



Strategies, Heuristics and Biases in Complex Problem Solving

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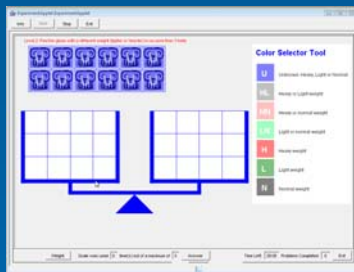
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Question: How do instructions help people solving complex puzzles?

Hypothesis: Instruction reduce problem solving constraints:

- Encoding simplifications (e.g., symmetry) (Freyd & Tversky, 1984)
- Problem solving sets (Glass & Holyoak, 1986)
- Functional fixedness (Duncker, 1945)
- Conceptual blocks (Adams, 1974)

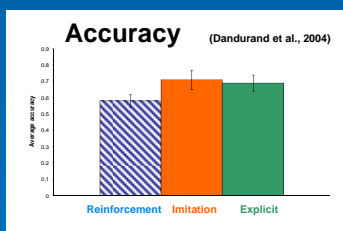


Complex problem solving task:

Which of the 12 balls is heavier or lighter than the rest?

Problem characteristics:

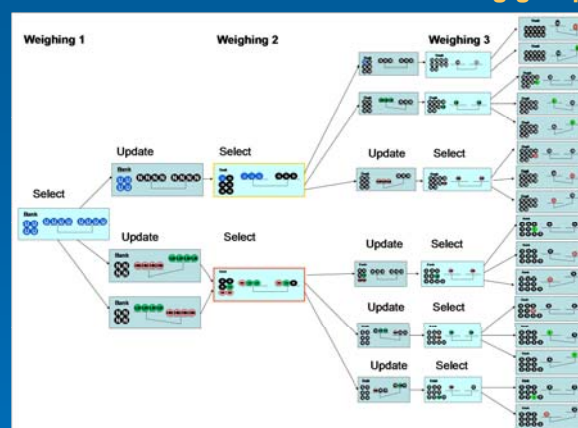
1. Selection and updates are often complex and asymmetrical
2. Updates have to be made to the balls in the bank, and not only on scale



How did we measure blocks and sets (operationalization)?

1. Symmetry bias
2. Simplicity bias
3. Tendency to ignore the ball bank

Solution shown to the imitation learning group



Design: Three-way mixed ANOVAs

- **Learning condition:** reinforcement, imitation or instruction (*independent*)
- **Correctness:** correct or error response (*repeated*)
- **Weighing number:** 1, 2 or 3 (*repeated*)

Methods

Means-ends analysis

Label	Distance
Unknown (U)	2
Heavy or Light (HL)	1
Heavy or (HN)	1
Light or (LN)	1
Heavy (H)	0
Light (L)	0
Normal (N)	0

Selection simplicity

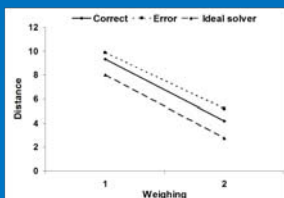
	Example	Index
Complexity	HN HN (1) vs. N N (1)	2
	HN LN (2) vs. HN LN (2)	2
Asymmetry	HN vs. LN	0
	LN LN LN vs. LN LN LN	1

Labelling complexity

Labels before	Labels after	Index
Bank: U U U U Left: U U U U Right: U U U U	Bank: U U U U (2) Left: HN HN HN HN (1) Right: LN LN LN LN (1)	2
Bank: U U U U Left: U U U U Right: U U U U	Bank: N N N N (1) Left: HN HN HN HN (1) Right: LN LN LN LN (1)	3
Bank: HN HN LN N N Left: HN LN LN Right: HN LN N	Bank: N N N N N (2) Left: HN LN LN Right: N LN N (1)	4

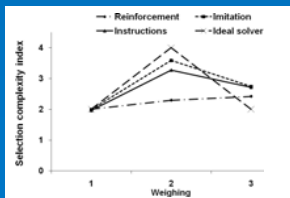
Results

Means-ends analysis



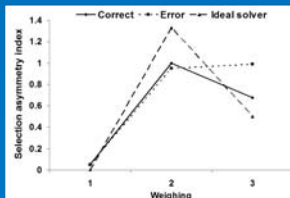
Distance from the goal was smaller after each weighing, and trials leading to correct answers were closer to the goal and approached it faster than trials leading to erroneous answers

Selection simplicity



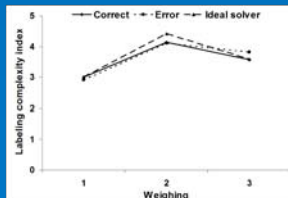
Participants in the instruction and imitation groups produced selections that were more complex than the reinforcement group, especially on weighing 2.

Selection asymmetry



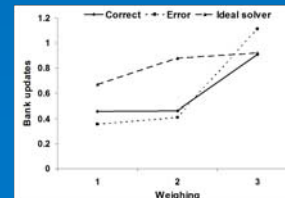
Weighings 2 and 3 were more asymmetrical than weighing 1, and on weighing 3, trials leading to errors were more asymmetrical than those leading to correct answers.

Labelling complexity



Complexity was higher on weighings 2 and 3 than on weighing 1. It was also higher on trials leading to errors than trials leading to correct answers, but only on the third weighing.

Bank updates



More bank updates were made on the third weighing.

Conclusions

Instructions helped:

1. reducing symmetry and simplicity biases
2. attending to the bank

References

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