Preschool Children Can Flexibly Infer the Functions of Novel Objects
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ABSTRACT
Can young children figure out a function of a novel object, then infer a different function? This practical flexibility increased from 3 to 5 years. Children solved problems by generalizing functions from a standard object, or by directly analyzing the choice objects. Three-year-olds incorrectly repeated (i.e., perseverated) their first responses. Experiment 2 showed that children remember their first responses, so later inferences must overcome interference.

SPECIFIC QUESTIONS
1. Can children flexibly shift attention and causal inferences to infer different functions for the same novel objects?
2. Does flexibility increase from 3 to 4 years of age?
3. If children are inflexible, do they perseverate across trials?
4. Are older children flexible in spite of interference from earlier inferences about object functions?

EXPERIMENT 1: METHOD
Participants: 92 English-speaking 3,4 & 5 year-old children

Design: Flexible Induction of Function test: Children see three effects caused by the same object; must infer which object caused each effect. In the Standard-Present condition children see one object that did the effect and must generalize to another object. In the Standard-Absent condition they simply see the choice objects (i.e., more difficult search problem).

Materials
• Five novel object sets, each including a Standard object with three functional parts, plus three comparison objects (each with one part shared by the standard), and a foil object (see Figure for example).
• Substrates: clay, paper & sand “pre-effect” & “post-effect” displays. For example, a plain sheet of clay, and a sheet with a pattern printed in it by a roller (see Figure).

Procedure
1. Pre-exposure to test sets (30 sec/set), then two practice trials
2. Three test trial blocks, one per substrate (clay, paper, sand); each block has five test trials, one per set
3. Each trial: Children see a “before-and-after” effect caused by some object
   • Experimenter (E) takes pre-effect substrate (and standard, in standard-present condition) behind a screen, pretends to do something, then reveal post-effect substrate
   • Standard-present: “I used [standard] to do this!”
   • Test: “Can you find another one to do that same [effect]?”
4. E. shows child objects for 30 sec; child chooses which comparison object could produce the effect.

Variables
Correct inferences in the first test block (baseline); vs. correct inferences in later blocks (flexibility)
EXPERIMENT 1: RESULTS

**First inferences:** 3x2 (age x condition) ANOVA:
- 5-year-olds did better than 3- & 4-year-olds: Age factor $F(2,86) = 15.1, p < .001$
- Children did marginally better when the standard was present: Condition factor $F(1,86) = 3.8, p = .056$

**Correct switches:** 3x2 (age x condition) ANOVA:
- All ages differ from the other two: $F(2,86) = 21.6, p < .001$
- No significant condition effect: By the 2\textsuperscript{nd} and 3\textsuperscript{rd} trial per set, children apparently had analyzed the comparison objects well enough to choose correctly.

EXPERIMENT 2: METHOD

Do children flexibly infer function in spite of interference from earlier choices? If they remember earlier responses, it will show proactive interference in later responses.

**Participants:** 9 English-speaking 3 & 4 year-olds, mean = 47 months (5 girls, 4 boys)

**Procedure:** Same as Experiment 1, but in block 2 children were asked to recall their block 1 responses

EXPERIMENT 2: RESULTS

1\textsuperscript{st} Block: mean = 47% correct. This is above chance (25% expected), t(8) = 3.2, p = .012

2\textsuperscript{nd} Block: mean = 69% of block 1 responses remembered, above chance (25% expected): t(8) = 4.4, p = .002

3\textsuperscript{rd} Block: 48% correct, similar to Experiment 1 (53%), so repeating choices (in memory block) had no effect.

CONCLUSIONS

- Four-year-olds flexibly infer different possible functions of the same object. They notice more functions with more exposure (note greater accuracy of later choices). They show no effects of interference from earlier inferences.
- Three-year-olds’ 1\textsuperscript{st} inferences are above chance, but they then regress to chance in later blocks, showing effects of interference. There is a significant age difference in correct switches in later blocks.
- Generalizing from a known tool (Standard) helps children find another tool for an effect, in early trials.
- Children remember their first inferences about objects’ possible functions, which means that they can be affected by proactive interference in later trials.

REFERENCES

Duncker K. (1945). *Psychological Monographs, 58* (5, Whole No. 270)