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Published in:
Frontiers in Psychology

DOI:
10.3389/fpsyg.2012.00264

Citation for published version (APA):
Once bitten, twice shy: on the transient nature of congruency sequence effects

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Edited by:
Wilfried Kunde, Julius-Maximilians-Universitaet Wuerzburg, Germany

A commentary on

Going, going, gone: characterizing the time-course of congruency sequence effects

Life is ambiguous at times, presenting conflicting situations and conflicting response tendencies. For example, when confronted with a jinxing soccer opponent, you might easily be fooled by a skillful leg feint and fail to react to the direction of the ball. Here, your goal-directed action – no pun intended – is executed by resisting the impulse to react to the distracting jinx maneuver and instead reacting to the ball.

To explore adaptive cognitive control to resolve situations of interference and response conflict, as in the soccer example, a few tasks in the toolkit have been as illustrous as the Stroop task (Stroop, 1935) named after its creator, John Ridley Stroop (1897–1973). Instructed to name the font color of a word, responses are typically fast (control is relaxed after a congruent trial).

As a more theory-neutral term, we adopt the operational term congruence sequence effect (CSE), following Egner et al. (2010). In their insightful paper published in Frontiers in Psychology, Egner and colleagues addressed the unresolved issue of the time-course of CSE. To determine whether CSE is short-lived or persists for several seconds, they systematically varied the interval between subsequent face-word stimuli from 500 to 7,000 ms (see Figure 1C). As expected, responses to incongruent face-word stimuli were significantly slower than responses to congruent face-word stimuli, reflecting the additional time to resolve the interference. Second, this congruency effect was modulated by the congruency of the preceding trial. That is, following congruent trials, interference was quite large, but after incongruent trials the interference effect diminished to just a few ms (Figure 1A). Most important is the demonstration that CSE steadily diminished with time, despite an exponential increase in the likelihood of stimulus appearance with increasing interval duration (i.e., an exponential hazard function), making their finding all the more non-trivial. Disappearing within 4,000 ms, adaptive effects appear to be rather short-lived (Figure 1B).

Several accounts have been offered to explain CSE, including two influential views that emphasize the role of top-down cognitive control processes. Gratton et al. (1992) emphasized the role of expectancy or anticipation as preparing for expedi-ent processing of future conflict. On this account, one would predict that the more time passes after a conflict trial, the better prepared one should be to handle further conflict, and hence CSE should increase. This prediction is clearly refuted by the Egner et al. (2010) findings. By contrast, Botvinick et al. (2001) attributed CSE to the role of attentional control engaged to reduce the detrimental impact of task-irrelevant stimulus processing in the event of future instances of conflict. This view predicts that top-down attentional control is stronger immediately following instances of conflict, but likely dissipates as time elapses between trials, consistent with Egner et al.’s findings of CSE diminishing over time. It should be noted, however, that at least part of the CSE pertains to action control rather than attentional control (van den Wildenberg et al., 2010). For instance, incongruent trials are followed by reduced impulse capture (reflected by fewer fast errors) and augmented inhibitory control...
neutral state, being equally prepared for an upcoming congruent as for an incongruent trial. After all, body and leg motion often is predictive of where the opponent will play the ball, and responding to such information may in general be advantageous enough to risk the incidental jinx.

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Received: 20 June 2012; accepted: 09 July 2012; published online: 26 July 2012.

This article was submitted to Frontiers in Cognition, a specialty of Frontiers in Psychology.

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