Effects of Perceptual and Conceptual Cues in a Response Switching Task

Whitney A. Hansen & Stephen D. Goldinger

ABSTRACT

In the directed response switching (DRS) task, participants kept two conflicting responses active, choosing between responses on each trial. The primary response was word naming, whereas the secondary response was a generic verbal response, “bam.” In previous versions of DRS, we used color as the sole cue for the correct response, potentially allowing people to make decisions about correct responses without fully encoding the stimuli. In the present experiment, we varied perceptual (color) and conceptual (group membership) cues to examine the effect of more complex cues on decision making. We also manipulated the ease of detecting the primary response and secondary response cues. Using response times as the dependent measure, we found a three-way interaction: Altering the nature of the cues lead to dramatic changes in cognitive control performance. Conceptual input exaggerated both the task and discrimination effects, relative to perceptual input.

BACKGROUND

Many cognitive control tasks require participants to switch between competing responses.

Switching between tasks leads to slower responding, relative to performing a single task alone (Jersild, 1927).

Focus is often on the nature of the tasks, the added manipulations, or the output.

- Response (Hansen & Goldinger, 2006)
- Predictability of switch trials (Rogers & Monsell, 1995)
- Individual differences (Friedman et al., 2008)
- Nature of the decision (Mayr & Kliegl, 2006)

In these experiments some stimulus acts to cue the correct response on each trial.

- Shape
- Side of the screen
- Color of stimulus

What if the cue is not perceptual and has to be processed in some other way?

How does the nature of the cue affect performance in a cognitive control task?

DIRECTED RESPONSE SWITCHING TASK

- Words appear individually on the screen
- Participants respond to the word based on a cue that is contained within the stimulus
- Cue is randomly assigned, so participants cannot predict the correct response on any given trial.
- Design is easily manipulated to accommodate changes to secondary response, stimuli, and general manipulations.

- Cue: perceptual (color) or conceptual (group membership)
- Task: single (naming) or dual-task (naming or say “bam”)
- Discrimination: how easy it is to discriminate between cues that signal opposing responses - easy (dissimilar) or difficult (similar)

DESIGN

- 2 x 2 x 2 Within-Subjects Design
- Cue (Perceptual / Conceptual)
- Task (Name / Bam)
- Discrimination (Easy / Difficult)
- 3 Stimulus types:
  - Standard
  - Discrimination
  - Target
- RTs measured by voice key
- Errors documented by a researcher

STIMULI

- 360 words (45 per condition)
- 15 per stimulus type per condition (see Table)
- Each word appeared in one color and belonged to one of eight categories
- Color was randomly assigned to each word
- Words were selected from various lists and websites
- Words were counterbalanced across conditions

SAMPLE TRIAL

RESULTS

- Generally found main effects of:
  - Cue: RTs are faster for Perceptual relative to Conceptual
  - Task: RTs are faster in Naming conditions relative to Bam
  - Discrimination: RTs are faster in Easy conditions relative to Difficult (not true for target words)

- Interactions:
  - Discrimination x Cue: The discrimination effect is larger for Conceptual cues relative to Perceptual cues.

DISCRIMINATION

- RTs measured by voice key

STANDARD

DISCRIMINATION

TARGET

- Task x Cue: When the cue is perceptual, switching tasks has little effect on performance. When the cue is conceptual, there is a large cost to switching.

- Task x Discrimination: Discrimination (usually) has a larger effect when the secondary task must be maintained, relative to when a single response is maintained.


REFERENCES
