Cognitive Dynamics Underlying the Subjective Aspects of Self-Control

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Introduction:

1. Conflicting action plans are often experienced as competing 'urges' (e.g., to eat *and* not eat cake while dieting) (1). Less 'hot' versions of such conflicts arise in response-interference paradigms such as the Stroop task (2). In this task, participants are instructed to name the color in which letter strings are presented. Response times decrease when the color and word are congruent (e.g., RED presented in the color red); interference arises when the color and word are incongruent (e.g., RED presented in the color blue) (Fig. 1). Research on cognitive control has addressed the effects that such response interference has on behavior and the activities of certain brain regions, but this research has been silent regarding the subjective effects (e.g., urges) of such interference and regarding how these effects could be weakened, which would have implications for treatments of self-control disorders.

Figure 1: Sample Stroop stimuli. Increased urge rates are associated with incongruent stimuli.

2. We examined urges by developing a paradigm in which participants are trained to introspect conflict-related aspects of cognition during a special interference task and then introspect the same 'thing' while performing various kinds of interference tasks (e.g., *flanker tasks*; 3) (1). As predicted by a theory on the primary function of consciousness (4), stronger subjective effects should be associated with interference at the level of response selection than at the level of stimulus identification.

3. *We learned from this research that, as predicted by theory (4), (a) conflict at the level of action selection leads to strong changes in subjective experience ('conscious conflict') and (b) little or no perturbations in subjective experience arise when different processes lead to similar action plans ('double-blindness').*

Double-Blindness Results:

4. We replicated the Stroop effect, in which RTs are longest for the incongruent condition, followed by the control, and shortest for the congruent condition, F (2, 42) = 40.906, p < .0001. Stroop condition produced analogous effects on activity, F (2, 42) = 40.627, p < .0001 (η_p^2= .66), in which urges were greatest for the incongruent (M = 4.40, SEM = .28), followed the control (M = 3.26, SEM = .26) and congruent conditions (M = 1.73, SEM = .16), *Fisher's PLSD*, ps < .01. Typing errors resulted in the loss of 2 of the 528 ratings. Fourteen of the 22 participants had significant (ps < .05) positive correlations between RT and activity (grand mean r = .50, SEM = .053, p < .05), suggesting that participants may have based their judgments on RTs.

5. The urge to read findings suggest that, because the two outputs from different processes (i.e., color naming and word reading) are identical in the congruent condition, there may be 'double blindness' and the illusion of a decreased urge to read (Fig. 2). Moreover, similar effects are found when participants respond aloud or subvocally (i.e., 'in their heads').

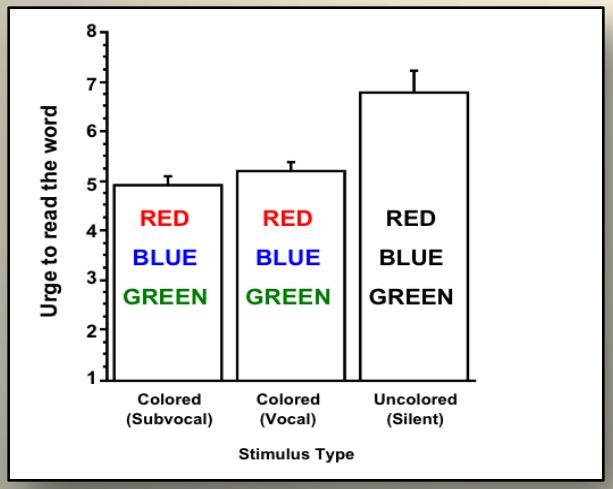

Figure 2: Urge to read ratings were greater for word stimuli when presented in standard (uncolored) font than when the same stimuli were presented in a congruent color.

An urge fan effect?

6. Variations of the classic Stroop paradigm have shown that, through extensive practice, interference from interfering automatic actions can be weakened or eradicated (5). However, the subjective aspects of this 'reversal' have not yet been explored, understanding these phenomena will illuminate the nature of disorders of self-control (6).

7. To examine further ways in which urges can be weakened, we are combining lines of research to evaluate the hypothesis that the strength of a particular stimulus-evoked urge is inversely related to the overall number of action plans associated with that stimulus, a 'fan effect' of sorts (Fig. 4). The notion is based on the conceptual fan effect, in which the retrieval time of a particular fact related to a concept is increased by the number of facts associated with that concept (7).

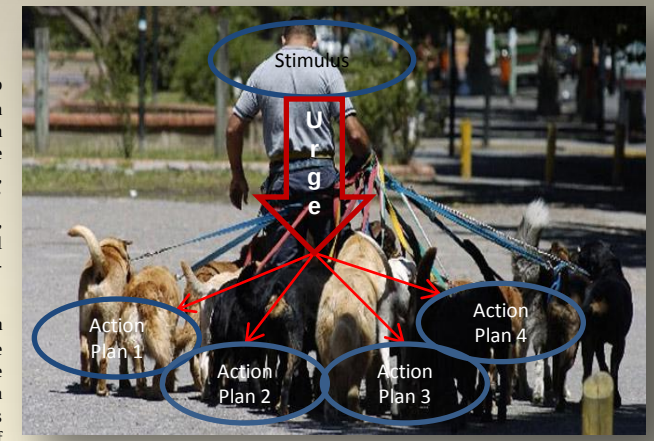

Figure 4: Much like the tugging of dogs, pulling in different directions, thereby weakening the feel of the pull in any particular direction, the number of action plans associated with a stimulus is inversely proportional to the strength of the urge associated with any single plan.

RED = 'three'

Figure 3: Sample training stimulus

Method:

8. SFSU undergraduate participants (n=100) will be randomly assigned to the letter counting and word reading conditions. In the letter counting condition participants will practice letter counting (Fig. 3) and in the word reading condition they will practice reading words. Following each of the conditions' training, all participants will perform the Stroop task. After each Stroop trial the participants' urge to err will be recorded on a 1-8 scale.

Implications:

9. ***Support for this hypothesis would have significant implications for our understanding of self-regulation and addiction. In addition, it may also help illuminate the complex nature of subjective states. Further research will help parse out weather the fan effect is an alternative form of double blindness or an entirely different mechanism altogether.***

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