Further Evidence for Negative Priming in Dimensional Shifting Tasks.

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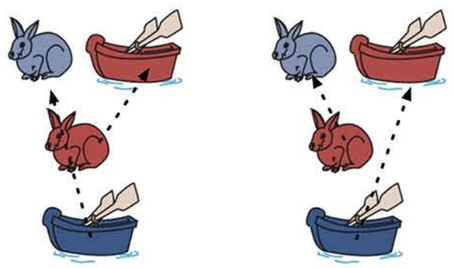
Aims

In the April 2005 issue of *Psychological Science*, Diamond and Kirkham reported adults show a switch cost (i.e., slowed response time; RT) on a task commonly used to assess cognitive flexibility in preschoolers, the Dimensional Change Card Sort (DCCS; Figure 1). The current work more closely examines Diamond and Kirkham's account for the *source* of difficulty on this seemingly simple task.

- Diamond & Kirkham explanation: **attentional inertia**
  - Problem shifting *away* from pre-instantiated mind-sets (inability to inhibit focus on previously relevant stimulus attributes[1,2])
- Alternative explanation: **negative priming**
  - Difficulty returning to dimension that was previously suppressed (problem engaging attention *to* the formerly irrelevant dimension[3,4]).

Figure 1

Dimensional Change Card Sort Task

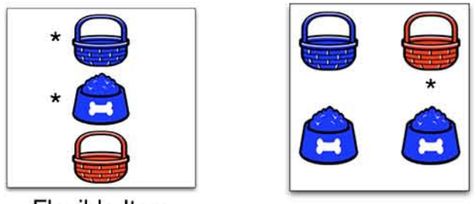


Pre-rule-switch (Sort by Color)

Post-rule-switch (Sort by Shape)

Figure 2

FIST and Oddity Tasks



Flexible Item Selection Task (FIST)

Choose two objects that match in a way that is not like the third

Oddity Task

Choose "odd" object that does not match the other three on some dimension

Method & Design

Participants

Temple University undergraduates (Exp. 1: twenty-four adults; Exp. 2: thirty adults).

General Design

Participants made a selection on FIST[5], and then made a selection on a dimension abstracted oddity task[6] (Figures 2 and 3). The primary manipulation was the relation between FIST (Screen 1) and oddity (Screen 2) selection (Figure 4), and how this affected oddity RT.

Exp. 1 (5 conditions).

1. *Neutral Control (NC):* FIST unrelated to oddity
2. *Relevant Prime (RP):* relevant FIST dimension was oddity target
3. *Irrelevant Prime (IP):* irrelevant FIST dimension was oddity target
4. *Total Change (TC):* all FIST stimulus values removed, but dimensions were maintained. As in *IP*, irrelevant FIST dimension was oddity target.
5. *Negative Priming (NP):* only relevant FIST stimulus values removed, while the irrelevant stimulus values maintained. As in IP, irrelevant FIST dimension was oddity target.

Exp. 2 (5 conditions).

Conditions 1,2,3 were the same as in Exp. 1. Conditions 4 and 5 were replaced.

4a. *Selected Neutral Control (SNC):* selected FIST dimension was held constant, and, as in *NC*, oddity target dimension was *unrelated* to FIST.

5a. *Selected Irrelevant (SI):* selected FIST dimension was held constant and, as in *IP*, *irrelevant* FIST dimension was oddity target.

How will FIST selection affect response time to select odd object on an oddity trial?

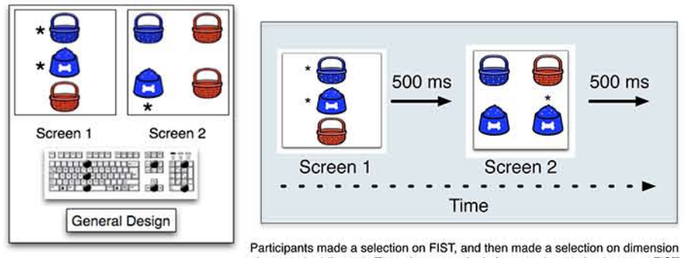


Figure 3

Participants made a selection on FIST, and then made a selection on dimension abstracted oddity task. The primary manipulation was the relation between FIST (Screen 1) and oddity (Screen 2) selection (Figure 4). There were 150 FIST-oddity trials for each experiment (30 per condition).

References

1. Diamond, A., & Kirkham, N. (2005). Not quite as grown-up as we like to think: Parallels between cognition in childhood and adulthood. *Psychological Science, 16*, 291-297.
2. Kirkham, N. Z., Cruess, L., & Diamond, A. (2003). Helping children apply their knowledge to their behavior on a dimension-switching task. *Developmental Science, 6*, 449-476.
3. Moller, U., Dick, A.S., Gela, K., Overton, W. F., & Zelazo, P. D. (2006). The role of negative priming in preschoolers' flexible rule use on the Dimensional Change Card Sort task. *Child Development, 77*, 395-412.
4. Zelazo, P. D., Moller, U., Frye, D., & Marcovitch, S. (2003). The development of executive function in early childhood. *Monographs of the Society for Research in Child Development, 68*(3), Serial No. 274.
5. Jacques, S., & Zelazo, P. D. (2001). The Flexible Item Selection Task (FIST): A measure of executive function in preschoolers. *Developmental Neuropsychology, 20*, 573-591.
6. Chalmers, K. A., & Halford, G. S. (2003). Young children's understanding of oddity: Reducing complexity by simple oddity and "most different" strategies. *Cognitive Development, 18*, 1-23.

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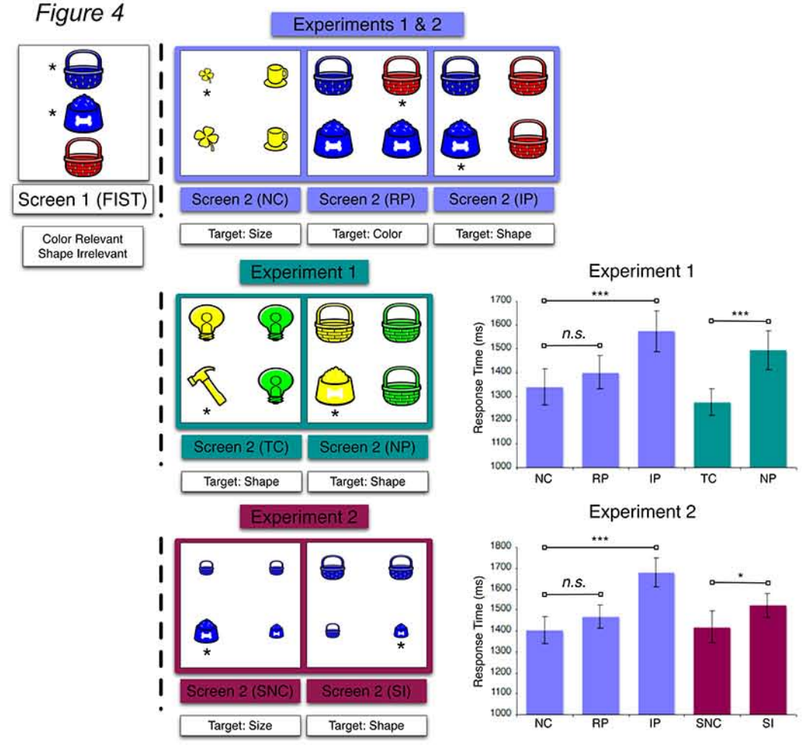
Results

Figure 4



Predictions & Results

Attentional Inertia	Negative Priming
~~1. NC > RP~~	1. NC = RP
2. NC < IP	2. NC < IP
~~3. TC = NP~~	3. TC < NP
~~4. SNC = SI~~	4. SNC < SI

Prediction Supported
Prediction Not Supported

Conclusions

- Supporting *negative priming*, values processed as irrelevant during the initial FIST task affected oddity selection such that, when these values became the target, RT was slower relative to a neutral stimulus.
- The was no facilitation effect for the *RP* condition.
- Taken together, the findings suggest *attentional inertia* cannot offer a complete explanation of difficulty on dimensional shifting tasks.
- Accounts of cognitive flexibility and its development must incorporate concepts such as negative priming to provide a complete explanation.