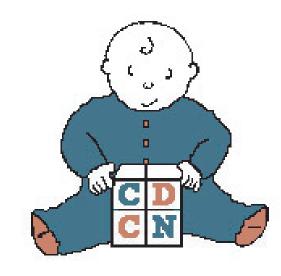
Appearance Matters -- But Not to Young Infants: Development of Spatial and Visual Discrimination Learning from 9-21 Months



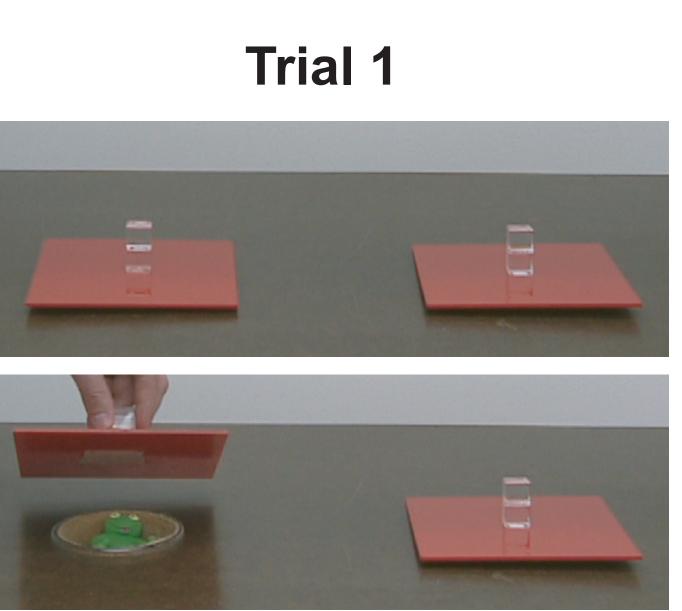
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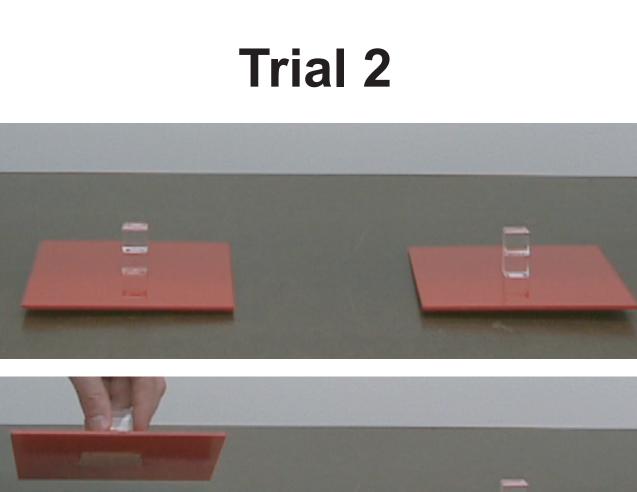
We predicted that infants would succeed on Spatial Discrimination at a younger age and in fewer trials than on Visual Discrimination.

Non-human primates find it much easier to learn SD than VD and are able to do so in far fewer trials (Butter, 1969; Nissen et al., 1938).

Additionally, infants tend to pay more attention to physical properties (such as number, trajectory, etc.) than to object appearance (e.g. color) (Spelke, 1991; von Hofsten et al., 1998; Xu et al., submitted). Location, we would argue, is a physical property like number or trajectory, so one might predict that infants would be likely to attend to it.

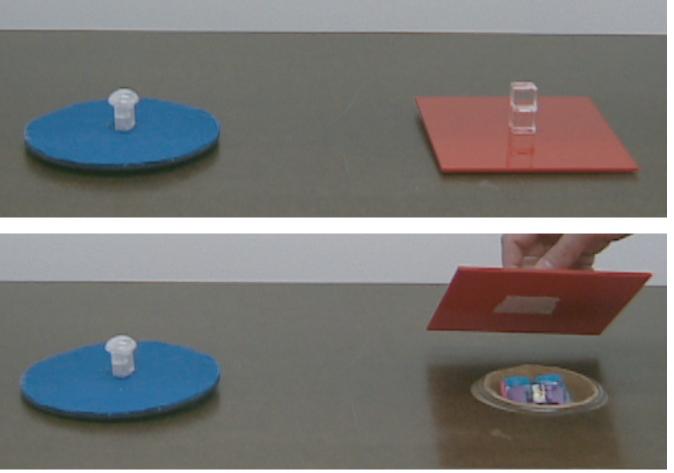
In Spatial Discrimination (SD), one must deduce the rule that the reward is always hidden on the right or the left:

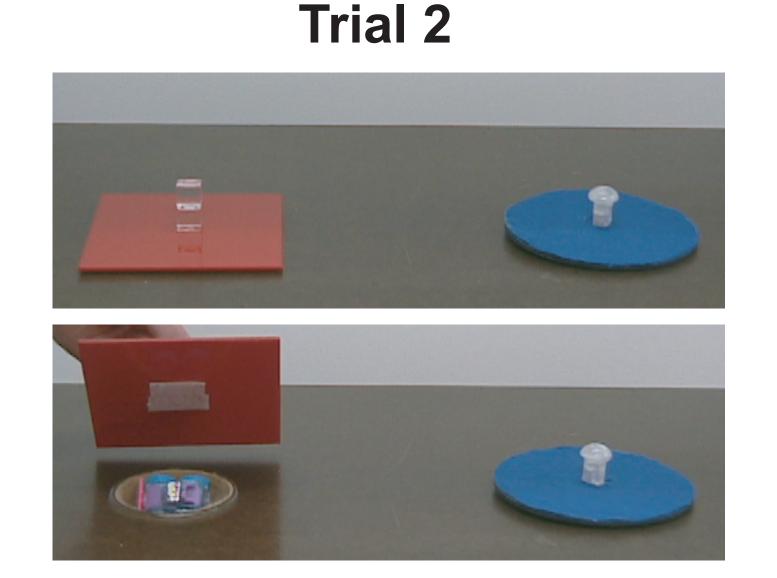




In Visual Discrimination (VD), one must deduce the rule that the failed VD even at 12 months. reward is always hidden under a cover of a particular appearance (here, a red, plexiglass square or a blue, felt-covered plexiglass circle). The left-right positions of the covers are varied randomly over trials; thus, the left-right location of the reward is also varied:







For BOTH SD and VD :

- Infants never saw the experimenter hide the reward.

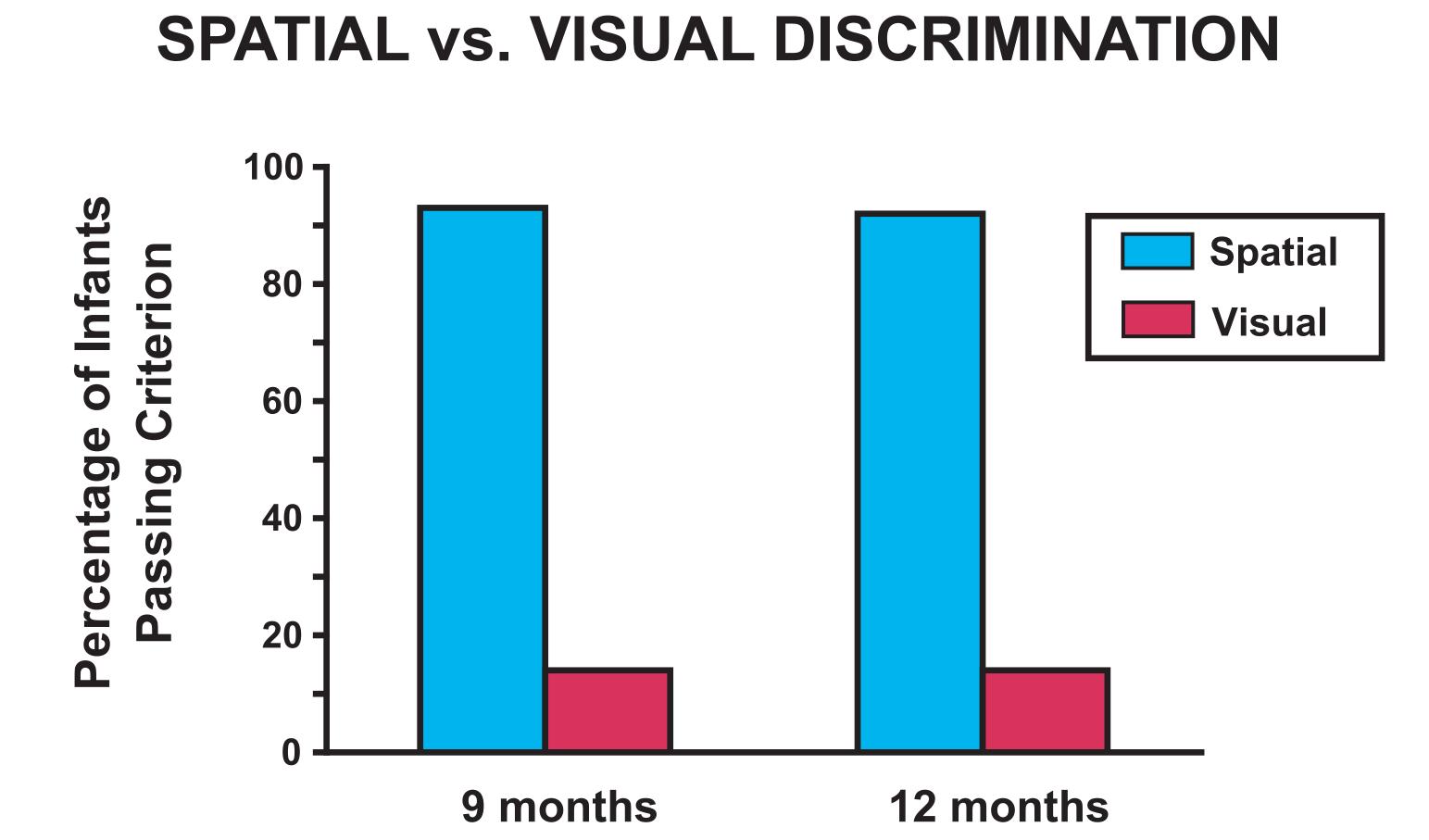
- Up to 16 trials were administered; minimum = 12 trials.

MEASURES OF PERFORMANCE:

-Passed Criterion: 5 consecutively correct trials anywhere in the session. -Trials to Criterion: The number of trials until 5 in a row correct.

-%Correct Out of 8: Percentage of correct responses on the last 8 trials in the session (unless >5 correct in first 8 trials and indication of boredom after that).

The measure of performance used in graphs in this poster is the for a total of 168 infants. percentage of infants passing criterion. Results were the same using 🛛 In addition, another 14 infants (7 M, 7 F) per reward condition (in well, either of the other two dependent measures, except where otherwise noted.



The difference in performance between SD and VD was significant at both 9 and 12 months. As predicted, SD was much easier for infants than VD. Infants of both ages performed at ceiling on SD.

DEVELOPMENTAL PROGRESSION

At what age can infants succeed on VD?

S	10
e of Infants Criterion	8
	6
Percentage Passing C	4
Perce	2

21-month-olds performed significantly better than either 9- or 12-montholds on VD. Note, however, that only 57% of 21-month-olds passed criterion on VD. 21 months marks the threshold when success on VD begins to appear.

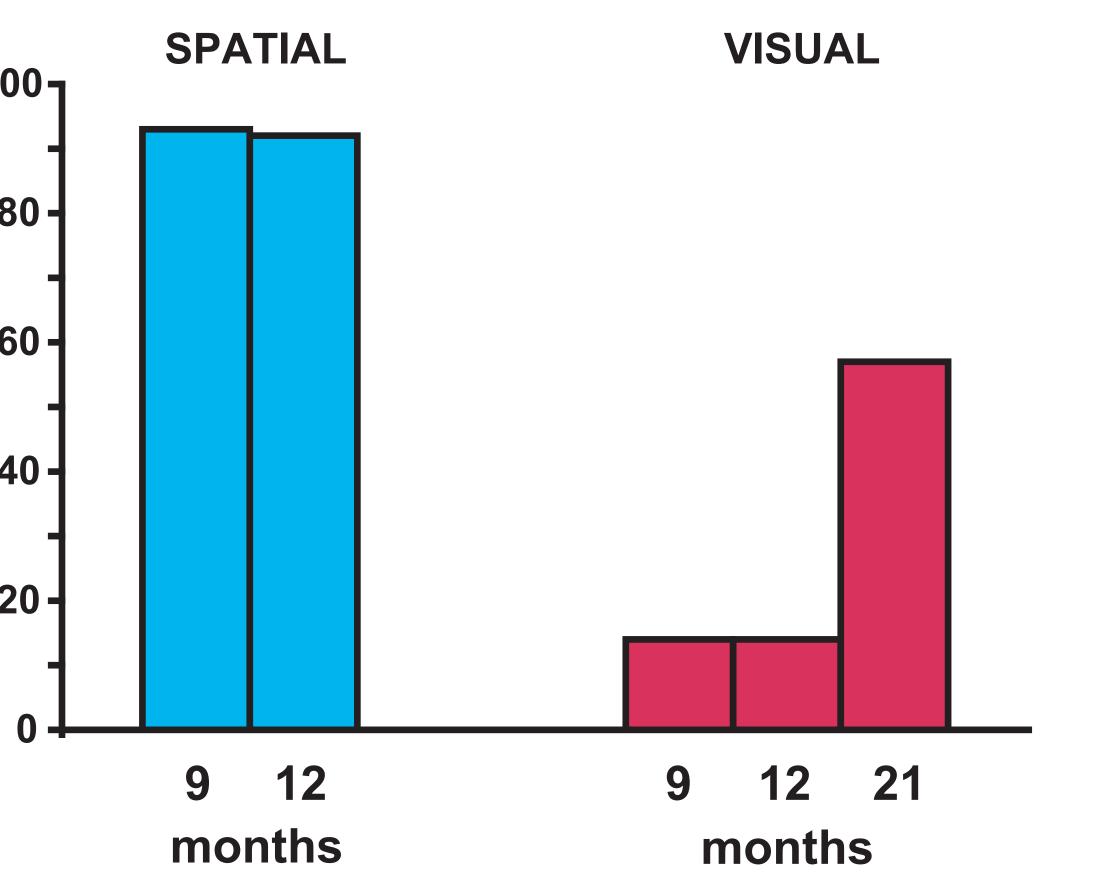
SUBJECTS:

14 infants (7 M, 7 F) per age (9 & 12 months), per task (SD, VD, & SD-w/-Irrelevant-Appearance-Info), and per reward condition (in well, attached to underside of cover) attached to underside of cover) were tested on VD at 21 months.

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There were no significant differences between the performance of infants of 9 and 12 months on either VD or SD.

On SD, even 9-month-olds were at ceiling. Almost all infants



WHY IS SPATIAL DISCRIMINATION EASIER, I?

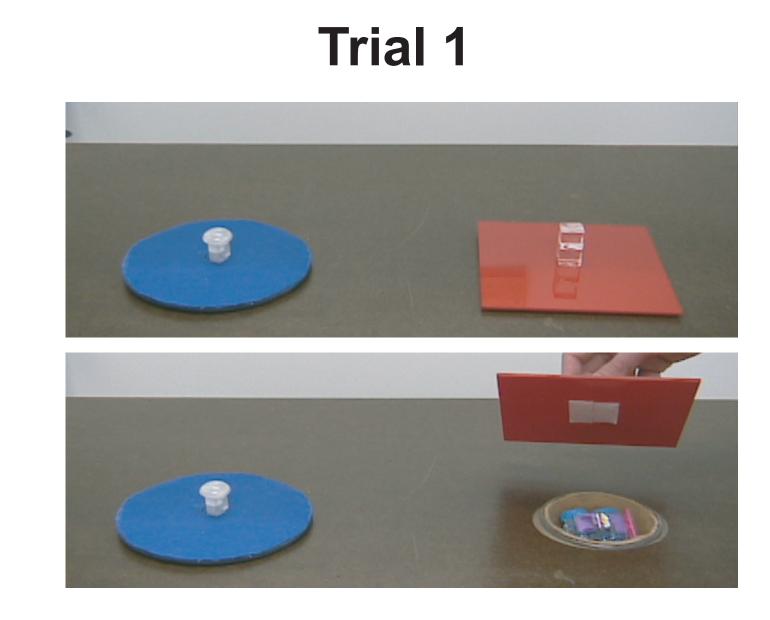
Hypothesis 1: SD is easier because the stimuli differ on only one dimension -- location. In VD, 2 dimensions are potentially relevant -- the stimuli differ in both appearance and location.

To test this, we added a second dimension to the SD task so that, like VD, it would have 2 dimensions as well.

SD with Irrelevant Appearance Information (SD w/ Irrelevant):

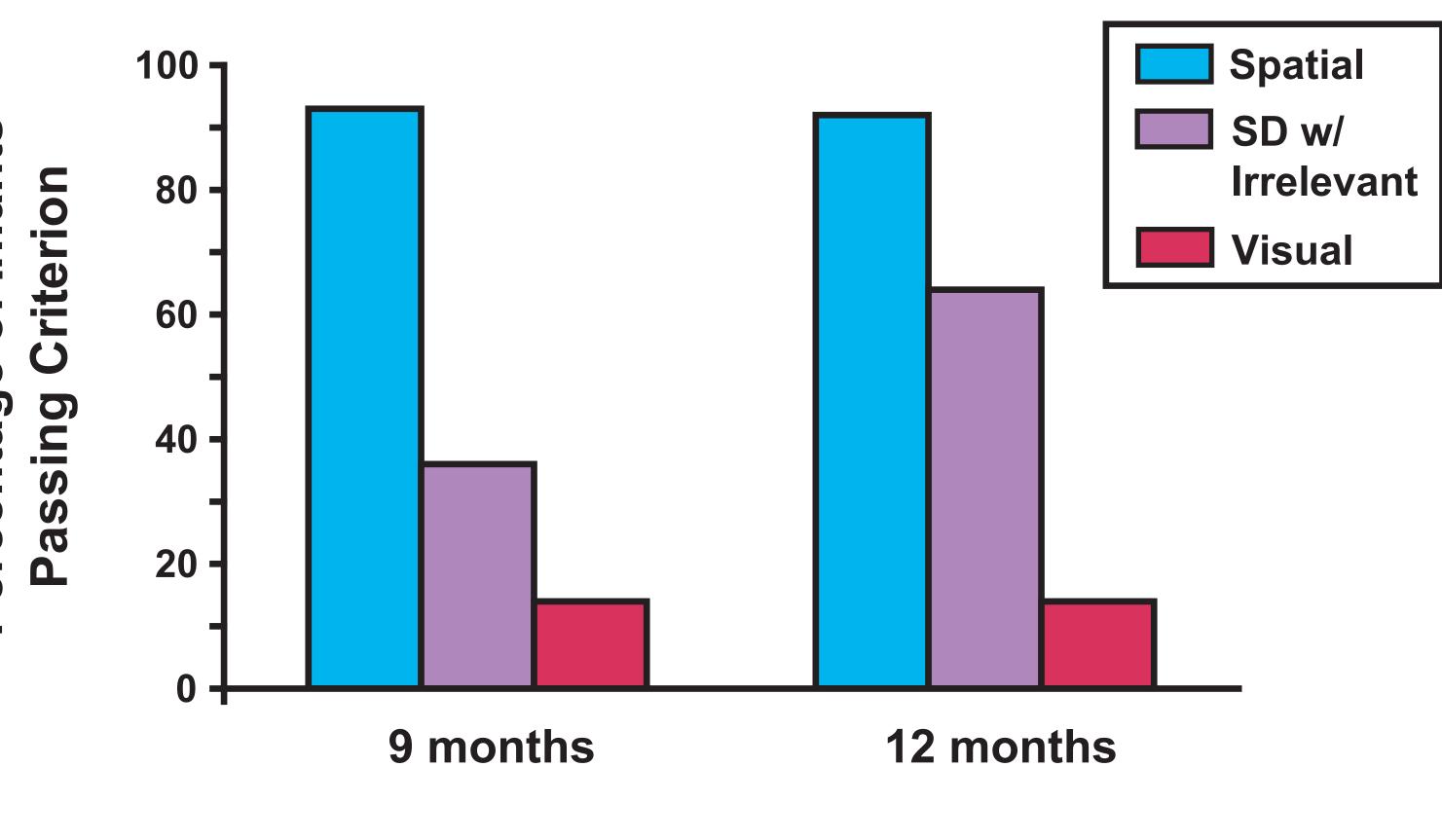
-The covers were different from one another (same stimuli as VD). -The left-right positions of the covers were varied randomly across trials (but the movement of the covers was irrelevant to the task);

- the reward did not follow a cover.
- -The reward was always hidden on the left or the right.



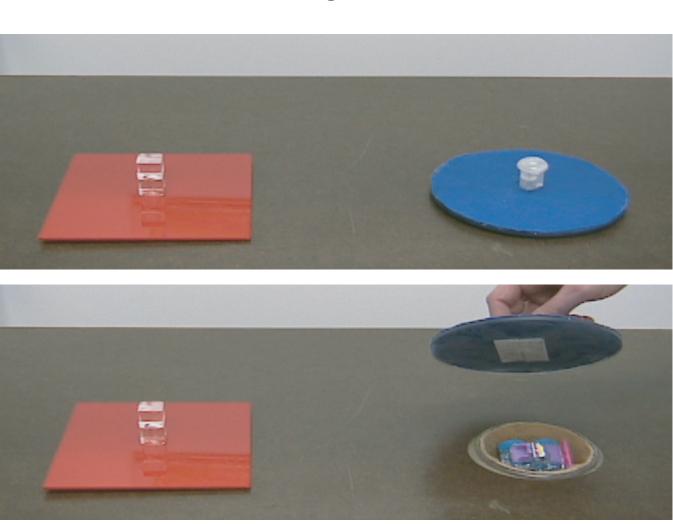
Predictions:

-Worse performance on SD w/ Irrelevant than on SD. -Less difference in performance between SD w/ Irrelevant & VD than between SD & VD. Indeed, a strong prediction would be comparable performance on SD w/ Irrelevant and VD.



- 9 months: SD performance significantly better than SD w/ Irrelevant Consistent with Hypothesis 1.
- 12 months: SD w/ Irrelevant performance not significantly different from SD On %Correct Out of 8 & Trials to Criterion. SD w/ Irrelevant





SD w/ Irrelevant performance not significantly different from VD

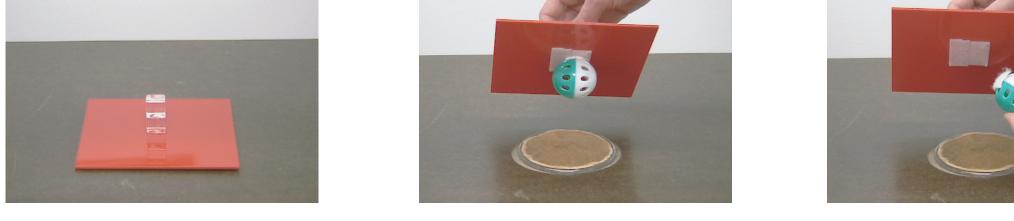
SD w/ Irrelevant performance significantly better than VD Performance on SD robust in the face of irrelevant information.

performance was worse than SD. Thus, the performance of 12-month olds was to some extent affected by irrelevant appearance information

WHY IS SPATIAL DISCRIMINATION EASIER, II?

Hypothesis 2: SD is easier because the rewards are placed in A bias was said to be present if either criterion was met: stationary wells which might encourage attending to where the reward is located in space, rather than attending to what is on top of the wells. Attaching the reward to the cover might help participants learn that the appearance of the covers is relevant to the task.

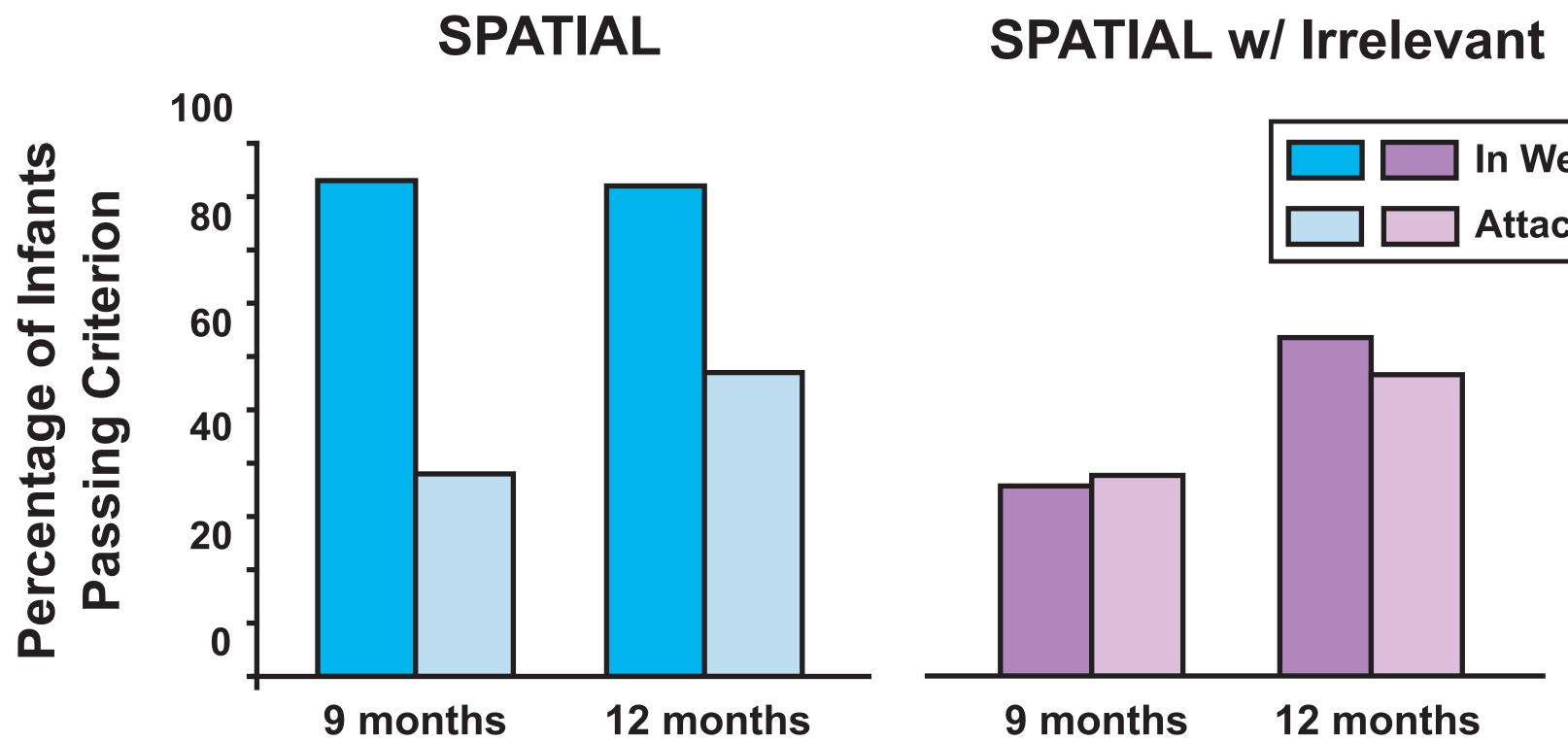
To test this, we administered each condition (SD, SD w/ In SD, a bias could only be on the relevant dimension. For VD & SD w/ Irrelevant, & VD) with the reward attached to the underside of the cover, rather than having the reward sit in the well:



The reward was still concealed within the well when the covers were The number of infants displaying a bias decreased with age. 21-month-olds in place. The reward was velcroed to, though detachable from, the showed the fewest and 9-month-olds showed the most. underside of the cover.

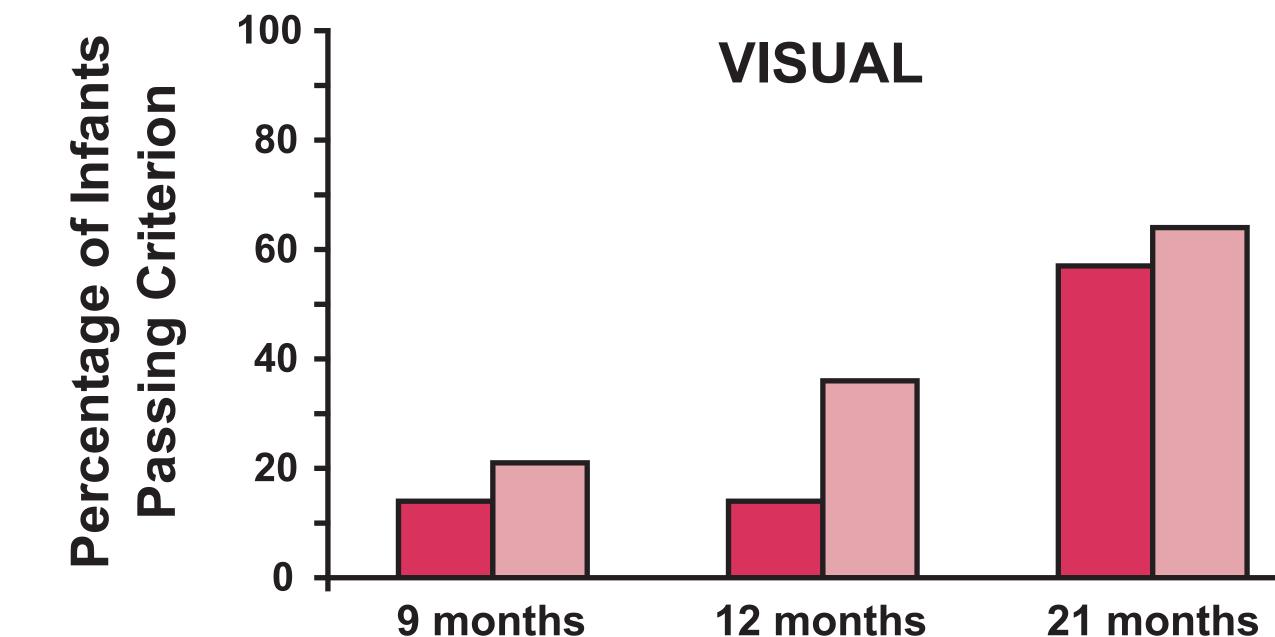
Predicted effects of attaching the reward to the cover:

- Worse performance on SD & on SD w/ Irrelevant than when the reward is in the well.
- Better performance on VD than when the reward is in the well.



Both 9- & 12-month-olds performed significantly worse on SD-attached than on SD-in well, consistent with Hypothesis 2. Attaching the reward to the cover did not affect performance on SD w/

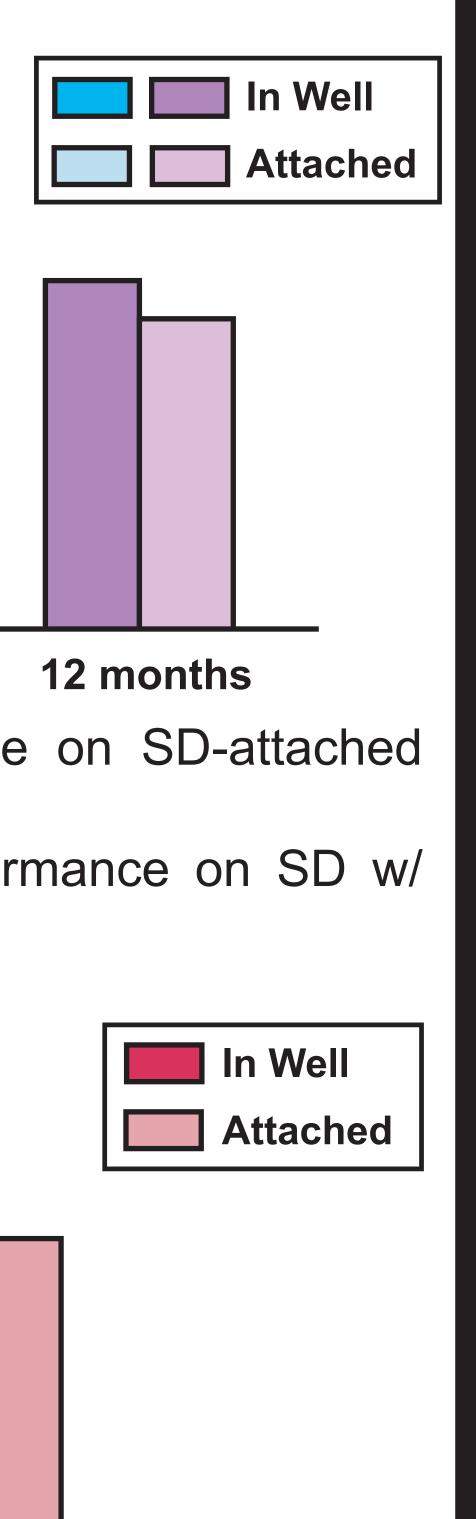
Irrelevant at 9 or 12 months, contrary to Hypothesis 2.



von Hofsten, C., Vishton, P., Spelke, E. S., Feng, Q., & Rosander, K. (1998). Predictive action in Both 9- & 12-months-olds performed better on VD-attached than on VD-ininfancy: Tracking and reaching for moving objects, Cognition, 67, 255-285. Spelke, E. S. (1991). Physical knowledge in infancy: Reflections on Piaget's theory. In S. Carey & R. well, but this difference was not significant for %Passing Criterion. This Gelman (eds.), The Epigenesis of Mind: Essays on Biology and Cognition (133-170). Hillsdale, difference was significant, however, for the dependent measure %Correct New Jersey: Lawrence Erbaum. Out of 8 at both 9 and 12 months. Xu, F., Carey, S., Quint, N., & Bassin, S. (*submitted*). Kind-based object individuation in infancy.







BIASES

- ≥5 consecutive responses to the wrong value within the relevant dimension (e.g., 5 responses to the right when left was the correct choice).
- \geq 7 consecutive responses to the same value on the irrelevant dimension (some of those responses would be rewarded because by chance they would correspond to the correct choice on the relevant dimension; e.g, 7 responses to the right when blue cover was the correct choice).
- Irrelevant, a bias could be to the wrong value of the relevant dimension or to either value of the irrelevant dimension.
- It was only possible to detect biases that negatively affected performance. It is not possible to distinguish correct performance due to a bias from correct performance due to mastery of the task.

Findings

When there was a significant difference between conditions, it was always in the direction of more infants showing a bias on the harder condition. Significantly more children showed a bias on:

VD-in-well than SD-in-well at 9 & 12 months.

SD w/ Irrelevant-in-well than SD-in-well at 12 months.

VD-in-well than VD-attached at 9 months.

SD-attached than SD-in-well at 9 months.

Do infants perform poorly because of a bias or do infants revert to a bias when confronted with a task they can't solve?

If infants perform poorly because of biases, their biases should be present at the outset of the session.

- If infants display biases because they find the task unsolvable, biases should emerge later in the session.
- Criterion used for an early-appearing bias =
- String of biased responses that began at or before Trial 3.
- Criterion used for a late-appearing bias =

String of biased responses that began at or after Trial 6.

Findings

Early biases were more evident at 12 months than at 9 months. More 12-month-olds showed a bias early in the session than late. More infants of 9 months than 12 months developed a bias late in the

Those 21-month-olds showing a bias were more likely to overcome the bias and succeed anyway than were of 9- or 12-month-olds.

100% of 21-month-olds succeeded on VD-attached if the infants showing a bias are omitted from the analysis.

References

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chimpanzees. Journal of Comparative Psychology, 26, 361-386.