recognition (see Courage, et al, 2004; Hart &

Fegley, 1994; Lewis & Brooks-Gunn, 1979), even in samples who begin the study with very low mirror familiarity (Kärtner et al, 2012). Moreover, Vyt (2001) and Courage et al. (2004) have shown that the ability to use reflective surfaces to infer the location of objects is variable in onset, sometimes preceding and sometimes following MSR. These results are in line with the idea that MSR is based on cognitive self-awareness, as opposed to general cognitive reasoning or learnt familiarity with the self-image. In additional to cultural variation in mirror familiarity, mothers reported earlier walking for rural infants. It is possible that this difference may have resulted in more encounters with physical obstacles, leading to the Zambian advantage on the body-as-obstacle task. However, our data did not support this explanation, as we did not find a statistical link between the onset of walking and performance on the body-as-obstacle task.

Whatever the explanation for the cultural difference, this study highlights the necessity of recognizing that the measurement of self-awareness is inextricably bound with the context of our development. More care needs to be taken in measuring self-awareness if valid cross-cultural comparisons are to be made. There are both theoretical and empirical reasons to believe that the MSR test may not provide a full profile of self-awareness, and could be challenging for those whose dominant perspective on self is interdependent. The reverse may be true of the body-as-obstacle task. This is the first research to identify an established empirical measure of self-awareness which may be well suited to interdependent cultures. In support of the distinction between the form of objective self-awareness measured by the MSR and body-as-obstacle tasks (first raised by Moore et al, 2007), we find a dissociation between performance in the tasks within and between different cultural settings. Performance in the tasks was not related, and whereas autonomy was predictive of success in the MSR task, relatedness predicted success in the body-as-obstacle task.

We hypothesized that autonomous cultures would perform well in the MSR task due to its familiar individualistic context. In contrast, we expected related cultures to be more successful in the body-as-obstacle task, by virtue of a lack of requirement for individualism (in recognizing or being motivated by self-image), and the inclusion of an other-focused and explicit goal (infants are explicitly told to deliver the trolley to their mother). However, the data go beyond this prediction, indicating that infants from related cultures actively outperform infants from cultures emphasizing separateness in the body-as-obstacle task. This implies that the body-as-obstacle task is suited to interdependent cultures not only due to the absence of individualism but due to an active, facilitating factor related to that context. Since we would expect infants from all contexts to respond well to explicit goals, the other-focused nature of the dependent variable is the obvious candidate to explain this facilitation. Isolation of this variable is in keeping with Keller et al's (2004) idea that social responsiveness to others' requests may offer a potential indicator of the relational self. However, a fully social version of the test, requiring recognition of the relation between self and other as opposed to self and object, may ultimately be more relevant to the experience of relatedness. The current project takes only the first step, moving beyond the mark test to demonstrate that self-recognition performance is influenced by methodology and cultural context.

The question of *how* parenting influences self-awareness, and why certain methodologies capture self-awareness more successfully in some contexts, is an open one. We provide a rationale for considering the body-as-obstacle and MSR tasks to measure self-awareness in contexts which can be contrasted with the infants' typical perspective on self, as scaffolded by distal and proximal parenting strategies. However, Keller and colleagues argue that rather than having a direct impact on MSR performance, parenting behaviors which scaffold autonomy (such as face-to-face interaction) increase mind mindedness, leading to increased capacity to process the idea of self as distinct from other (Keller & Kärtner, 2013;

Kärtner, 2015). Although different, these are not incompatible hypotheses, and future work could usefully address the interaction between these ideas. Despite an interesting body of research correlating MSR with other social and cognitive developments in infancy, beyond the work summarized in this paper (and work on autobiographical memory, e.g. Alea & Wang, 2015; Schröder, Kärtner, & Keller, 2015; Miller, Potts, Fung & Hoostra, 1990; Miller, Wiley, Fung & Wang, 1997) there has been little empirical exploration of the idea that the early self is set in a specific context, and adapted to it. Although it pays to be individualistic in Western society, a preoccupation with the self as a distinct object is unlikely to be of benefit in interdependent societies. Moreover, there are a multitude of cultural settings which benefit from both autonomous and related perspectives on self (Kagitcibasi, 2012). Thus, different socialization strategies, and possibly different developmental schedules, are likely to evolve. Yet despite established cross-cultural variations in adult's experience of self-awareness (Hofstede, 2001), we currently have very little data concerning the development of this difference. Given this striking omission, the principal aim of the current report is to stimulate debate and further experimental research concerning the early social construction of self.

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List of Figure captions

Figure 1 Self-awareness performance, split by task type and cultural group. The percentage of infants passing the task is represented by black bars for Scottish infants, white bars for Turkish infants, and diagonal striped bars for Zambian infants.