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THEMATIC COLLECTION: COMMENTARIES

Reply to Bogartz, Shinskey, and Schilling; Schilling; and Cashon and Cohen

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This thematic collection includes three failed replications of the initial rotating screen experiments with 4½- and 5½-month-old infants (Baillargeon, 1987a; Baillargeon, Spelke, & Wasserman, 1985). Readers should be aware that Lécuyer in France (using computer-animated events) and Slater in England are currently conducting replications of these same experiments, with highly promising results. The three articles in the collection are discussed in turn; order of presentation reflects only ease of exposition.

BOGARTZ, SHINSKEY, AND SCHILLING

The article written by Bogartz, Shinskey, and Schilling (this issue) presents several important misconceptions; four of these are addressed in the following sections.

Misconceptions About Prior Evidence

Bogartz et al. (this issue) apparently believe that the experiments of Kellman and Spelke (1983), Baillargeon et al. (1985), and Baillargeon and Graber (1987) are the

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primary experiments to suggest that young infants can represent occluded objects. Having failed to replicate each of these experiments in turn, Bogartz and his collaborators (Bogartz & Shinskey, 1998; Bogartz, Shinskey, & Speaker, 1997; Bogartz et al., this issue) conclude that their research "effectively calls into question the tenability of the assumption that young infants represent occluded objects in occlusion" (Bogartz et al., this issue, p. 427). Bogartz et al. (this issue) admit that "A body of work that to date remains as a bulwark in support of the assumption of young infant representation of occluded objects is the work on infant arithmetic" (p. 427). However, they assure us that they are "working on this problem" (p. 427), so we can no doubt expect, in short order, a nonreplication of Wynn's (1992) findings.

What Bogartz et al. (this issue) fail to appreciate is that there are now dozens and dozens of reports, coming from a variety of laboratories and using a variety of paradigms, all suggesting that infants aged 2½ to 7½ months can represent occluded objects. For purposes of illustration, 30 of these reports are listed in Table 1 (my apologies to those researchers I could have cited and did not). Because many of these reports include two or more experiments with positive findings, we have here a very large number of diverse findings all pointing to the same conclusion.

To demonstrate at this point that young infants cannot represent occluded objects, a scientist would need to show that, for each report in Table 1 (and all other relevant reports), explanations based on perceptual factors provide a more parsimonious interpretation of the findings. Furthermore, a scientist would need to consider explanations across sets of related experiments. Arguments that Finding 1 is best attributed to Factor A, Finding 2 to Factor B, Finding 3 to Factor C, and so on, where A, B, and C are all generated post hoc with little or no attempt at theoretical integration, could never be favored over accounts that provide a single coherent explanation of large bodies of findings (for further discussion, see Baillargeon, 1999).

Misconceptions About Prior Evidence—Further Issues

In their research, Bogartz et al. (this issue) focused primarily on the result of the experimental condition in Baillargeon et al. (1985), which, they suggest, "plays a supportive role in various formulations of the young infant's cognitive capacities" (pp. 403–404). Here again, however, Bogartz et al. appear unaware that this finding is only a part of a large body of interrelated findings all obtained with the rotating screen paradigm. In my attempts at describing young infants' reasoning about the physical world (e.g., Baillargeon, 1993, 1995), I do not single out the particular finding of interest to Bogartz et al., but consider all of the rotating screen results as a whole. These (and parallel results obtained with other tasks; e.g., Baillargeon, 1994, 1995, 1998) reveal some of the conditions under which infants succeed and fail at predicting event outcomes, and as such provide valuable insights into the development of their physical reasoning.

TABLE 1
Incomplete List of Experimental Reports That Support the Conclusion That Infants Aged 2½ to 7½ Months Can Represent Fully Hidden Objects

1.	Aguiar & Baillargeon (1999)
2.	Aguiar & Baillargeon (2000a)
3.	Baillargeon (1986)
4.	Baillargeon (1987a)
5.	Baillargeon (1987b)
6.	Baillargeon (1991)
7.	Baillargeon & DeVos (1991)
8.	Baillargeon & Graber (1987)
9.	Baillargeon, Graber, DeVos, & Black (1990)
10.	Baillargeon, Spelke, & Wasserman (1985)
11.	Goubet & Clifton (1998)
12.	Hespos & Baillargeon (in press-a)
13.	Hespos & Baillargeon (in press-b)
14.	Hespos & Rochat (1997)
15.	Hofstadter & Reznick (1996)
16.	Hood & Willatts (1986)
17.	Koechlin, Dehaene, & Mehler (1998)
18.	Lécuyer (1993)
19.	Newcombe, Huttenlocher, & Learmonth (2000)
20.	Rochat & Hespos (1996)
21.	Simon, Hespos, & Rochat (1995)
22.	Spelke, Breinlinger, Macomber, & Jacobson (1992)
23.	Spelke & Kestenbaum (1986)
24.	Van de Walle & Spelke (1996)
25.	Wilcox (1999)
26.	Wilcox & Baillargeon (1998a)
27.	Wilcox & Baillargeon (1998b)
28.	Wilcox, Nadel, & Rosser (1996)
29.	Woodward, Phillips, & Spelke (1993)
30.	Wynn (1992)

When a scientist calls into question the interpretation of a particular finding in a body of work, he or she typically does not focus only on that finding alone, but considers the body of work as a whole. This approach helps prevent scientists from chasing red herrings, because an interpretation suggested by a particular finding may be immediately contradicted by examination of other findings in the same body of work. Typically, only interpretations that are not immediately contradicted by other related findings would be pursued.

Of course, researchers do not always choose this prudent path: They sometimes focus on a single finding in a body of work and seek an alternative interpretation for it. Indeed, there have been quite a few of these single-finding accounts in recent years. For example, Haith (1998) suggested that young infants look reliably longer in the rotating screen task when the screen rotates through the box because they have a lingering, sensory representation of the box, and the sight of the screen rotating through the box is novel for them. Haith was apparently unaware of additional results (Baillargeon, 1991, 1993) showing that 4½-month-old infants do not look reliably longer when the screen rotates through the top 80% of the box; only the full, 100% violation elicits prolonged looking. At 6½ months of age, infants succeed in detecting the 80% violation but fail with a smaller, 50% violation. It is difficult to see how Haith's account could be extended to explain these results—unless one were willing to make the assumption that infants' lingering representations of objects include at first only their bottoms and grow upward with age (a new bottom-up approach?).

Bogartz et al. (this issue) are guilty of the same type of single-finding interpretation as Haith (1998). They suggest that young infants in the rotating screen task look reliably longer when the screen rotates through the box than when it stops against the box because they were habituated to the screen rotating through a 180° arc and prefer this familiar rotation in the test events. However, this explanation fails to address the additional results that young infants tested without a box behind the screen in the test events do not show a reliable preference for the familiar 180° rotation (Baillargeon, 1987a; Baillargeon et al., 1985). Clearly, if a preference for the familiar 180° rotation were the key factor at work, one would expect the same preference to arise whether infants were tested with or without a box (indeed, this is precisely what Bogartz et al. predict in their own research). And yet, Bogartz et al. fail to even mention these inconsistent results when introducing their research.

Misconceptions About Replications

Bogartz et al. (this issue) believe that their experiments contain replications of the experimental and control conditions in Baillargeon et al. (1985). They do not. The stimuli and procedures used in these experiments are markedly different. For example, the infants in the Baillargeon et al. experiment saw the 180° and 120° rotations on alternate trials for three pairs of test trials; about half of the infants were tested with a box behind the screen and half without a box; and about half of the infants in each condition saw the 180° rotation on the first test trial, and half saw the 120° rotation. In contrast, the infants in the Bogartz et al. experiments saw the 180° rotation with the box, the 180° rotation without the box, the 120° rotation with the box, and the 120° rotation without the box each for a single test trial, with a different order being randomly assigned to each infant.

In light of these and other differences between the experiments, I was not terribly surprised that the infants in the Bogartz et al. (this issue) experiments did not respond to the 180° and 120° rotations with the box as did the infants in the

Baillargeon et al. (1985) experiment. But what can one learn from these negative results? Because the methods of the experiments are so different, the results are open to at least two very different interpretations. One is that proposed by Bogartz et al.; the other is that 5½-month-old infants in the rotating screen task can represent and reason about the box behind the screen, but not when confused, distracted, or otherwise led astray by the experimental procedure. Under such conditions, infants are likely to process the events only superficially, focusing on perceptual changes in the screen, the box, or both.

Misconception About Methods

Although Bogartz et al. (this issue) do not make this point clear, something like their Event Set × Event Set method has already been in use for quite some time. I have in mind, for example, Oakes's (1994) experiment on infants' causal reasoning. To illustrate, Oakes habituated 7-month-old infants to one of three computer-generated events: (a) a contact event in which a blue ball approached and contacted a red ball, which immediately moved off; (b) a no-contact event in which a 12-cm gap separated the motions of the first and second ball; and, finally, (c) a delay event in which a 0.75-sec delay separated the two balls' motions. Following habituation, the infants saw all three of the events. During habituation, the infants tended to look equally at the events. During test, the infants habituated to the contact event dishabituated to the no-contact and delay events, but the infants habituated to the no-contact or delay event tended to dishabituate only to the contact event.

The Event Set × Event Set method, as I understand it, is a simple extension of the more traditional habituation–dishabituation method. It is well-suited to ask, as in Oakes (1994), whether infants can distinguish between various physically possible events, or, to put it another way, whether infants can categorize events.[1] Such a method is not appropriate, however, for asking whether infants view events as consistent or inconsistent with their physical knowledge, for reasons that are discussed later.

The method I have used most consistently in my investigations of infants' physical knowledge is the violation-of-expectation method (e.g., Baillargeon, 1998).

[1]Oakes's (1994) events were all physically possible because the balls were self-moving (e.g., the first ball initiated its own motion), so that infants could always explain the second ball's motion: They could assume that it was caused by the first ball in the contact event, and that it was self-caused in the no-contact and delay events. Oakes's experiment was thus designed to test whether infants could distinguish between causal and noncausal events (i.e., Would infants habituated to a causal event dishabituate to a noncausal one? Would infants habituated to a noncausal event dishabituate to a causal but perhaps not another noncausal event?). Oakes's results suggested that her infants had no difficulty with this distinction, a finding consistent with Leslie's earlier results (e.g., Leslie & Keeble, 1987; for discussion, see Kotovsky & Baillargeon, 2000).

This method is often confused with the habituation–dishabituation method, but the two are actually distinct. In a violation-of-expectation task, infants see an event consistent and an event inconsistent with the physical expectation under examination. With appropriate controls, evidence that infants look reliably longer at the inconsistent event indicates that they possess the expectation being examined and detect the violation in the inconsistent event. It is not essential in a violation-of-expectation task that infants receive habituation trials. If the test events used are complex or unusual (e.g., a screen that rotates spontaneously through a 180° arc), infants may be given habituation or familiarization trials to first orient them to the events. However, these trials are understood in the same terms as the practice trials or verbal instructions older children and adults might require in a more complex task. When my colleagues and I began conducting violation-of-expectation experiments during the 1980s, it was not unusual to give infants up to 14 habituation trials prior to the test trials. Over the years, however, we have come to realize that long habituation phases are often not necessary and can sometimes be counterproductive. As a result, procedures have become increasingly streamlined. Many recent experiments have used few or no familiarization trials (e.g., Aguiar & Baillargeon, 1998; Baillargeon, Graber, DeVos, & Black, 1990; Hespos & Baillargeon, in press-a; Kotovsky & Baillargeon, 1994, 2000; Needham, 1998, 1999; Needham & Baillargeon, 1993, 1998; Wilcox & Baillargeon, 1998a).

One recent experiment from my laboratory is particularly germane to this discussion. This experiment examined whether 4-month-old infants realize that the width of an object relative to that of an occluder determines whether the object can be fully or only partly hidden when lowered behind the occluder (Baillargeon & Brueckner, 2000). The infants received no habituation or familiarization trials; they saw only a wide- and a narrow-occluder test event, in two successive trials (see Figure 1). At the start of the wide-occluder event, a hand held a knob attached to the center of a wide rectangular object. The object was held centered above and directly behind a wide wooden occluder that was slightly wider than the object. Next, a screen hid the occluder, the hand lowered the object behind the occluder, and the screen was removed to reveal only the occluder (with the object presumably hidden behind it). The narrow-occluder event was identical except that the occluder was much narrower so that it should have been impossible for the object to be fully hidden behind the occluder when the screen was removed. The infants looked reliably longer at the narrow- than at the wide-occluder event, suggesting that they (a) believed that the object continued to exist when lowered behind the occluder; (b) realized that the width of the object relative to that of the occluder determined whether the object could be fully or only partly hidden when behind the occluder; and (c) expected the object to be fully hidden when lowered behind the wide but not the narrow occluder, and were surprised or puzzled when this last expectation was violated. Support for this interpretation came from a control condition conducted with a narrow object that could be fully hidden behind either

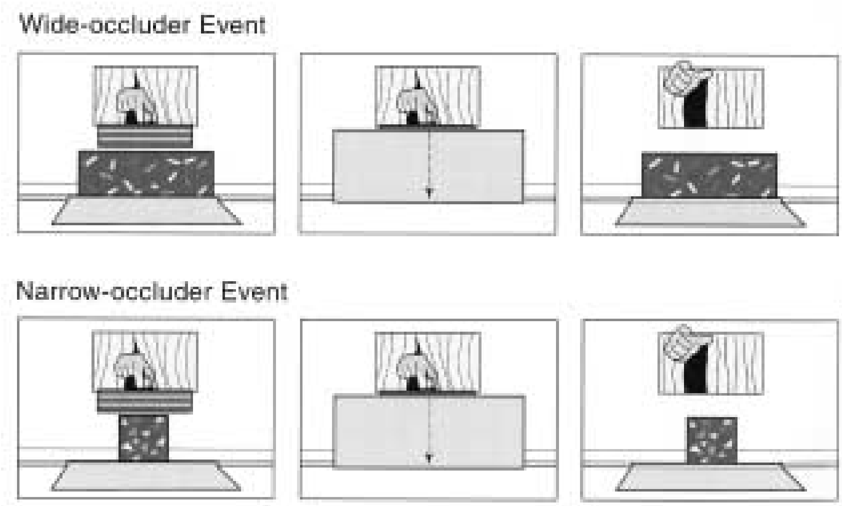

FIGURE 1 Schematic drawing of the test events used in Baillargeon and Brueckner (2000).

occluder; the infants looked about equally at the narrow- and wide-occluder events.

This experiment (which should be added to those in Table 1) provides a clear illustration of the little-understood fact that habituation or familiarization trials are by no means an essential feature of the violation-of-expectation method. It also seriously undermines the central claim by Bogartz et al. (this issue) that "looking time differences result from the novelty or familiarity relations between the familiarization events and the test events rather than as a result of surprise on the part of the infant to so-called impossible events" (p. 405). Where there are no familiarization events, there can be no novelty or familiarity relations to explain prolonged looking at test events.[2]

To return to the Event Set × Event Set method, one would not use this method to present infants with events consistent and inconsistent with their physical knowledge for the following reasons. If infants do not require habituation trials, because the test events are relatively simple and familiar, then why introduce habituation trials at all? On the other hand, if infants do require at least a few habituation trials, because the test events are complex or unfamiliar, then

[2]I am avoiding using the phrase *impossible events* because the violation-of-expectation method predicts that infants should respond with prolonged looking to events they view as inconsistent with their physical expectations, whether or not these expectations accurately reflect the workings of the physical world. When their expectations are incorrect, infants may be led to view physically impossible events as expected, and physically possible events as unexpected (e.g., Luo & Baillargeon, 2000).

showing infants inconsistent events during this habituation phase makes no sense at all. Would one include gibberish in instructions to older children and adults and expect a superior performance?

SCHILLING

A number of inconsistencies emerged when reading Schilling's (this issue) article; three of these are discussed in the following sections.

Prior Data Obtained Without the Box

In the introduction to his article, Schilling (this issue) writes that one difficulty with the original rotating screen experiments (Baillargeon, 1987a; Baillargeon et al., 1985) is that "possible familiarity preferences were not controlled" (p. 390). Infants might have looked longer at the 180° rotation during test simply because of a familiarity preference for the rotation to which they had been habituated. It is difficult to understand these comments. As mentioned earlier, each of the original rotating screen experiments included a control condition in which infants were tested without a box behind the screen (Baillargeon, 1987a; Baillargeon et al., 1985). In the Bogartz et al. (this issue) article, it is clearly assumed that a familiarity preference should lead infants habituated to the 180° rotation to prefer this same rotation in test with or without the box present. Hence, doesn't the fact that the no-box conditions in the original rotating screen experiments revealed no reliable preference for the 180° rotation refute the statement that "possible familiarity preferences were not controlled"?

Predictions About Condition D

Again, in the introduction, Schilling (this issue) writes that Baillargeon would predict that the 6-month-old infants who were given seven familiarization trials to the 180° rotation without the box (Condition D) should look reliably longer at the 180° than at the 112° rotation with the box during test. I would not, for the simple reason that I already have performed a similar experiment and found that 6½-month-old infants who receive multiple habituation trials do not show a reliable preference for the 180° rotation during test (Baillargeon, Kotovsky, & Needham, 1995). These older infants do show the expected preference, however, when given only one habituation trial. Initially, I assumed that the infants tested with the standard procedure were confused as to whether they should focus on the conceptual violation in the 180° rotation or on the perceptual violation in the 112° rotation. I now think other explanations are possible, such as that the infants were bored with the events and processing them only superficially, or that the infants were perseverating in their responses, not fully registering the presence of the box behind the screen (e.g., Aguiar & Baillargeon, 2000b). At any rate, it should be clear that I would not have predicted that infants this age would prefer the 180° rotation after receiving seven familiarization trials. Schilling was no doubt aware of this point, because he discusses the results I just described later on in his article.

A general comment is perhaps in order here. At several points in his article, Schilling (this issue) suggests that I would predict identical performances for infants tested in the original rotating screen task, irrespective of age, familiarization experience, and so on. I am puzzled by these statements. Would any researcher ever predict that a finding should remain unperturbed, regardless of changes in the age of the infants tested, the number and content of the familiarization trials they receive, and so on? If I have learned one thing in all my years of studying infants, it is that getting sensible data out of them is a complicated and often frustrating business, and that a wide variety of factors can and often do affect the data collection process. I knew, based on my own data, that 3½-month-old infants show a preference for the 180° rotation with the box if they are fast but not slow habituators (Baillargeon, 1987a); that 6½-month-old infants show this preference if they receive one but not six or more habituation trials (Baillargeon et al., 1995); and that although 6½-month-old infants who receive six or more habituation trials do not detect the 100% violation, they do detect the 80% violation (Baillargeon, 1991). So why would I have thought that age, familiarization experience, and a myriad of other factors would not matter? They almost always matter (Baillargeon, 1995).

Data From Condition A

Schilling (this issue) found that the 4-month-old infants who received seven familiarization trials to the 180° rotation without the box (Condition A) looked reliably longer at the 180° than at the 112° rotation with the box in test. This result appears to replicate my result with 4½-month-old infants (Baillargeon, 1987a). But does it really? Consider the mean looking times obtained in the two experiments. The infants in my experiment looked 29.2 sec at the 180° rotation and 17.7 sec at the 112° rotation. Schilling's infants looked at the same events for 13.5 sec and 9.7 sec, respectively. (Out of curiosity, I went back to the data of the 6½-month-old infants who were tested with multiple habituation trials [Baillargeon et al., 1995]; their mean looking times were 13.4 sec and 13.1 sec, respectively, quite similar to those of Schilling's infants).

The comparatively low looking times of Schilling's (this issue) infants suggest that they were not entirely engaged by the events and were processing them rather superficially. It is difficult to say why this was the case, but a few possibilities come to mind. One has to do with the box used. The one in my experiment was a wooden box 25 cm high, 15 cm wide, and 5 cm thick, painted bright yellow, and decorated with a large, brightly colored clown face. The box in Schilling's experiment was a piece of foam core 10 cm high, 18 cm wide, and 1 cm thick that was decorated with a black and white checkerboard pattern. It may be that young infants are more likely (a) to attend to a box that is clearly 3-D, tall, bright, and decorated with a large colorful face; and hence (b) to detect a violation involving such a box.

Other factors may have affected infants' differential attention to the box in the two experiments. For example, I allowed the infants to manipulate the box for a few seconds prior to the experiment; I gave the infants a familiarization trial during which the screen lay flat against the apparatus floor with the box visible behind it; and I inserted a brief pause between each screen rotation during which infants could fixate the box. Schilling (this issue) included none of these manipulations.

Whatever the explanation for the differences between our results, it seems likely that Schilling's (this issue) infants, like those of Bogartz et al. (this issue), processed the test events only superficially, responding on the basis of shallow familiarity or novelty preferences.[3] Although these experiments may teach us about the conditions under which such preferences are likely to arise, they cannot advance our understanding of how infants respond when they do bring to bear their physical knowledge and attempt to predict and explain (rather than perhaps simply compare) objects' displacements and interactions.

CASHON AND COHEN

A Word About the Introduction

In their introduction, Cashon and Cohen (this issue) write that a number of experiments have suggested that even very young infants can represent occluded objects, and that in these experiments, "Typically, the possible event was constructed so that it was perceptually novel, whereas the impossible event was perceptually more familiar, but conceptually novel" (p. 430). This statement is incorrect, although it is a common misperception. The sort of design Cashon and Cohen describe was indeed used in many of the rotating screen experiments (e.g., Baillargeon, 1987a, 1987b; Baillargeon et al., 1985). However, my colleagues and I have not used this

[3]Another difficulty with Schilling's (this issue) experiment has to do with the ages of the infants tested. The 4½-month-old infants in Baillargeon (1987a) ranged in age from 4 months 2 days to 5 months 2 days and averaged 4 months 14 days. Schilling does not provide an age range, but the mean age of his younger infants was 4 months 3 days. This is problematic because in Baillargeon (1987a), I also tested infants aged 3 months 15 days to 4 months 3 days (M = 3 months 24 days) and found that, in this younger age group, only fast habituators showed a reliable preference for the 180° over the 112° rotation with the box.

design in any of our other experiments on infants' responses to occluded objects (e.g., Aguiar & Baillargeon, 1999; Baillargeon, 1986; Baillargeon & Brueckner, 2000; Baillargeon & DeVos, 1991; Baillargeon & Graber, 1987; Baillargeon et al., 1990; Hespos & Baillargeon, in press-a; Wilcox & Baillargeon, 1998a, 1998b). When I obtained negative results with 6½-month-old infants in the standard rotating screen task (Baillargeon et al., 1995), I concluded that this design was potentially troublesome and stopped using it. Although other researchers have continued using it with great success (e.g., Spelke, Breinlinger, Macomber, & Jacobson, 1992), the point remains that there are now many more published experiments that did not, as opposed to that did, use this design. Objections aimed at the experiments that did use the design, therefore, cannot be taken to invalidate the entire set of experiments or to cast doubt on the conclusions that they generally support.

A Word About the Experiment

Many aspects of the procedure Cashon and Cohen (this issue) chose for their experiment surprised me. For example, I was puzzled that they chose to test 8-month-old infants in a debate that focuses on whether young infants can represent occluded objects (because 8-month-old infants can search for hidden objects, no one is in any doubt about their ability to represent occluded objects). I was also surprised that Cashon and Cohen chose to give their infants 6 to 20 habituation trials, partly because 20 is a staggering number to use with older infants, and partly because 6½-month-old infants respond poorly in the rotating screen task if first given 6 or more habituation trials (Baillargeon et al., 1995). I was also surprised that Cashon and Cohen adopted the same four-test design as Bogartz et al. (this issue), partly because it is so different from the one I used that it cannot in fairness be called a replication, and partly because, to my knowledge, no positive results have ever been obtained in a violation-of-expectation task (as opposed to a habituation–dishabituation task) using such a design. Finally, I was surprised that Cashon and Cohen chose a 2-sec minimum value for each test trial. In the 180° events, the screen rotated 4 sec away from the infant, paused for 1 sec, and then rotated 4 sec back toward the infant. Infants who looked for 2 sec and then looked away for 2 sec, thus ending the trial, would have lacked sufficient information to distinguish among the test events.

A Word About the Findings

Consider the test findings Cashon and Cohen (this issue) obtained with the infants who saw the 180° rotation without the box during the habituation trials. During test, the infants who were nonhabituators looked reliably longer at the 180° than at the 120° rotation with the box, whereas those who were habituators showed the reverse looking pattern. This means that the infants who received more habituation trials (20) showed a familiarity preference, and that the infants who received fewer habituation trials (6–19) showed a novelty preference. This is the opposite pattern from that observed by Bogartz et al. (this issue) and Schilling (this issue; they found that infants with fewer familiarization trials showed a familiarity preference, and infants with more trials a novelty preference), but I will leave this issue for now.

My interpretation of the results of Cashon and Cohen (this issue) is, once again, that the infants processed the events only superficially, focusing on the changes in the screen, the box, or both. The fact that the infants' looking times at the events were generally very short (e.g., see Figures 2a and 2b in Cashon & Cohen) is certainly consistent with this view. Why the infants were not engaged by the events is hard to fathom, although one clue comes from the work of Lécuyer. As mentioned earlier, Lécuyer is currently conducting a replication of the original rotating screen experiments; the experimental condition (with the box) has been completed so far, with positive results (Lécuyer & Durand, 1996). Lécuyer also obtained evidence of object permanence in young infants using novel computer-animated events of his own design (Lécuyer, 1993; Lécuyer, Abgueguen, & Lemarié, 1992). When visiting the University of Illinois recently, Lécuyer (1999) explained that one key factor in conducting experiments using computer-animated events with young infants is that of depth perception: It is important to provide infants with sufficient depth cues to correctly interpret the events (e.g., they must understand that they are being shown a screen rotating back and forth through a 180° arc).

In light of Lécuyer's (1993; Lécuyer et al., 1992; Lécuyer & Durand, 1996) findings, one plausible interpretation of the results of Cashon and Cohen (this issue) is that the computer-animated events they used were impoverished perceptually, so that the infants could not interpret them. From this perspective, one may suggest that (a) the habituators simply could not interpret the events very well and hence responded to them only superficially; and (b) the nonhabituators who received 20 habituation trials were eventually able to make sense of the events and processed them appropriately: They showed a preference for the 180° over the 120° rotation when the box was present but not when it was absent. It is equally possible, however, that both the habituators and the nonhabituators failed to correctly interpret the events due to lack of appropriate depth information, and that the various novelty and familiarity effects observed by the authors merely reflect the shallow responses of slightly different groups of infants to the events.

CONCLUDING REMARKS

Three main themes emerged in the separate discussions of the articles in this thematic collection. First, Bogartz et al. (this issue), Schilling (this issue), and Cashon and Cohen (this issue) were highly selective in their discussion of the relevant experimental literature, ignoring all results from the rotating screen and other paradigms that were inconsistent with their viewpoint. Second, the authors presented their experiments as replications of the original rotating screen experiments, even though their experiments differed from these experiments in multiple respects (e.g., design, stimuli, and procedures), making it difficult to evaluate their negative results. Finally, the authors all insisted that their results are highly consistent, but examination of the data suggests a different picture. Consider, in particular, the responses to the test rotations with the box of the infants who were habituated to the 180° rotation without the box. Schilling's 4-month-old infants showed a familiarity preference after 7 familiarization trials and a novelty preference after 12 familiarization trials. The 5½-month-old-infants tested by Bogartz et al. showed a familiarity preference after 3 familiarization trials and a novelty preference after 7 familiarization trials. Finally, the 8-month-old infants tested by Cashon and Cohen showed a familiarity preference if they received 20 habituation trials (nonhabituators), and a novelty preference if they received 6 to 19 trials (habituators). These data are consistent only in showing that infants in different experiments show novelty and familiarity preferences with different numbers of familiarization or habituation trials; one does not come away with a coherent picture of the development of these effects with age. Notice also that neither Bogartz et al. nor Cashon and Cohen replicated the results of Rivera, Wakeley, and Langer (1999); clearly, what one gets in the rotating screen task very much depends on how one goes about setting it up.

My general perspective on all of this research is this: It is not possible at this time to doubt young infants' ability to reason about occluded objects based on failures to replicate the original results from the rotating screen paradigm. How could it, with subsequent results from so many other paradigms all pointing to the same conclusion? At the same time, however, I agree that it would be helpful to better understand the rotating screen paradigm and the conditions under which infants do and do not produce meaningful responses that reflect the full scope of their physical knowledge and reasoning abilities. But whatever may be learned from delving into the mysteries of the rotating screen paradigm, researchers should take care to avoid making conceptual mountains out of methodological molehills.

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