Developmental Psychology
2013, Vol. 49, No. 6, 1021–1026

0012-1649/13/$12.00 DOI: 10.1037/a0029398

BRIEF REPORT

Trajectory Perception and Object Continuity: Effects of Shape and Color Change on 4-Month-Olds' Perception of Object Identity

J. Gavin Bremner
Lancaster University

Alan M. Slater
University of Exeter

Uschi C. Mason and Jo Spring
Lancaster University

Scott P. Johnson
University of California, Los Angeles

Previous work has demonstrated that infants use object trajectory continuity as a cue to the constant identity of an object, but results are equivocal regarding the role of object features, with some work suggesting that a change in the appearance of an object does not cue a change in identity. In an experiment involving 72 participants, we investigated the effects of changing object shape and color, singly and in combination, on 4-month-olds' perception of object continuity. A change in the shape of an object while it passed behind an occluder had no effect on perception of continuity, whereas a change in shape and color led to perception of discontinuity, and a change in color led to no clear percept regarding continuity or discontinuity. These results are discussed in terms of a perceptual learning model of development of object identity.

Keywords: trajectory, object identity, shape, color, occlusion

Perception of an object's identity across a gap in visibility is cued to adults in various ways. For instance, the percept that an object's motion is continuous indicates a single object. Additionally, constancy of object features contributes to the percept of a single object. In contrast, perception of movement discontinuity or featural change is a strong cue that more than one object is involved in the event in question. An important developmental question concerns the emergence of sensitivity to these cues during infancy.

Several studies have demonstrated that infants use motion continuity and discontinuity as information for object singularity and plurality. Xu and Carey (1996) demonstrated that 10-month-olds used trajectory continuity as a cue to the presence of a single object. Working with much younger infants, Spelke, Kestenbaum, Simons, and Wein (1995) obtained similar results to those of Xu and Carey. However, Xu and Carey also tested the effect of featural change, presenting events in which one object emerged from and returned behind one side of an occluder, but a different object emerged from and returned behind the other side of the occluder. Following repetitions of this event, 10-month-olds showed no evidence of expecting to see two objects when the occluder was removed. Xu and Carey therefore proposed that this age group does not use featural information to individuate objects—a surprising finding given infants' ability to discriminate object shape from birth (Slater, Morison, & Rose, 1983).

In contrast, Wilcox and Baillargeon (1998a) obtained positive results of featural change in a simpler event monitoring task designed to investigate 7- to 9-month-olds' inferences about the number of objects involved in an event, results later replicated with 4.5-month-olds (Wilcox & Baillargeon, 1998b). Infants saw one object move behind an occluder and one that differed in shape, color, and surface pattern reemerge at the other side. In one condition, the occluder was wide enough to hide both objects, whereas in another it could hide only one object. Infants looked longer at the narrow occluder event, suggesting that they knew that the change in object form indicated a different object and that this was impossible when the occluder was too narrow to hide both. Using the same methodology, Wilcox (1999) extended this work to investigate the contribution of shape, size, color and pattern change and found that 4.5-month-olds only used shape information, with use of pattern and color emerging at 7 and 11 months, respectively, or at 5 and 7 months under more supportive testing circumstances (Wilcox & Chapa, 2004).

The late emergence of use of color information is surprising, given evidence that 4-month-olds form color categories close to those of adults (Franklin & Davies, 2004; Teller, Civan, &

This article was published Online First July 16, 2012.

J. Gavin Bremner, Department of Psychology, Lancaster University, Lancaster, England; Alan M. Slater, School of Psychology, University of Exeter, Exeter, England; Uschi C. Mason and Jo Spring, Department of Psychology, Lancaster University; Scott P. Johnson, Department of Psychology, University of California, Los Angeles.

This work was supported by Economic and Social Research Council Grant R000231341 and National Institutes of Health Grants R01 HD40432 and R01 HD48733. We acknowledge the assistance of staff of University Hospitals of Morecambe Bay NHS Foundation Trust in recruitment and are grateful to parents and infants who took part in the work.

Correspondence concerning this article should be addressed to J. Gavin Bremner, Department of Psychology, Lancaster University, Lancaster LA1 4YF, England. E-mail: j.g.bremner@lancaster.ac.uk

Bronson-Castain, 2004) and that 3-month-olds appear to be more sensitive to color information than shape information in discriminations tasks (Catherwood, 1994; Rose & Slater, 1983). Additionally, there are concerns over just what this particular event monitoring task measures. Wilcox and Baillargeon's (1998a) wide screen condition involved a longer time between one object disappearing and the other reappearing, raising the possibility that screen width or time out of sight might be a factor explaining their result. They counteracted this by demonstrating that longer looking in the narrow screen condition was lost if the objects were made small enough to fit behind it simultaneously. Note, however, that the use of smaller objects meant that the time between one completely disappearing and the other beginning to reemerge was longer than in the narrow occluder large object condition. There is strong evidence that time out of sight is an important factor in young infants' trajectory perception (Bremner et al., 2005; Johnson et al., 2003) and longer looking in the original narrow occluder condition may have arisen because they only perceived continuous movement of a single object across the small temporal gap and treated the changes in features as anomalous in this condition alone (Carey & Xu, 2001). Even more simply, maybe they only detected featural change across a small temporal gap. The possibility that this technique is tapping into one of these lower levels is made plausible by two related findings: First, object features were not used by 4- to 5-month-olds to identify distinct objects (Mareschal & Johnson, 2003), and second, the use of featural information to individuate objects was not observed in infants younger than 9.5 months (Krøjgaard, 2007).

The primary problem in this area relates to the range of tasks used, leading to both differences in processing load and ambiguity regarding the meaning of the results. Our aim is to investigate the effects of changes in the object's appearance on perception of trajectory continuity, in a task that minimizes perceptual load from time and distance out of sight but that should provide unequivocal evidence regarding the effect of featural change on perception of object identity. Figure 1 illustrates the chosen method of testing infants' perception of trajectory continuity (Bremner et al., 2007, 2005; Johnson et al., 2003). Infants are habituated to an object moving back and forth across a display screen, disappearing behind a centrally placed occluder. Looking preference is then assessed on two test trials in which the occluder is absent but the object moves either continuously or discontinuously. If infants perceive continuity in the habituation trajectory, they should exhibit a novelty preference for the discontinuous test display, whereas if they perceive discontinuity, they should show a novelty preference for the continuous test display. Furthermore, we may assume that any change in the object's properties that leads to perception of discontinuity arises because that change leads infants to perceive distinct objects on each side of the occluder.

Here we employ a version of this task that uses a narrow occluder in which infants perceive trajectory continuity in the case of an unchanging object (Johnson et al., 2003), and measure the effects of changing object form and object color both singly and in combination. Thus, instead the same moving image being presented on each side of the occluder, the image changed shape, color, or both shape and color between disappearance and reappearance. The prediction is that if infants use shape or color, singly or in combination, to define an object's identity, they should perceive the habituation trajectory as discontinuous and show a looking preference for the continuous test display.

Here we focus on 4-month-olds because this age appears to be pivotal for the emergence of perception of trajectory continuity. Two-month-olds do not perceive an object's trajectory as continuous even across the shortest gap in perception, whereas 6-month-olds exhibit robust perception of trajectory continuity (Johnson et al., 2003). Four-month-olds are the youngest infants to have been shown to perceive trajectory continuity in this paradigm, and they only do so when the occlusion event is of short duration or takes place across a short spatial extent (Bremner et al., 2005; Johnson et al., 2003). This is also the age group around which most controversy exists regarding whether or not infants use object features to define object identity, and clarity regarding ability of this age group has implications for understanding the developmental sequence and process. Given the conflicting findings regarding use of shape versus color in object individuation, we do not make a prediction regarding priority of one over the other; on the face of it, both stimulus dimensions are discriminable by this age group and could be a basis for individuating objects. Instead our aim is to assess the effectiveness of these two object properties, singly and in combination, in a task that minimizes perceptual load but that unambiguously measures infants' perception of object continuity and discontinuity.

Method

Participants

Seventy-two 4-month-old infants (M = 126.0 days; range: 110–145 days; 37 girls, 35 boys) took part in the experiment. A further

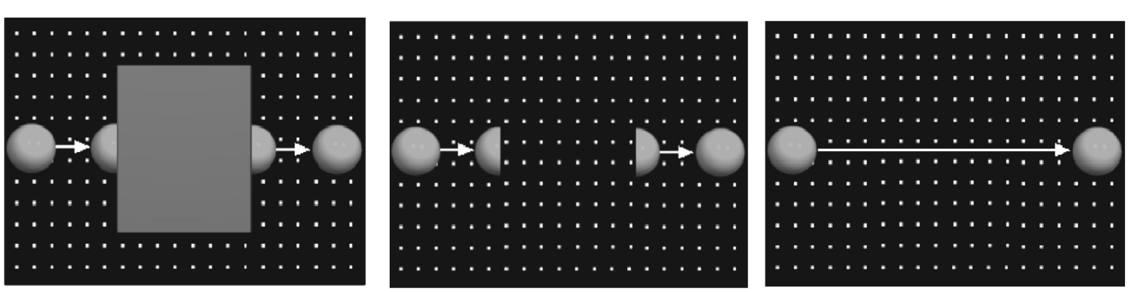

Figure 1. The displays presented in Johnson et al. (2003): habituation (A), discontinuous test (B), and continuous test (C).

11 did not complete testing due to fussiness (10) or equipment failure (one). Twelve infants were assigned to the three experimental and control conditions in such a way as to ensure that mean age and gender balance were comparable across conditions. Infants took part in only one condition. Participants were recruited by personal contact with parents in the maternity unit when the baby was born, followed up by telephone contact near test age to those parents who volunteered to take part. Infants with reported health problems including visual and hearing deficits and those born 2 weeks or more before due date were omitted from the sample. The majority were from Caucasian, middle-class families.

Apparatus and Stimuli

A Macintosh computer and a Samsung 100-cm color monitor were used to present stimuli. An observer viewed the infant on a second monitor, and infants were video recorded for later independent coding of looking times by a second observer. Both observers were unaware of the hypothesis under investigation. With Habit software (Cohen, Atkinson, & Chaput, 2000), the computer presented displays, recorded looking time judgments, calculated the habituation criterion for each infant, and changed displays after the criterion was met. The observer's judgments were input with a keypress on the computer keyboard.

Figure 2 illustrates the shape change habituation display. Habituation displays were presented against a black background measuring 48 × 48 cm (27° × 27° visual angle) with a 20 × 20 grid of white dots serving as texture elements. A stationary blue occluder with vertical extent 21.5 cm (12.3°) and horizontal extent 7.0 cm (4.0°) was placed centrally. During habituation trials, an object of vertical and horizontal extent 6.7 cm (3.8°) moved back and forth from one side of the display to the other, at 16.5 cm/s (9.4 degrees/s), undergoing deletion at one edge of the occluder and accretion at the other edge. It took 2,500 ms for the object to traverse the width of the display. Time from complete visibility to invisibility or the reverse was 400 ms. Time totally out of sight was 67 ms. Time completely in sight to left and right of the occluder was 1,634 ms. The animation ran as a continuous loop for the duration of the trial. In the shape change display a green object appeared first with either a circular or diamond shape, and changed to the other shape behind the occluder. In the color change display, a green or red circular shape was visible to the left of the occluder and changed to the other color behind the occluder. In the color and shape change display, a green or red circular shape was visible to the left of the occluder and changed to the other color and shape behind the occluder. In all cases, order of change was counterbalanced.

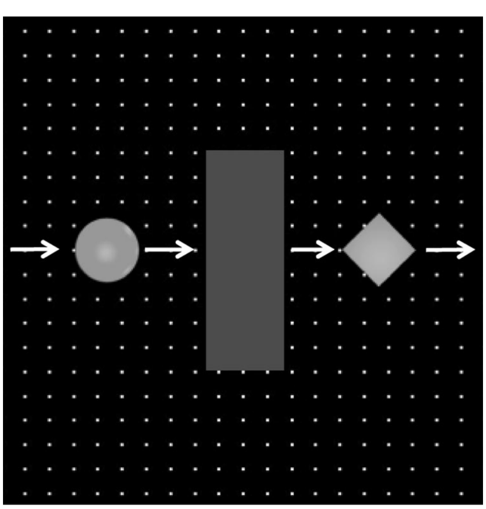

Figure 2. The shape change habituation display.

In test displays the occluder was absent and the object moved back and forth at the same speed as in the habituation display. On discontinuous test trials the same change as in habituation occurred between disappearance and reappearance, whereas on continuous test trials the object moved on a continuous trajectory and changed abruptly at the midpoint. The color change is the same as used by Wilcox and Baillargeon (1998a, 1998b) and can be assumed to be of sufficient magnitude to be discriminated by this age group (Franklin & Davies, 2004). Discrimination between figures such as circles and diamonds has been demonstrated at birth (Slater et al., 1983).

Procedure

Infants were tested in a semidarkened room, seated 100 cm from the display. In the experimental conditions, the habituation display was presented until looking time across four consecutive trials, from the second trial on, added up to less than half the total looking time during the first four trials. Timing of each trial began when the infant fixated the screen after display onset. A trial terminated when the observer released the timing key for 2 s or 60 s had elapsed. Between trials, a beeping target was shown to attract attention back to the screen. Following habituation, infants saw the two test trials in alternation, three times each. Infants in the control conditions received only the test trials, to assess any intrinsic preference. Half the infants in each condition were presented with the continuous trajectory first, and the rest viewed the discontinuous trajectory first. The second observer coded all infants' looking times from videotape for purposes of assessing reliability of looking time judgments. Interobserver correlations were high (Pearson $r = .98$), and the data were based on the first observer's judgments.

Results

Figure 3 shows average looking times at the two test displays across display types and experimental and control conditions. Data in many cells were positively skewed, violating assumptions of homogeneity of variance required by analysis of variance; therefore scores were log-transformed prior to analysis. A 3 (display: shape change vs. color change vs. shape and color change) × 2 (condition: experimental vs. control) × 2 (test trial order) × 2 (test trial type: continuous vs. discontinuous) × 3 (test trial block) mixed analysis of variance yielded an interaction between test trial type and display, $F(2, 60) = 4.39$, $p = .017$, $\eta_p^2 = .13$, qualified by an interaction between test trial type, display, and condition, $F(2, 60) = 17.64$, $p < .001$, $\eta_p^2 = .37$. There were also main effects of test trial block, $F(2, 59) = 25.39$, $p < .001$, $\eta_p^2 = .46$, and condition, $F(1, 60) = 5.82$, $p = .001$, $\eta_p^2 = .18$, qualified by an interaction between test trial block and condition, $F(2, 59) = 8.5$,

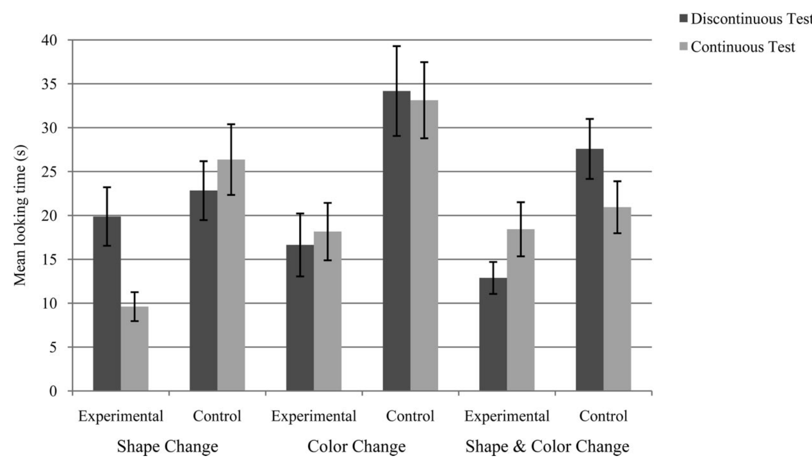

Figure 3. Mean looking times to the two test displays in the experimental and control conditions for each display type. Error bars display standard errors.

$p = .001$, $\eta_p^2 = .22$. Thus further analyses were carried out on experimental and control conditions separately.

In the experimental conditions, there was no effect of test trial type, $F(1, 30) = 1.39$, $p = .25$, $\eta_p^2 = .04$, but there was an interaction between test trial type and test display, $F(2, 30) = 15.92$, $p < .001$, $\eta_p^2 = .52$. This arose because for shape change displays infants looked longer at the discontinuous test display, $F(1, 10) = 46.85$, $p < .001$, $\eta_p^2 = .82$, whereas for color change displays there was no difference in looking at the test displays, $F(1, 10) = 0.07$, $p = .79$, $\eta_p^2 = .01$, and for shape and color change displays infants looked longer at the continuous test display, $F(1, 10) = 10.95$, $p = .008$, $\eta_p^2 = .52$. A comparison between the shape change and color change displays indicated an interaction between display and test trial type, $F(1, 20) = 12.67$, $p = .002$, $\eta_p^2 = .39$, as did a comparison between the shape change and shape and color change displays, $F(1, 20) = 49.9$, $p < .001$, $\eta_p^2 = .71$, whereas a comparison between color change and shape and color change displays did not reveal an interaction, $F(1, 20) = 2.2$, $p = .15$, $\eta_p^2 = .1$.

In the control conditions there was no effect of test trial type, $F(1, 30) = 0.13$, $p = .72$, $\eta_p^2 = .01$, but there was an interaction between test trial type and display, $F(2, 30) = 3.9$, $p = .031$, $\eta_p^2 = .21$. This arose because although there was no test trial type effect for the shape change display, $F(1, 10) = 1.59$, $p = .24$, $\eta_p^2 = .14$, or for the color change display, $F(1, 10) = 0.22$, $p = .65$, $\eta_p^2 = .02$, infants exposed to the shape and color change displays looked longer at the discontinuous test display, $F(1, 10) = 7.9$, $p = .018$, $\eta_p^2 = .44$, the opposite of the effect in the experimental condition. There was also an effect of test trial block (Block 1: $M = 40.78$, $SD = 7.08$; Block 2: $M = 21.5$, $SD = 7.23$; Block 3: $M = 20.24$, $SD = 9.61$), $F(2, 29) = 35.51$, $p < .001$, $\eta_p^2 = .71$, due to a reduction in looking between Blocks 1 and 2. Additionally, there was an interaction between test trial type and test trial order, $F(1, 30) = 9.23$, $p = .005$, $\eta_p^2 = .24$, due to longer looking at the test trial presented first. This effect was also due to a decline in looking across trials, a common pattern in control conditions in which test trials are the first events encountered.

Discussion

Despite the change between disappearance and reappearance, infants exposed to the shape change habituation display showed a strong preference for the discontinuous test display, consistent with perception of object continuity. This replicates the effect obtained in previous work in which the object's features remained constant (Bremner et al., 2005; Johnson et al., 2003). In fact, the preference for the discontinuous test display (discontinuous: $M = 19.88$, $SD = 11.54$; continuous: $M = 9.61$, $SD = 5.7$) is more marked than Johnson et al. (2003) obtained for the same occluder width with a constant object (discontinuous: $M = 20.25$, $SD = 10.66$; continuous: $M = 13.06$, $SD = 10.5$). In contrast, infants exposed to the color change habituation display showed no preference for either test display, whereas those exposed to the shape and color change display showed a significant preference for the continuous test display, consistent with perceiving object discontinuity. This pattern suggests that, across color and color and shape changes, infants' percept of a single object was declining, despite the fact that spatiotemporal information provided by the constant trajectory might cue a single object.

Why did infants in the control condition show a preference for the discontinuous color and shape change test display? To our knowledge, this is the first case with this methodology in which infants have shown a spontaneous preference for one test display over another (cf. Bremner et al., 2007, 2005; Bremner, Slater, Johnson, Mason, & Spring, 2012; Johnson et al., 2003). It should be noted however, that in their test phase, Xu and Carey (1996) obtained a baseline preference for two distinct objects over one but not for two identical objects. It is likely that discontinuity along with shape and color change in this display provided a particularly clear percept of two distinct objects, prompting a preference.

Our findings, particularly the results of the shape and color change conditions, provide evidence that changes in the visual appearance of an object are used as cues to object discontinuity. Thus our findings are in keeping with Wilcox and Baillargeon's (1998a, 1998b) claim that infants use featural properties to individuate objects. However, why did we find no evidence for an effect of shape change but evidence of an effect of color change when Wilcox (1999) found the opposite? We conclude that this is evidence that their task simply measured infants' detection of a change in object features across a perceptual gap, whereas our task measured perception of identity change. A detection task is likely influenced by the salience of the stimulus dimension, and Kaldy and Blaser (2009) demonstrated that color was considerably less salient than shape at 6.5 months. Thus Wilcox's developmental sequence of sensitivity going from shape and size, to pattern, and then to color may just reflect an age-related reduction in the effects of a salience hierarchy on detection of stimulus change across a temporal gap. Furthermore, Woods and Wilcox's (2010) finding that in the same task 7.5-month-olds responded to a change in color and luminance but not to either singly, could likewise be a salience effect through additive effects of these two cues. In contrast, it seems unlikely that our lack of an effect of shape change arose because infants did not notice the change, because habituation studies have indicated that shape changes are readily detected by infants from birth (Slater, et al., 1983) even in the case of moving objects (Slater, Morison, Town, & Rose, 1985). However, there is a reason why shape change might have less effect than color change in perception of object identity. The changing retinal image resulting from viewing an object from various angles calls on three-dimensional form constancy to recognize a constant object. Thus, although shape constancy is present at birth (Slater & Morison, 1985), there may be high processing costs in using shape change as information for object change. In contrast, color, though it may change in saturation with changing lighting conditions, remains largely constant within a color category. Thus a change across color categories, although not particularly salient compared to shape change, may be a simple and reliable cue to object change.

But why, if shape change had no effect, did it combine with color change to produce a strong percept of two objects? There is growing evidence that infants attend selectively to combinations of cues, as indicators of continuities and discontinuities in perceptual experience. For instance, 4-month-olds use changes in trajectory direction or height (Bremner et al., 2007) but not violation of smoothness of movement (Bremner et al., 2005) as cues to discontinuity behind an occluder. Also, with no visible occluding surface, 4-month-olds use the combination of deletion and accretion, a visible occluding edge, and occluded background as cues to an occlusion event in which an object persists behind the "occluder," but do not perceive occlusion if any of these cues is absent (Bremner et al., 2012). Likewise, information such as deletion and accretion of background, alignment of object parts (Johnson & Aslin, 1996), and figural goodness (Johnson, Bremner, Slater, & Mason, 2000) in certain combinations cue object unity when part of an object is hidden.

Thus infants may have to detect more than one cue to identity change to perceive distinct objects. Alternatively, there may be a perceptual threshold for detection of object change, and a change in both shape and color was sufficient to exceed this threshold. Thus our results may be explained by an account based on differing reliance on shape and color cues, along with additive effects of cues and a threshold that has to be reached for a change in identity to be registered. Color change on its own abolishes perception of object continuity but does not establish change in object identity. Shape change has no effect on its own, but contributes, with color change, to reaching the threshold for perception of object identity change. As such, our results reinforce the importance of considering the contribution of multiple cues to infants' perception of object continuity and discontinuity across gaps in perception and of uncovering the process through which infants move toward more adult levels by learning to perceive identity change through a wider variety of single cues.

References

Bremner, J. G., Johnson, S. P., Slater, A. M., Mason, U., Cheshire, A., & Spring, J. (2007). Conditions for young infants' failure to perceive trajectory continuity. *Developmental Science, 10,* 613–624. doi:10.1111/j.1467-7687.2007.00616.x

Bremner, J. G., Johnson, S. P., Slater, A. M., Mason, U., Foster, K., Cheshire, A., & Spring, J. (2005). Conditions for young infants' perception of object trajectories. *Child Development, 76,* 1029–1043. doi:10.1111/j.1467-8624.2005.00895.x

Bremner, J. G., Slater, A. M., Johnson, S. P., Mason, U. C., & Spring, J. (2012). Illusory contour figures are perceived as occluding surfaces by 4-month-old infants. *Developmental Psychology, 48,* 398–405. doi:10.1037/a0024922

Carey, S., & Xu, F. (2001). Infants' knowledge of objects: Beyond object files and object tracking. *Cognition, 80,* 179–213. doi:10.1016/S0010-0277(00)00154-2

Catherwood, D. (1994). Exploring the seminal phase in infant memory for color and shape. *Infant Behavior and Development, 17,* 235–243. doi:10.1016/0163-6383(94)90002-7

Cohen, L. B., Atkinson, D. J., & Chaput, H. H. (2000). Habit 2000: A new program for testing infant perception and cognition (Version 1.0) [Computer software]. Austin: University of Texas.

Franklin, A., & Davies, I. R. L. (2004). New evidence for infant colour categories. *British Journal of Developmental Psychology, 22,* 349–377. doi:10.1348/0261510041552738

Johnson, S. P., & Aslin, R. N. (1996). Perception of object unity in young infants: The roles of motion, depth, and orientation. *Cognitive Development, 11,* 161–180. doi:10.1016/S0885-2014(96)90001-5

Johnson, S. P., Bremner, J. G., Slater, A. M., & Mason, U. C. (2000). The role of good form in infants' perception of partly occluded objects. *Journal of Experimental Child Psychology, 76,* 1–25. doi:10.1006/jecp.2000.2545

Johnson, S. P., Bremner, J. G., Slater, A. M., Mason, U., Foster, K., & Cheshire, A. (2003). Infants' perception of object trajectories. *Child Development, 74,* 94–108. doi:10.1111/1467-8624.00523

Kaldy, Z., & Blaser, E. (2009). How to compare apples and oranges: Infants' object identification tested with equally salient shape, luminance, and color changes. *Infancy, 14,* 222–243. doi:10.1080/15250000802707088

Krøjgaard, P. (2007). Comparing infants' use of featural and spatiotemporal information in an object individuation task using a new event-monitoring design. *Developmental Science, 10,* 892–909. doi:10.1111/j.1467-7687.2007.00640.x

Mareschal, D., & Johnson, M. H. (2003). The "what" and "where" of object representations in infancy. *Cognition, 88,* 259–276. doi:10.1016/S0010-0277(03)00039-8

Rose, D. H., & Slater, A. M. (1983). Infant recognition memory following brief stimulus exposure. *British Journal of Developmental Psychology, 1,* 221–230. doi:10.1111/j.2044-835X.1983.kb00896.x

Slater, A., & Morison, V. (1985). Shape constancy and slant perception at birth. *Perception, 14,* 337–344. doi:10.1068/p140337

Slater, A., Morison, V., & Rose, D. (1983). Perception of shape by the newborn baby. *British Journal of Developmental Psychology, 1,* 135–142. doi:10.1111/j.2044-835X.1983.tb00551.x

Slater, A., Morison, V., Town, C., & Rose, D. (1985). Movement perception and identity constancy at birth. *British Journal of Developmental Psychology, 3,* 211–220. doi:10.1111/j.2044-835X.1985.tb00974.x

Spelke, E. S., Kestenbaum, R., Simons, D. J., & Wein, D. (1995). Spatiotemporal continuity, smoothness of motion and object identity in infancy. *British Journal of Developmental Psychology, 13,* 113–142. doi:10.1111/j.2044-835X.1995.tb00669.x

Teller, D. Y., Civan, A. L., & Bronson-Castain, K. (2004). Infants' spontaneous color preferences are not due to adult-like brightness variations. *Visual Neuroscience, 21,* 397–401. doi:10.1017/S0952523804213360

Wilcox, T. (1999). Object individuation: Infants' use of shape, size, pattern, and color. *Cognition, 72,* 125–166. doi:10.1016/S0010-0277(99)00035-9

Wilcox, T., & Baillargeon, R. (1998a). Object individuation in infancy: The use of featural information in reasoning about occlusion events. *Cognitive Psychology, 37,* 97–155. doi:10.1006/cogp.1998.0690

Wilcox, T., & Baillargeon, R. (1998b). Object individuation in young infants: Further evidence with an event-monitoring paradigm. *Developmental Science, 1,* 127–142. doi:10.1111/1467-7687.00019

Wilcox, T., & Chapa, C. (2004). Priming infants to attend to color and pattern information in an individuation task. *Cognition, 90,* 265–302. doi:10.1016/S0010-0277(03)00147-1

Woods, R. J., & Wilcox, T. (2010). Covariation of color and luminance facilitate object individuation in infancy. *Developmental Psychology, 46,* 681–690. doi:10.1037/a0019161

Xu, F., & Carey, S. (1996). Infants' metaphysics: The case of numerical identity. *Cognitive Psychology, 30,* 111–153. doi:10.1006/cogp.1996.0005

Received August 30, 2011
Revision received April 20, 2012
Accepted May 11, 2012 ■

Correction to Sulik et al. (2012)

In the article "Interactions Between Serotonin Transporter Gene Haplotypes and Quality of Mothers' Parenting Predict the Development of Children's Noncompliance," by Michael J. Sulik, Nancy Eisenberg, Kathryn Lemery-Chalfant, Tracy L. Spinrad, Kassondra M. Silva, Natalie D. Eggum, Jennifer A. Betkowski, Anne Kupfer, Cynthia L. Smith, Bridget Gaertner, Daryn A. Stover, and Brian C. Verrelli (*Developmental Psychology*, 2012, Vol. 48, No. 3, pp. 740–754), the haplotype combinations for Group 1 and 2 (under the subheading SLC6A4 haplotype groups) are incorrectly described. The true haplotype combinations for Group 1 and 2 are as follows:

"Group 1 (henceforth called S10 group) consisted of the following combinations: S10–S12 and S10-L10. These individuals had the critical S10 haplotype (no children had S10–S10 or S10–L12). Group 2 (called S12 group) included S12–S12, S12–L10, and S12-L12 haplotypes."

This inaccuracy does not alter the results, nor the conclusions presented in the article.

DOI: 10.1037/a0032762