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When Not Choosing Leads to Not Liking: Choice-Induced Preference in Infancy

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Abstract

The question of how people's preferences are shaped by their choices has generated decades of research. In a classic example, work on cognitive dissonance has found that observers who must choose between two equally attractive options subsequently avoid the unchosen option, suggesting that not choosing the item led them to like it less. However, almost all of the research on such choice-induced preference focuses on adults, leaving open the question of how much experience is necessary for its emergence. Here, we examined the developmental roots of this phenomenon in preverbal infants ($N = 189$). In a series of seven experiments using a free-choice paradigm, we found that infants experienced choice-induced preference change similar to adults'. Infants' choice patterns reflected genuine preference change and not attraction to novelty or inherent attitudes toward the options. Hence, choice shapes preferences—even without extensive experience making decisions and without a well-developed self-concept.

Keywords

infant development, preferences, decision making, cognitive development, open data

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That our preferences guide our choices feels intuitive—we tend to order foods we like, and for countless purchases, from cars to coffee, we spend more to get what we want. But lately it has become clear that the reverse is also true: Our choices shape our preferences. That is, the very act of choosing can change our disposition toward the options.

A classic example of this is choice-induced preference change, which occurs when making a decision modifies the chooser's attitudes about the choices. For instance, when people rate a series of items and then must choose between two items rated as equally attractive, they later rate the unchosen item as less attractive than before (Brehm, 1956; Festinger, 1957, 1962), even years after (Sharot, Fleming, Yu, Koster, & Dolan, 2012). The typical explanation is that people are trying to rationalize their choice, as if thinking, "I guess I didn't really like that (unchosen) one after all." Some scholars take choice-induced preference change as evidence of cognitive dissonance (Festinger, 1957, 1962; Harmon-Jones & Harmon-Jones, 2007): When someone's actions and attitudes are not aligned, cognitive dissonance causes tension that is reduced by changing either the action or the attitude. In this example, changing one's preferences (devaluing the unchosen option) increases alignment with the earlier choice.

Recent work suggests that choice-induced preference is neither specific to adults nor unique to humans. Four-year-old children and capuchin monkeys in a free-choice task chose between two equally desirable options and then got a new choice: the unchosen option from the first decision or a new, equally desirable option. Children and monkeys avoided the initially unchosen option, apparently changing their disposition toward it (Egan, Santos, & Bloom, 2007). This suggests that choice-induced preference appears early in ontogeny and phylogeny but leaves open the role of experience in its emergence. Children and monkeys have had years of making choices and experiencing the resulting outcomes. It may be that this experience is required for

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choice-induced preference to develop; individuals may gradually learn that inconsistent preferences are unpleasant and conflict inducing. Cooper (1998) argued that in adults, cognitive dissonance can be extinguished over time and therefore is affected by experience, so it is reasonable to suppose that experience is required to establish it in the first place.

Further, in earlier work on choice-induced preference, researchers typically assumed that an advanced self-concept was needed in order to view oneself as internally consistent and thus to rationalize one's decisions (Aronson, 1968; Bem, 1967, 1972; Steele, 1988), although others have argued that dissonance is more automatic (Izuma et al., 2010; Jarcho, Berkman, & Lieberman, 2010; Lieberman, Ochsner, Gilbert, & Schacter, 2001; Shultz & Lepper, 1996). Findings that choice-induced preference change can be modulated by highlighting concepts of behavioral inconsistency further suggest that such preference change involves self-awareness, which may not be present early in life (Hagège, Chammat, Tandetnik, & Naccache, 2018; Rochat, 2003).

Here, we asked whether significant experience making choices or having a developed self-concept are required for choice-induced preference change. We tested preverbal infants in a version of the task designed by Egan and colleagues (2007). In Experiments 1a and 1b, we found that infants given a choice between two equally attractive toys avoided the unchosen toy in a future decision. In Experiments 2a and 2b, we found that this avoidance disappeared when infants were given one of the toys rather than choosing it themselves. In Experiments 3a and 3b, when infants made a blind choice between objects with concealed identities, we again observed no choice-induced preference. Finally, in Experiment 4, even when fully controlling for the possibility that infants had initial preferences among the options, we found that choosing between two known options induced a preference shift.

Experiment 1

In our first experiment, we used a free-choice procedure in which infants first chose between two equally appealing toys. After choosing one, infants were given a second choice between the unchosen toy from the previous trial and a novel toy. If infants do exhibit choice-induced preference change, they should prefer the novel toy and avoid the previously unchosen toy.

Experiment 1a

Method. Twenty-one full-term infants between 10 and 20 months old participated (M = 14 months, 9 days; SD = 3 months, 18 days; 11 female). Fourteen additional infants were excluded for fussiness or failure to choose (n = 11) or for experimenter error (n = 3). Parents provided informed consent, and infants received a small gift (T-shirt, stuffed animal, book) for their participation. Sample size was chosen on the basis of sizes in other studies using the binary-choice method with infants of this age (e.g., Feigenson, Carey, & Hauser, 2002).[1]

The procedure was reviewed and approved by a university institutional review board. Infants completed just a single trial to ensure that they did not gradually form preferences over the course of testing. Infants sat with a parent on the floor of a laboratory testing room, facing an experimenter sitting approximately 1 m away. First, to give infants practice approaching and retrieving toys, the experimenter showed infants as she hid a stuffed animal inside an opaque bucket. She then encouraged infants to crawl toward her and retrieve it. After the infants had done so, they were returned to their parent's lap, and the experimenter removed the stuffed animal and bucket from sight.

Next came the preference-induction trial. The experimenter brought out two foam blocks and held up one in each hand. The blocks (each approximately 10 cm × 10 cm × 20 cm) were visually distinctive: a black rectangular block with white dots, a green cubic block with light green stripes, and an orange arch-shaped block with light orange triangles (pilot testing suggested that infants found these three objects equally attractive). Two of these three were used in the induction trial, counterbalanced across infants (we will call these *block A* and *block B*). The experimenter made sure infants attended to both blocks, shaking them overhead. She then placed each block inside a clear plastic box,[2] one on her left side and one on her right, after which infants' attention was drawn to the midpoint between the boxes. Then the experimenter put her head down, and parents were instructed to let infants crawl freely to retrieve a block from one of the open boxes. We will call the chosen block "block A" and the unchosen block "block B," regardless of the physical features of the blocks actually presented or chosen. After infants had chosen a block (i.e., had met the criterion of approaching and touching or pointing to one of the blocks), the chosen and unchosen blocks were removed from sight, and infants were returned to their parent's lap.

For the critical test trial, the experimenter reached behind her back and retrieved two blocks: the unchosen block (B) from the induction trial and a new block that infants had never seen before (block C). The experimenter held one of these in each hand, shaking them to draw infants' attention. She then simultaneously placed one block on the floor to her right and one on the floor to the left (side of placement was counterbalanced across infants) and, as before, drew infants' attention to the midpoint between the blocks. The experimenter then put her head down, and infants were allowed to crawl or walk freely. After infants chose between blocks B and C, the experiment ended.

Results. In the initial induction trial with blocks A and B, infants showed no systematic preference: Equal numbers of infants chose each of the blocks (seven infants chose the black rectangle, seven infants chose the orange arch, and seven infants chose the green cube). However, in the critical test trial that followed, 16 of 21 infants (76.2%) chose the new block (block C; Fig. 1)—a percentage significantly different from chance, according to a two-tailed binomial test, $p = .026$, 95% exact confidence interval (CI) = [52.83%, 91.78%], relative risk ratio = 1.52. A chi-square test of independence indicated no significant effect of age or gender on infants' choices, $\chi^2(19, N = 21) = 18.24$, $p = .506$, and $\chi^2(1, N = 21) = 0.15$, $p = .696$, respectively.

Experiment 1b

Given the relatively small sample size of Experiment 1a, we next attempted to replicate the findings with an independent sample. We tested 26 more infants between 10 and 20 months of age (*M* = 14 months, 21 days; *SD* = 2 months, 24 days; 13 females) using the procedure from Experiment 1a. Five additional infants were excluded for fussiness or failure to choose ($n = 2$) or for experimenter error ($n = 3$).

Nineteen of the 26 infants (73%) chose the novel block (block C; Fig. 1). This percentage was significantly different from chance, according to a two-tailed binomial test, $p = .029$, 95% exact CI = [52.21%, 88.43%], relative risk ratio = 1.46. A chi-square test of independence indicated no significant effect of age or gender on infants' choices, $\chi^2(20, N = 26) = 20.92$, $p = .402$, and $\chi^2(1, N = 26) = 0.20$, $p = .658$, respectively.

Discussion

After choosing between two initially equally attractive toys, infants subsequently avoided the previously unchosen toy. These results are consistent with the view that infants' preferences were changed by the choice they had made. However, an alternative possibility is that infants chose block C because it was more novel. Experiment 2 tested this possibility.

Experiment 2

All aspects of Experiment 2 were the same as in Experiment 1, except that in the induction trial, the experimenter gave infants one of the blocks rather than allowing them to choose for themselves.

Experiment 2a

Method. Twenty-nine infants between 10 and 20 months of age participated (*M* = 14 months, 21 days; *SD* = 2 months, 9 days; 15 female). One additional infant was excluded for fussiness.

The design and procedure were the same as in Experiment 1, except on the induction trial. After the experimenter had shown infants blocks A and B, she placed them on the floor, each in a plastic box. Because the boxes were clear, infants could see which block was in which box. The experimenter closed her eyes and shuffled the boxes several times to mix up their locations, then randomly chose one box and pushed it forward so that it was directly in front of the infant. The other object remained visible inside its box, out of infants' reach. Infants were allowed to retrieve the block that had been chosen for them (block A); after a few seconds, the experimenter took blocks A and B and placed them out of view.

The test trial that followed was the same as in Experiment 1: Infants were given a choice between block B (which had previously been seen, but not received) and the novel block (block C). Which blocks served as block A, B, and C was counterbalanced.

Results. Sixteen of 29 infants (55.1%) chose the novel block (C) on the critical test trial (Fig. 1). A two-tailed binomial test indicated that this percentage did not significantly differ from chance, $p = .711$, 95% exact CI = [35.69%, 73.55%], relative risk ratio = 1.10. A chi-square test of independence indicated no significant effect of age or gender on infants' choices, $\chi^2(26, N = 29) = 26.98$, $p = .410$, and $\chi^2(1, N = 29) = 0.04$, $p = .837$, respectively.

Experiment 2b

We sought to replicate the findings of Experiment 2a in a separate sample of infants. Twenty-two infants between 10 and 20 months of age participated (*M* = 14 months, 24 days; *SD* = 3 months, 15 days; 14 female). Four additional infants were excluded for fussiness or failure to choose in the test trial ($n = 3$) and for experimenter error ($n = 1$).

Ten of 22 infants (45.5%) chose the novel block (C) on the critical test trial (Fig. 1). A two-tailed binomial test indicated that this percentage did not significantly differ from chance, $p = .832$, 95% exact CI = [24.39%, 67.79%], relative risk ratio = 0.91. A chi-square test of independence indicated no significant effect of age or gender on infants' choices, $\chi^2(19, N = 22) = 22.00$, $p = .284$, and $\chi^2(1, N = 22) = 1.47$, $p = .225$, respectively. To check whether infants' preferences differed when they

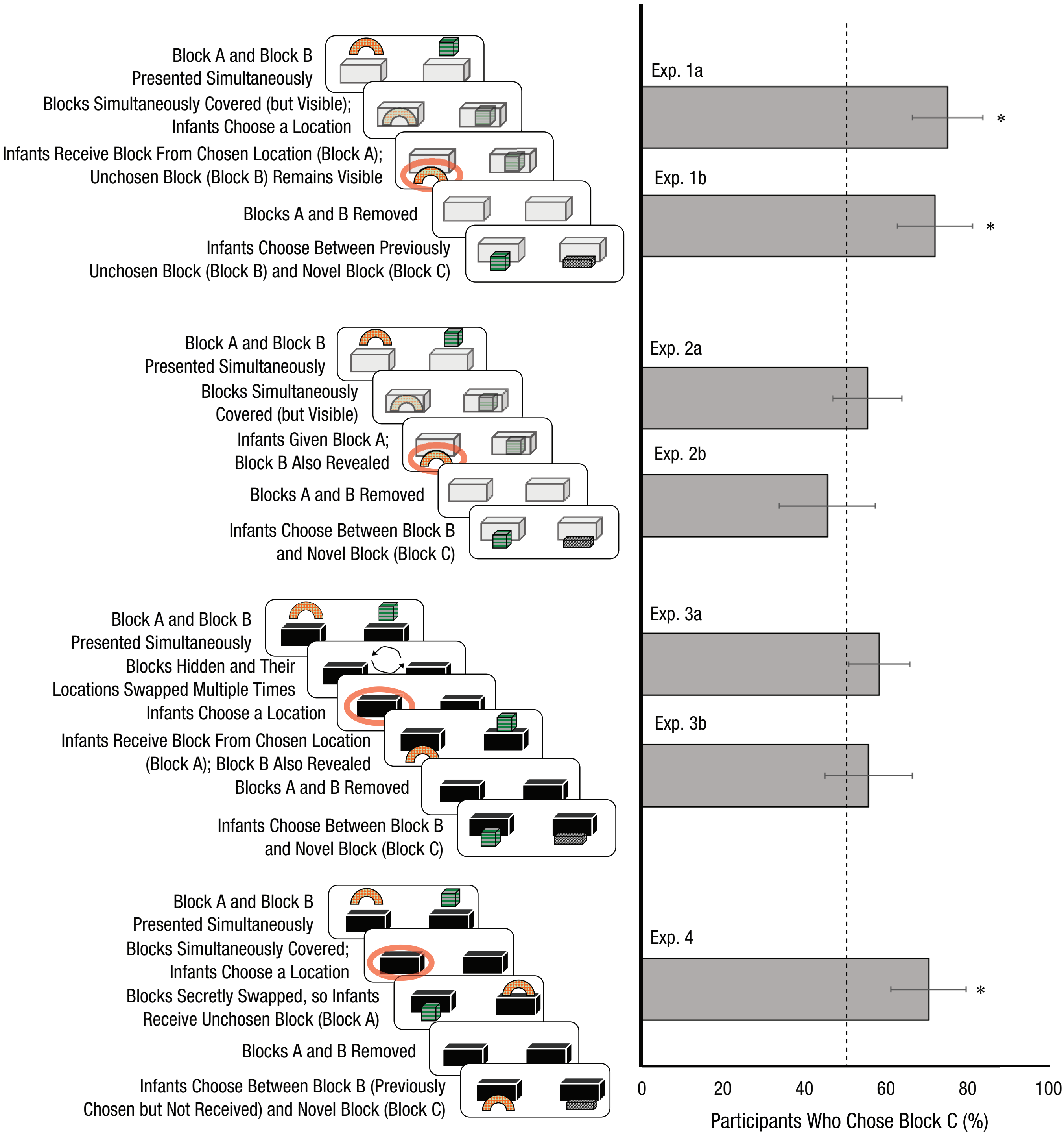

Fig. 1. Timeline of preference-induction and test trials (left) and percentage of infants who chose the novel block (block C; right) in Experiments 1 through 4. Asterisks indicate significant differences from chance ($p < .05$). Chance is marked by the dashed line. Error bars represent standard errors.

themselves had chosen an object compared with when they had simply been given an object, we compared infants' choices in Experiments 1a and 1b, collapsed, with those in Experiments 2a and 2b, collapsed. A two-tailed Fisher's exact test revealed that these preferences were significantly different, $p = .022$.

Discussion

Infants' choices were not based on novelty: Receiving one object and not another did not motivate infants to prefer the new, third object. Combined with the results of Experiments 1a and 1b, this result suggests that infants must make their own choices in order to experience choice-induced preference change.

These findings raise the question of what other features are needed to constitute a choice. Is choice determined by motor planning and action (crawling toward and grasping an object), or does it also require representing and evaluating both objects as viable options before one makes a choice?

Experiment 3

In Experiment 3, we asked whether choice-induced preference change requires knowledge of the options prior to choosing. Previous work with children, adults, and monkeys has suggested that choice-induced preference change occurs even when participants choose from unknown options (see Egan, Bloom, & Santos, 2010; Sharot, Velasquez, & Dolan, 2010). However, it is unknown whether infants, who have substantially less experience making choices, respond similarly or whether infants require more knowledge of the options prior to choosing in order to experience choice-induced preference change. In Experiment 3, we used a blind-choice paradigm in which infants actively chose during the induction trial but did so from options whose identities were concealed. After infants had chosen, the options' identities were revealed. Finally, infants chose between the previously unchosen toy and a new toy.

Experiment 3a

Method. Forty-three infants between 10 and 20 months of age participated (M = 14 months, 0 days; SD = 3 months, 6 days; 19 female). Seventeen additional infants were excluded for fussiness or failure to choose (n = 14) or for experimenter error (n = 3).

The design and procedure were the same as in Experiment 1, except that on the induction trial, the boxes placed over the objects were opaque. After the experimenter had shown infants blocks A and B and drawn their attention, she placed the blocks on the floor and covered each with an opaque box. The experimenter closed her eyes and shuffled the boxes to mix up their locations so that infants would be uncertain which object was under which box. Infants were then allowed to approach the box of their choice. Once they had approached one of the boxes, the boxes were lifted and both objects' identities were revealed. Infants were briefly allowed to play with the chosen block (block A) before it was removed.

The test trial that followed was the same as in the previous experiments: Infants were given a choice between the unchosen block (B) and a novel block (C). Which blocks served as block A, B, and C was counterbalanced.

Results. Twenty-five of 43 infants (58%) chose the novel block (C) on the critical test trial (Fig. 1). A two-tailed binomial test indicated that this percentage did not significantly differ from chance, p = .360, 95% exact CI = [42.13%, 72.99%], relative risk ratio = 1.16. A chi-square test of independence indicated no significant effect of age or gender on infants' choices, $\chi^2(37, N = 43) = 43.00$, p = .230, and $\chi^2(1, N = 43) = 0.35$, p = .553, respectively.

Experiment 3b

We next attempted to replicate the findings of Experiment 3a with an independent sample. We tested 18 more infants between 10 and 20 months old (M = 14 months, 21 days; SD = 2 months, 19 days; 9 females) using the procedure from Experiment 3a. Eleven additional infants were excluded for fussiness or failure to choose (n = 9) or for experimenter error (n = 2).

Ten of 18 infants (55.6%) chose the new block (block C; Fig. 1). This percentage was not significantly different from chance, according to a two-tailed binomial test, p = .815, 95% exact CI = [30.76%, 78.47%], relative risk ratio = 1.11. A chi-square test of independence indicated no significant effect of age or gender on infants' choices, $\chi^2(14, N = 18) = 15.98$, p = .315, and $\chi^2(1, N = 18) = 0.00$, p = 1.000, respectively.

Discussion

When infants chose without knowing what they were choosing, they did not subsequently devalue the unchosen object—hence, for infants, choice-induced preference requires knowledge of the options.

Together, the results of Experiments 1 through 3 suggest that infants use their choices to infer their preferences. However, an alternative explanation is that infants had already devalued block B from the very start of our experiments, prior to making any choice at all. Recall that in the induction trial, approximately equal numbers of infants chose each block—there was no systematic preference for any particular block. But what if all infants had their own idiosyncratic but consistent object preferences? For example, imagine that in the induction trial, a given infant dispreferred the green-striped block and preferred (and chose) the black-and-white block. When this infant was later presented with the previously unchosen green striped block and the orange arched block, choosing the orange block (block C) might have reflected initial aversion to the unchosen green block (block B) rather than choice-induced preference change. This concern has been raised as a criticism of extant studies (Chen & Risen, 2010). It cannot be ruled out by examining group-choice behavior, because infants may have contrasting but consistent individual preferences. Therefore, in Experiment 4, we used a new manipulation to test the possibility that infants' test-trial choices reflected intrinsic individual preferences.

Experiment 4

Infants first received an induction trial—as in Experiment 3, they saw blocks A and B, which were hidden under opaque boxes. Unlike in Experiment 3, however, boxes remained in their original positions so infants knew which one was where. However, blocks A and B were secretly swapped while hidden (via trap doors in the boxes and duplicate objects). Thus, regardless of which hidden object infants chose, they always received the other object—thereby giving infants the compelling illusion of having chosen block A despite having actually chosen block B. Giving adult participants false information about their behavior leads them to change their future preferences (Johansson, Hall, Tärning, Sikström, & Chater, 2014); we reasoned that a similar process might affect infants. Finally, as in Experiments 1 through 3, infants chose between the unchosen block (B, which they had actually originally chosen but had not received) and a novel block (C). If infants exhibit choice-induced preference change, they should avoid the block that they originally chose (but thought they had not chosen) and choose block C.

Method

Thirty infants between 10 and 20 months of age participated (M = 14 months, 0 days; SD = 3 months, 15 days; 14 female). Six additional infants were excluded for fussiness.

In the induction trial, infants saw block A and block B placed under opaque boxes and were encouraged to choose one. Because the boxes remained in place and infants chose immediately after the objects were hidden, infants were expected to know which object was in which location. However, secretly, the experimenter had earlier hidden a duplicate of block A in the box used to cover block B and a duplicate of block B in the box used to cover block A. As infants approached their (covered) choice, the experimenter reached through a secret opening in each box and swapped the objects with the hidden duplicates. As a result, when the boxes were lifted, infants saw block A in block B's location and block B in block A's location, and they were given block A to play with (i.e., infants were given the alternative to whichever block they had approached).

Finally, on the test trial, infants were returned to their parent's lap. The experimenter brought out block B (the object from the induction trial that they had originally chosen but did not receive) and the novel block (C) and placed them on the floor, equidistant from infants. After infants made their choice, the experiment ended.

Results

Twenty-one of 30 infants (70%) chose the novel block (block C; Fig. 1). A two-tailed binomial test indicated that this percentage significantly differed from chance, p = .043, 95% exact CI = [50.60%, 85.27%], relative risk ratio = 1.40. A chi-square test of independence indicated no significant effect of age or gender on infants' choices, $\chi^2(26, N = 30) = 25.24$, p = .506, and $\chi^2(1, N = 30) = 0.41$, p = .523, respectively.

Discussion

We ensured that intrinsic preferences could not explain infants' choices in the critical test trial. Infants were led to believe they had chosen block A when they had actually chosen block B. When later offered the unchosen block (B, which they had actually chosen) and the novel block (C), infants consistently avoided block B. This provides strong evidence for choice-induced preference change.

Combined Results

The nature of our binomial data combined with the relatively small sample sizes afforded by infant experiments preclude testing for interactions among the individual conditions in our study. Instead, we combined data across experiments to investigate whether infants' choices in the experiments hypothesized to induce choice-induced preference change (Experiments 1a, 1b, and 4) differed from those in the experiments hypothesized to induce no such change (Experiments 2a, 2b, 3a, and 3b). A two-tailed Fisher's exact test revealed that infants' choices in Experiments 1a, 1b, and 4 (N = 77) significantly differed from choices in Experiments 2a, 2b, 3a, and 3b (N = 112), p = .015.

General Discussion

Choice has been suggested as a critical determinant of human well-being (Leotti, Iyengar, & Ochsner, 2010). Not only do we like having choices (Schwartz, 2004), but also we use our choices to draw inferences about ourselves. For example, not choosing something causes us to like it less. Whereas such effects of choice have been much studied in adults, far less attention has been paid to choice during development, especially in infancy—at the start of volitional control.

Here, we found that even though infants have had much less opportunity for choice than older children or adults, choice still changes their thinking. Specifically, we found that after selecting from two equally attractive objects, infants subsequently devalued the initially unchosen object. We ruled out the possibility that this reflects a desire for novelty or any intrinsic preference among the options. Our findings suggest that choice-induced preference change does not require extensive experience making choices, nor does it rely on advanced metacognitive ability or a developed sense of self.

Still, one aspect of our results differs from previous findings. In Experiment 3a, we found that making a blind choice from two unknown options did not trigger choice-induced preference change in infants, whereas blind choices have been argued to cause preference change in preschoolers and monkeys (Egan et al., 2010). It may be that in older, more experienced participants, one does not need to have considered the options' identities to feel that one has genuinely chosen among them (whereas infants might need more evidence of the options to experience any effect of choosing). However, methodological aspects of previous studies make it hard to know for sure. Egan and colleagues' tasks differed from ours in several respects, including whether participants chose from visible or hidden options. Further, the evidence that much older, adult participants experience preference change in a blind choice task is mixed. Sharot et al. (2010) found an increase in liking for stimuli that adults were led to believe they had chosen, but they found no change for stimuli that participants thought they had rejected. Thus, more work is clearly needed to understand the conditions that lead individuals of various species and ages to feel that they have made a choice, so that having made this choice then affects their preferences.

Previous work on choice also raised the concern that past empirical results reflected participants' inherent preferences rather than genuine preference change (Chen & Risen, 2010). An advantage of the design of our Experiment 4 is that we used a different approach to address this worry. Infants in Experiment 4 had ample time to encode the options before choosing and clearly could have approached either object. However, because the options were secretly swapped after infants had chosen, any inherent preference was ruled out as a source of choice on the critical test trial. This offers strong evidence for an effect of choice.

Using choices to understand the world begins early in life (Kushnir, 2012). Infants expect other agents to choose consistently (Woodward, 1998), infer what people like from their choices (Kushnir, Xu, & Wellman, 2010), and detect when others' actions result from choice versus necessity (Gergely, Bekkering, & Király, 2002). Our findings add to our understanding of the role of choice in infancy, showing that infants use their own choices to shape their preferences. This work raises the question of whether other aspects of the psychology of decision-making also have their roots very early in life.

Transparency

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Author Contributions

A. E. Stahl, R. Loiotile, and L. Feigenson developed the study concept. All authors contributed to the study design. Testing was performed by A. E. Stahl, A. M. Silver, and A. S. Smith-Flores. A. M. Silver analyzed the data. All authors contributed to the writing of the manuscript and approved the final version for submission.

Declaration of Conflicting Interests

The author(s) declared that there were no conflicts of interest with respect to the authorship or the publication of this article.

Open Practices

All data have been made publicly available via OSF and can be accessed at https://osf.io/MFZG4/. The design and analysis plans for the experiments were not preregistered. The complete Open Practices Disclosure for this article can be found at http://journals.sagepub.com/doi/suppl/10.1177/0956797620954491. This article has received the badge for Open Data. More information about the Open Practices badges can be found at http://www.psychologicalscience.org/publications/badges.

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Notes

1. All of the infants in Experiments 1 through 4 also participated in an unrelated study prior to the experiments reported here (following a brief break in the laboratory waiting room). Because infants were recruited for these other studies rather than recruited directly, and because we avoided switching from one experimental design to another within a given week in order to maintain consistency, slightly different sample sizes were tested in Experiments 1 through 4.
2. The plastic box was included in Experiment 1 only to equate aspects of the presentation with Experiments 2 through 4.

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