Implicit learning of a speed-contingent target feature

When opening a door, the force with which it is pushed – or pulled – determines how fast it swings. Often it is supposed that the stimulus following such an action can be consciously foreseen. But let's assume that the stimulus following the action occurs coincidentally. Would it still be possible to identify the dependence (i.e. contingency) between the action and stimulus that follows – even if the stimulus would be considered "consciously unpredictable?" An example can be drawn from nature, where living organisms are often faced with coincidences triggered by their own actions. Even when the dependence is barely discernible, organisms appear to catch on. For instance if the early bird catches the worm, and the bird does this enough times, it can then anticipate catching worms early in the morning. What this suggests is that if our very own response (in the form of action, i.e. moving quickly vs. slowly) renders the dynamic changes in our environment predictable, the dependence between our response and the successive stimulus can be acquired even if not consciously acknowledged.

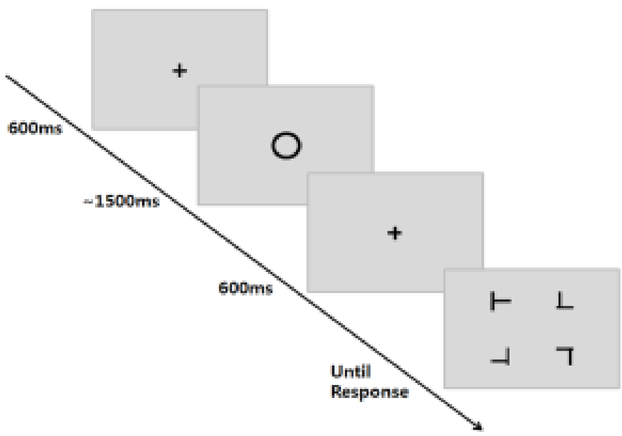

Fig. 1. Example of the experimental procedure. In the first task, the participants responded to target "O." In the second task, the participants responded to the rotated orientation of "T".

As part of an experiment we designed two tasks in which the participant's response in the first task (a simple detection task, where participants were asked to respond differently to the various shapes appearing on a screen) implicitly affected the target stimulus in the second task (a visual search task, where participants would spot and respond to a "T" shape). For this group (the Experimental Group), we discovered that the location of the target in the second task was determined by the relative speed of the participants' response (e.g., very fast, fast, slow, or very slow) in the first task. From the perspective of the participant, no dependence was apparent between the two. The main purpose of this study was to determine whether it is indeed possible to anticipate a feature of a given target by means of its dependence with a foregoing response speed, and whether such a contingency can be used as a predictive sign for relative success in the second task. We hypothesized that if the participant's response speed could be used as a predictive cue for the upcoming target feature, then the response time in the second task would be achieved faster as the block progressed.

In parallel, a random control experiment (the Random Control Group) was conducted to trace any effect of practice during the experimental procedure. A yoked control experiment (the Yoked Control Group) was also performed to exclude the influence of repetition in regards to the target's location in the second task that could be a result of the experimental design. For the yoked control experiment, the sequence of the target's locations in the second task was identical to that of the Experimental Group.

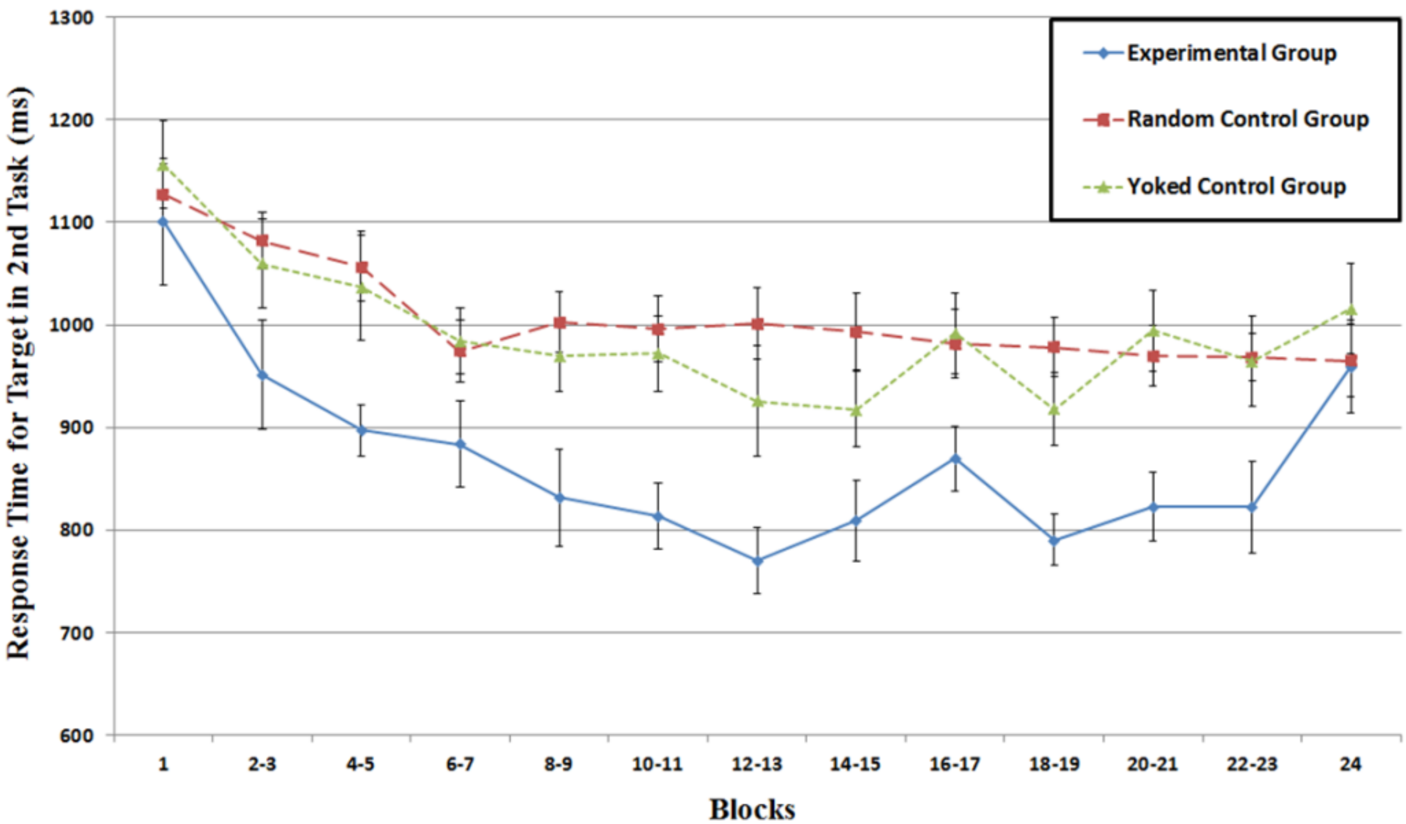

Fig. 2. The response times in the experimental, random control and yoked control groups. The X axis shows the blocks. We combined two blocks as one epoch from the 2nd to 23rd block. The Y axis shows the response time to the target in the second task.

Compared to other groups, the first group showed a sharper decrease of response time to reach target T as the blocks (i.e., bundles of trials) progressed. In this group, the response time to target T took significantly longer in the last block (with no contingency) than in the next-to-last blocks (with contingency).

Our research suggests that individuals may use the speed of their own response as a predictive cue to guide attention toward upcoming target locations. The implications for this work are broad, given the ubiquity of implicit contingency learning in our daily lives. The results of our study are critical for providing approaches to scrutinize the mechanism underlying response-stimulus associative learning.

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