Learning task knowledge concerning cognitive control processes in adults and 9-to 10-year-olds

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- How does prior task experience influence engaging cognitive control?
  → We highlighted two types of task knowledge that capture the regularities of a cognitive control task and support generalization of engaging cognitive control to different task environments.

1. Knowledge of task representations
   → Task goals and stimulus-response mappings (e.g., sorting a bivalent stimulus according to a color dimension, If the stimuli is blue, press Q key)

   (Aim 1) Whether prior task experience of engaging proactive control would lead adults and 9- to 10-year-olds to respond more quickly (more proactive control mode) in different task-contexts → Positive transfer of both types of knowledge, excluding S-R mappings

   (Aim 2) Whether prior task experience of engaging reactive control would make adults and 9- to 10-year-olds respond more slowly (more reactive control mode) in different task-contexts → Negative transfer of knowledge of task management

   (Aim 3) Potential developmental differences of learning task knowledge between adults and 9-to 10-year-olds

Online Experiment 1 (Preregistered methods)

Participants
- 32 adults in the reactive training group (M = 25.93 years, SD = 3.16 years)
- 32 adults in the control training group (M = 26.47 years, SD = 2.92 years)

Procedure (Figure on the right side)
- Task switching paradigm (Chevalier et al., 2015)
  - “Proactive impossible” condition
  - “Proactive possible” condition

Online Experiment 2 (Preregistered methods)

Participants
- 29 children in the reactive training group (M = 9.76 years, SD = 0.59 years)
- 31 children in the control training group (M = 9.92 years, SD = 0.59 years)

Same paradigm as Experiment 1

1. Altering the timing of cue presentation in training

   Exp 1: Adults • Response times
   - Reactive/Training (M = 1113 ms) > Control/Training (M = 807 ms) (p < .001)

   Exp 2: Children • Response times
   - Reactive/Training (M = 1523 ms) > Control/Training (M = 1167 ms) (p < .001)

2. Positive transfer

   Exp 1: Adults • Response times
   - Control/Training > Control/Test (First /Second block: \( p_{\text{adjusted}} < .001 \), Third block: \( p_{\text{adjusted}} = .993 \))

   Exp 2: Children • Response times
   - Control/Training (M = 1117 msec) \( \approx \) Control/Test (M = 1107 msec) (p = .367)

   Exp 2: Children • Correct rates
   - Control/Test (M = 82.4%) < Control/Test (M = 89.3%) (p < .001)

3. Negative transfer (Figure on the right side)

   Exp 1: Adults • Response times
   - Reactive/Test > Control/Training (Focusing on the First block: First mini-block: \( p_{\text{adjusted}} = .038 \), Second, Third, and Forth mini blocks: \( p_{\text{adjusted}} > .250 \))

   Exp 2: Children • Response times
   - Reactive/Test > Control/Training (First block: \( p_{\text{adjusted}} = .028 \), Second and Third block: \( p_{\text{adjusted}} > .250 \))

- Both adults and school-aged children exhibited positive transfer effects.
  → They can learn both types of knowledge from prior task experience, independent of S-R mappings.

- Both adults and school-aged children also exhibited negative transfer effects.
  → They can learn knowledge of task management from prior task experience.
  → They showed a reduction of negative transfer as they adapted to new task demands (more rapidly in adults).