The Effect of Perceived Difficulty on Perceptual Learning

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Abstract

When trying to account for performance on perceptual tasks such as motion extrapolation, researchers typically postulate specific properties of the perceptual system. The present study investigated whether a counterintuitive finding in a previous motion-extrapolation experiment could be explained solely by subjects' differing beliefs about task difficulty. As hypothesized, a one-sentence warning of increased difficulty measurably increased learning of object trajectories. But self-reports showed no evidence of increased effort, leaving ambiguous the means of increased learning. These results suggest that high-level attitudes and beliefs can play an influential role in low-level tasks.

Introduction

In an experiment by Schrater and Powell, participants tried to catch a moving cloud of dots in a bucket as it emerged from behind an occluder.

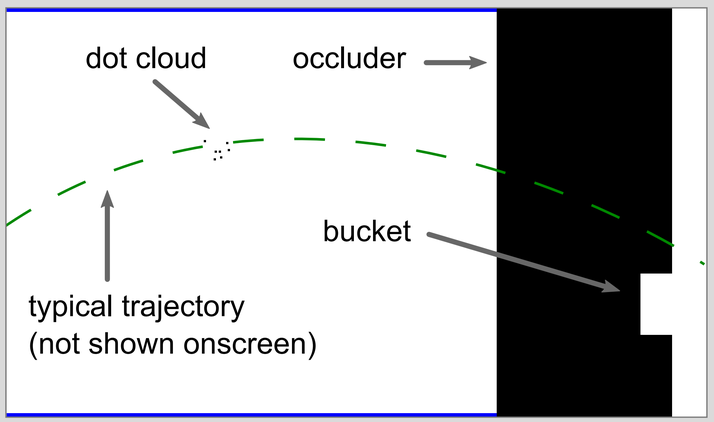

Figure 1: A screenshot of the task in progress

Over many trials, participants improved their performance by learning more about the trajectories in which the cloud traveled. Surprisingly, the noisier the cloud of dots, the better subjects learned the trajectories.

Why did subjects do better when the task was more difficult? Could the mere perception of difficulty have caused subjects to learn more, perhaps by inducing increased effort? I ran a variation of this experiment in which I tried to manipulate perceptions of difficulty independently of actual task characteristics.

Design

All subjects completed one block of 145 trials with each of two trajectory types, sinusoidal and parabolic; the order of the two types was random.

Before Block 2, all subjects were told the trajectories would change. Some were also given a warning of increased difficulty: "Note that this task is more difficult than the first."

Table 1. Between-subjects conditions

1. 145 sinusoidal trials 2. **No** warning 3. 145 parabolic trials	1. 145 sinusoidal trials 2. Warning 3. 145 parabolic trials
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Results

Data were collected from 9 subjects. For each half of each block, subjects were assigned error scores based on how accurately they extrapolated trajectories. Improvement within a block was measured as the difference between the error scores for each half.

In Block 2, as hypothesized, subjects who received a warning of increased difficulty improved more than those who did not.

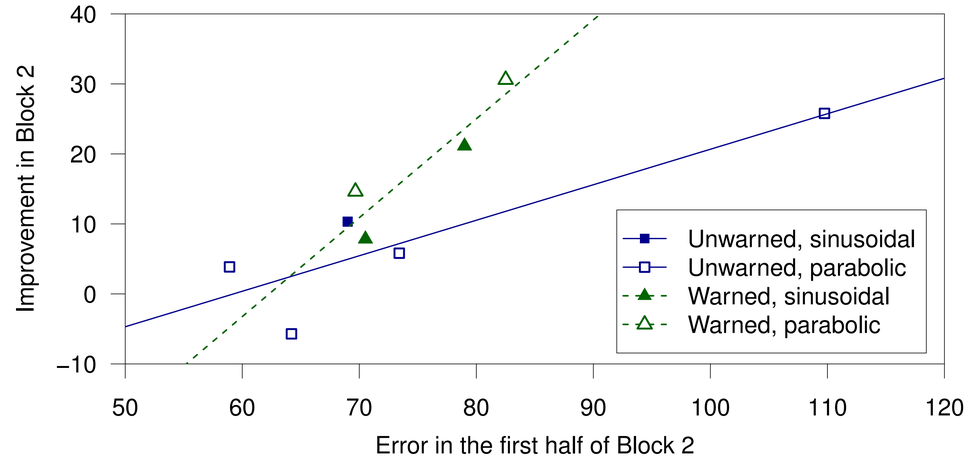

Figure 2. Trajectory learning in Block 2

Table 2. Questionnaire results

After Block 2, subjects answered questions on 7-point response scales. Each question was presented once per block.

"Change" scores were calculated as the mean difference between the ratings for Block 1 and Block 2.

Question	Level 1 label	Level 7 label	Change		*p* (one-tailed *t*-test)
			Unwarned	Warned	
How difficult did you find the task?	very easy	very difficult	–0.20	+1.00	.143
How much effort did you put into the task?	no effort	great effort	+0.40	+0.50	.453

Thus, it is ambiguous whether the warning changed subjects' perceptions of task difficulty as it was intended to.

We are left with no evidence that subjects felt they exerted more effort due to the warning.

New questions

- What motivated subjects to learn more?
- What did subjects actually do that permitted them to learn more?
- How consciously did subjects change their behavior according to the warning?
- Can we explain other features of seemingly simple behavior with reference to high-level beliefs and attitudes?