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

Kaichi Yanaoka[1], Félice van 't Wout[2], Satoru Saito[3], Christopher Jarrold[4]

(1) The University of Tokyo (2) University of Exeter (3) Kyoto University (4) University of Bristol

・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)

**2. Knowledge of task management**
→ Timing of task goal activation (e.g., activating a task goal before the appearance of a bivalent stimulus)

(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)

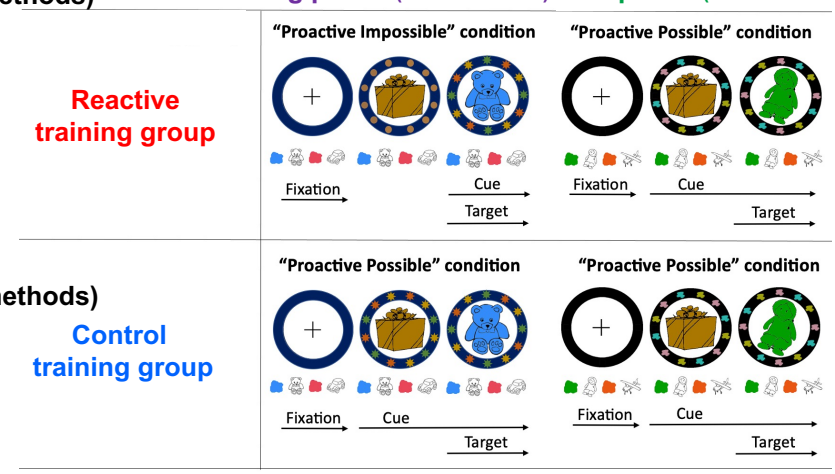
*Participants*
32 adults in the reactive training group
(*M* = 25.93 years, *SD* = 3.16 years)
32 adults in the control training group
(*M* = 26.47 years, *SD* = 2.92 years)

*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: $p_{adjusted}$ <.001, Third block: $p_{adjusted}$ =.993)

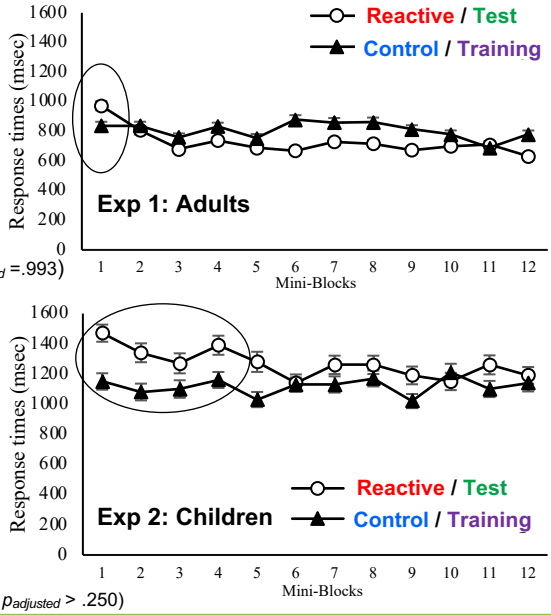
**Exp 2:** Children ・ *Response times*
Control/Training (M = 1117 msec) ≒ Control/Test (M = 1107 msec) ($p$ = .367)

**Exp 2:** Children ・ *Correct rates*
Control/Training (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: $p_{adjusted}$ =.038, Second, Third, and Forth mini blocks: $p_{adjusted}$ >.250)

**Exp 2:** Children ・ *Response times*
Reactive/Test > Control/Training (First block: $p_{adjusted}$ =.028, Second and Third block: $p_{adjusted}$ > .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).