인지과학, 제 23 권 제 1 호
Korean Journal of Cognitive Science
2012, Vol. 23, No. 1, 25−46.

The Phenomenology of Quitting: Effects from Repetition and Cognitive Effort [i]

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When performing a monotonous task, one often experiences an urge to quit. This urge may vary depending on how long one has performed the task (a *temporal* factor) and on which particular component of the task one is carrying out (an *event-based* factor). Using the Stroop task and a working memory task, we examined changes in the urge to quit as a function of basic temporal (repetition) and event-based (cognitive conflict) factors. Consistent with the *law of least work* and recent theorizing, for the memory task, urges to quit were greater following difficult trials; for the Stroop task, urges to quit were greater following incongruent than congruent trials, but only during early/novice phases of performance, when responding is inefficient. This is a demonstration of an avoidance response toward cognitive conflict. Regarding temporal sources of quitting, urges to quit were greater for late task stages than early stages. These basic findings may illuminate the nature of the more 'hot' motivational struggles involving the delay of gratification.

Key words : effort, persistence, quitting, disengagement, law of least work, urges. [1]

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* We acknowledge the advice of Mark Geisler and the assistance of Sergio Rizzo-Fontanesi.
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When performing a monotonous task such as filing papers or responding to hundreds of trials in a cognitive psychology experiment, one often experiences the urge to disengage from the task. This urge to quit may ebb and flow in and out of consciousness, appearing at different intensities during different phases of the task. From a scientific standpoint, these urges remain mysterious and unexamined, even though revealing their nature and sources may illuminate the dynamics of the more 'hot' (1, 2) motivational struggles involving, for example, the delay of gratification (e.g., the suppression of addiction-related urges; 3, 4).

To the benefit of the motivation researcher, the kinds of tasks used in the psychology laboratory provide an ideal portal through which to understand the sources and phenomenological properties of the urge to quit. To complete these repetitive and often monotonous tasks, participants must overcome the urge to quit by exerting self-control (5) and suppressing the tendency to discontinue the task and do something else (e.g., exhibit 'exploratory behavior'; 6). Thus, persisting on such tasks can be construed as a basic form of self-control, one that is essential for certain kinds of learning outside of the laboratory (e.g., skill rehearsal) and that is innocuous and experimentally-tractable in the laboratory.

Consider the classic Stroop task (7). In this task, participants are instructed to name the colors in which stimulus words are written. When the word and color are incongruous (e.g., RED presented in blue), response conflict leads to increased error rates, response times (RTs), and 'urges to make a mistake' (8, 9). Incongruent trials are effortful and require cognitive control (2). When the word and color are congruous (e.g., RED presented in red), there is little or no interference (see review in 10). Congruent trials demand little if any cognitive control/effort.

Neuroimaging evidence has revealed that the anterior cingulate cortex is reliably activated during the kinds of response conflict elicited by the incongruent condition (11, 12). According to Botvinick (13), such activation reflects the fact that the anterior cingulate cortex is necessary for the detection of 'inefficient processing,' which may occur during tasks involving conflict, effort, or a high likelihood of error.

This detection is thought to be necessary for a form of avoidance learning in which inefficient processing (e.g., processing involving internal conflict; 4, 14), and the contexts associated with such processing, are avoided by the organism (13, 15, 16). Although there is substantial neural evidence in support of these views (cf., 13), to date there is little evidence that participants have an avoidant disposition toward cognitive effort.

Temporal versus Event-Based Sources of the Urge to Quit

It is obvious to the participant and experimenter alike that urges to quit accompany the laboratory tasks, and that, throughout an experimental session, urges may vary in intensity, depending on how long one has performed the task and on which component of the task one is carrying out (e.g., an effortful versus a non-effortful trial). We refer to these factors as the temporal and event-based sources of the urge to quit, respectively. Event-based sources are discrete events that lead to acute changes in the urge to quit; temporal sources influence the urge to quit more globally, over time.

Regarding temporal sources, it is a common (though undocumented) observation that urges to quit may be weaker at the beginning of the task than toward the end of the task. For instance, during the first ten minutes of the Stroop task or a repetitive activity such as guitar practice, one may experience weak urges to quit. However, such urges may increase in strength toward the end of the tasks, after a form of habituation has transpired (17, 18). This is consistent with the view that these urges are more likely to occur under conditions of low activation, as when the mind is not in an attentive state, but bored and unchallenged (19). This can occur following habituation toward a particular task (18). This point of view is based on the homeostatic notion that the cognitive apparatus strives to maintain an optimal level of activation (see also 18, 20). When below this threshold, activation is sometimes increased by engaging in activities such as fiddling with objects or body parts. It has been demonstrated that during a monotonous laboratory task, automatisms (e.g., fiddling with a computer mouse) increase as a function of Stroop trial number (21).

Regarding event-based sources, urges to quit may be weaker during the easy and engaging components of the task than during the more effortful components of the task (22, 13, 15). There is a good theoretical basis for proposing that it would be adaptive for organisms to avoid task components associated with cognitive effort and to do so in part by experiencing strong urges to quit following the execution of those components (13, 15). This is consistent with the ‘law of least work’ (or ‘effort’; 15, 13), in which an organism prefers to obtain a goal through means that require the least amount of effort. Accordingly, in perception, when processing is smooth and facile, as during the processing of visual stimuli that are familiar, prototypical, or easy to perceive (e.g., high figure-ground contrast), the processing tends to generate positive affect (23, 24). Regarding action, people prefer situations and stimuli that require little mental effort or response interference/conflict (24-26). For instance, during guitar rehearsal, plucking some riffs may be more engaging than plucking other riffs, leading to acute reductions in the urge to quit. It is an open question whether effortful trials in laboratory tasks such as the Stroop task are followed by acute increases in the urge to quit.

Rationale and Predictions

Bindra (22) distinguishes the autonomic/visceral components of ‘level of arousal’ from its cognitive (or ‘cerebral’) *activation* components. In this article, we focus only on the latter and on its peculiar liaisons with cognitive effort, conflict (2), and with the urges to quit that modulate phenomenal experience as one performs a repetitive cognitive operation over a period of time.

To understand the nature of the urge to quit during a standard laboratory task, we used a basic working memory task that resembles the Simon memory game, in which one must keep recently seen sequences in working memory. This task can be performed over vast stretches of time and features trials involving difficult trials (holding a long sequence in mind) and easy trials (holding a short sequence), and is thus well-suited to investigating temporal and event-based influences on the urge to quit within the same paradigm. In this case, participants completed six blocks, with each block having 40 trials with stimulus sequences of varying lengths (from 3 to 6 items). Participants were asked immediately following each trial to rate how strong their urge was to quit the block.

When conducting a study about such urges, one cannot help but note the problems encountered with any kind of experiment involving self-report measures (cf. 9, 27, 28), such as reporting biases and limited access to internal states. Yet, insofar as one attempts to understand the phenomenology of quitting, one has no option but to use self-report and thereby inherit the problems and limitations with which it comes (27, 9).

Based on the law of least work and Botvinick (13), we predicted that urges to quit would be greater following more effortful trials. Such a trial-by-trial effect could *not* be explained by an account in which the subjective urge to quit is based on a metabolic change in the brain, because metabolic changes would presumably be too slow to constitute such an effect. Thus, finding such a trial-by-trial modulation would be an important datum in its own right. In addition, based on the idea that task habituation leads to the kinds of decreased activation that diminishes cognitive engagement (17-19), we predicted that the urge to quit would be stronger for late than early task stages. This finding would suggest that, when introspecting about the urge to quit, participants performing a Simon-like task are not simply basing their judgments on a heuristic such as "*If it is a trial with a long sequence to remember, then I should rate the urge to quit as strong.*"

In summary, in Study 1 we created a version of the classic Simon memory game in which participants must keep in working memory sequences of various lengths (from 3 to 6, in our paradigm), and investigated participants' urge to quit as a function of time at task and the amount of cognitive control expended on a trial-by-trial basis.

Method

Participants. Fifteen undergraduate San Francisco State University students participated for class credit.

Procedure. Run individually at a computer booth, participants were given the task of observing on the computer screen a sequence of colored circles (55 mm in diameter; colors included red, orange, yellow, green, blue, and purple), and then reproducing the observed sequence by button pressing using a PsyScope button box (Response Box; ioLab Systems; UK) with colored buttons corresponding to all six stimulus colors. Stimulus presentation and data recording was controlled by PsyScope software (30). Stimuli were presented on a white background of a 50.8 cm Apple eMac computer monitor.

Each trial began with a variable fixation interval lasting 500, 750, 1000, or 1250 ms, followed by a single sequence of circles. Colored circle stimuli were presented for 1000 ms each, with an inter-stimulus interval of 300 ms between circles. The stimuli were randomly pulled from lists of 3-, 4-, 5-, or 6-circle sequences. No color was repeated within a trial, to make difficulty equivalent within all sequences of similar length. The sequence lists were each composed of 100 possible combinations, to make equal the probability of randomly selecting a given string of stimuli across sequences of differing length. Participants were naïve as to the length of a given trial until the end of the sequence display, which was followed by a blank screen for 300 ms. Participants were then prompted with *"Please press the buttons in the same order you saw the colored circles. Press SPACE when finished."* Participants were then asked to introspect about and rate aspects of their response on a 1-to-8 scale, in which 1 signified "almost none" and 8 signified "extremely strong": *"How strong is your urge to NOT continue with the present set of trials, that is, how strong is your urge to quit the present set of trials?"* Participants completed six blocks of 40 trials, which lasted a total of approximately one hour. Following each block, the question

"Are you ready to begin the block of trials?" appeared on screen. At this time, participants were permitted a break if needed, and signaled the experimenter when they felt ready to continue.

Results

Typing errors and interruptions resulted in the loss of 64 (1.7%) out of 3,600 ratings. As illustrated in Figure 1, an ANOVA with Block-Order and Sequence Length as within-subjects factors reveals that there was the predicted main effects of Block-Order, F (5, 65) = 15.428, $p < .0001$, and Sequence Length, F (3, 39) = 5.823, $p < .05$, on the urge to quit. There was no interaction between the two factors, F (15, 195) = .81, $p > .60$. This analysis was done on only correct trials. If one looks at urges as a function of accuracy, the data reveal that urges to quit were stronger following incorrect (M = 4.73, SEM = .42) than correct trials (M = 4.00, SEM = .47), t (14) = 2.236, $p < .05$. Mean error rate was .29 (SEM = .03).

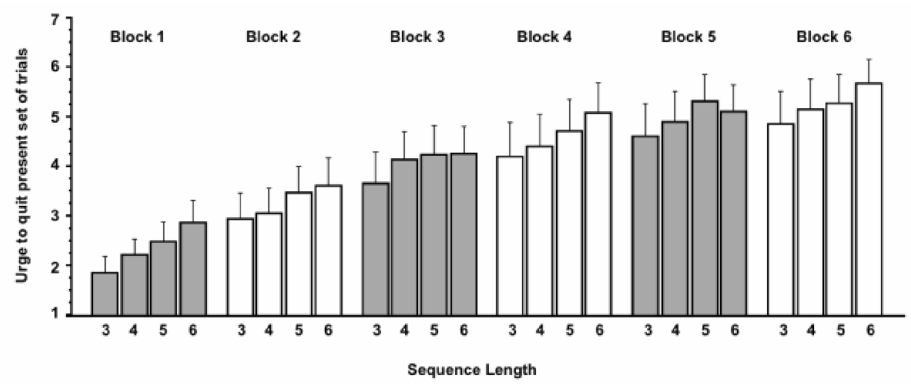

Figure 1. Mean urge to quit as a function of block number and the **number** of items that one had to hold in mind. Error bars indicate *SEM*s.

Discussion

Taken together, the results of Experiment 1 demonstrated that participants' urges to quit were influenced by temporal (time at task) as well as event-based (trial difficulty) factors. Difficulty in this case was determined by working memory load, yet in everyday experience we encounter more dynamic instances of difficulty (e.g. response conflict). Accordingly, Study 2 employs the classic Stroop task to determine whether similar effects arise from trials that are difficult due to cognitive conflict.

Study 2

To the benefit of the experimenter, the Stroop incongruent condition is an experimentally tractable form of conflict that lacks the confounding secondary effects of many other kinds of response conflicts (e.g., holding one's breath or holding a hot dish; 31). Most conflicts bring with them a state of deprivation, tissue damage, or the suppression of a vital need. Thus, the innocuous Stroop task is particularly suited for studying the relationship between the urge to quit (an avoidant response) and cognitive dynamics. This task can be performed over vast stretches of time and features both trials involving response conflict (demanding cognitive control) and trials featuring little or no such conflict (demanding little if any cognitive control).

In our paradigm, participants performed ten blocks of Stroop trials, with each block containing 40 trials representing different Stroop conditions. The first two blocks were regarded as representative of *Early* stages of task performance, in which one has just begun the task and is a novice. The last two blocks were regarded as representing *Late* task stages, in which one has experienced extensive repetition and is an expert at the task. Throughout all blocks, participants were asked immediately following each trial to rate how strong their urge was to quit the block of trials. To learn about other task-related *subjective* phenomena, we took the opportunity to have participants rate (a) how much control they felt they had to exert to respond accurately, (b) their urge to make a mistake, and (c) how much willpower they were currently experiencing (willpower in this case is considered to be the means by which one exercises mental control over their impulses; 5).

Based on the law of least work and Botvinick (13), we predicted that urges to quit would be greater following incongruent than congruent trials, and that this effect would be present only when processing is inefficient, that is, during the Early stage but not the Late stage. Such an effect would be a demonstration of an avoidance orientation toward a task involving response conflict and cognitive control. The effect would also be consistent with the view that, in the early stages of performance, stronger urges to quit should accompany the more challenging components of the task (incongruent trials) than the easier components (congruent trials). As activation decreases through habituation, participants would not seek to avoid such challenges (19, 22) and would no longer want to quit more following incongruent than following congruent trials.

In addition, based on the idea that task habituation leads to the kinds of decreased activation that diminishes cognitive engagement (17-19), we predicted that the urge to quit would be stronger for late than early task stages. This finding would suggest that, when introspecting about exerted control or other subjective aspects of responding to each Stroop stimulus, participants are not simply basing their judgments on a heuristic such as, "*If the color and word do not match, then I should rate the urge to quit as strong.*" Our secondary prediction was that RTs, urges to err, and reported exerted control would be greater for incongruent than congruent conditions.

Study 2

Method

Participants. Twenty-one San Francisco State University undergraduates participated for class credit. The data from two participants were excluded from analysis because the participants were unable to complete the experimental session.

Procedure. Run individually at a computer booth, participants performed ten blocks of 40 trials of the Stroop task (this lasted approximately the same length of time as Study 1). Stimulus presentation was controlled by PsyScope software (30), and stimuli were presented on a white background of a 50.8 cm Apple eMac computer monitor. Vocal responses were detected by microphone (Model 33-3014; Radio Shack; Fort Worth, TX) connected to a button box (Response Box; ioLab Systems; UK).

Each block presented 8 congruent (e.g., RED written in red), 16 incongruent (e.g., RED written in blue), 8 neutral (e.g., XXXX written in green), and 8 control (e.g., COOL written in pink) stimuli in random order. Eight common colors, correctly identified by all subjects, were used (red, orange, yellow, green, blue, purple, pink, and black). In the incongruent condition, targets (colors) and distracters (words) were re-paired systematically (e.g., if RED was written in blue then BLUE was written in red). Participants were instructed to name the color in which the word was written as quickly and as accurately as possible. Although our focus was on the effects of congruent versus incongruent trials, we included neutral and control conditions so that participants would not become insensitive to the two critical conditions. Increasing the percentage of trials representing a condition (e.g. the incongruent condition) can weaken the effect of that condition (10).

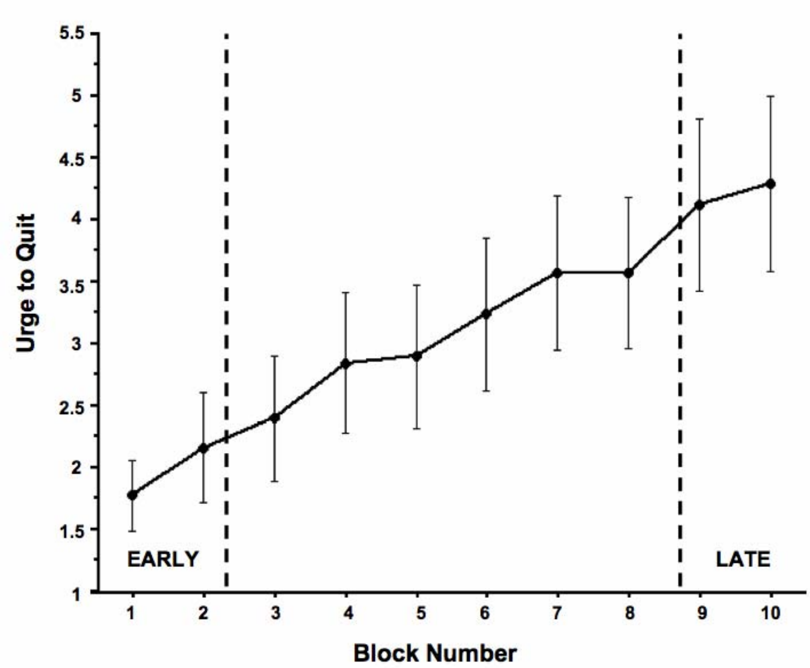

Figure 2. Mean urge to quit as a function of block number, during the Stroop task. Error bars indicate *SEM*s.

After a vocal response was detected, participants were asked to introspect and rate about aspects of their response on a 1-to-8 scale, in which 1 signified "almost none" and 8 signified "extremely strong": *How much control did you feel you had to exert to respond accurately?*, *How strong was your urge to make a mistake?*, *How strong is your urge to NOT continue with the present set of trials, that is, how strong is your urge to quit the present set of trials?*, and *How much 'willpower' are you currently experiencing?* After inputting each rating, participants pressed the return key to indicate that they were ready for the next question. To not confuse participants and to increase rating accuracy, questions were always presented in the same order, with those requiring access to memory appearing before those that do not require such access. The willpower rating concluded the trial. In many experiments, Stroop trials advance only when participants indicate through a button press that they are ready to continue onto the next trial. Because we wanted full control over the duration of each block, trial progress was controlled not by participants but by the computer program, which automatically presented the next Stroop stimulus. Participants were given a break at the beginning of each block and were asked, “Are you ready to begin the set of blocks?” Participants pressed a key to indicate that they were ready for the next block of trials, which began following 700 ms.

Results

The Influence of Stroop Condition

Response Times

RTs below 200 ms and above 2.5 s were excluded from analysis, resulting in the data loss of 299 (3.9%) out of 7,600 trials. We replicated the Stroop RT effect. ANOVA analyses revealed that Stroop condition had systematic effects on RTs, F (3, 54) = 23.10, $p < .0001$, in which the longest RTs were found for the incongruent condition (M = 1064.83, SEM = 46.87), followed by the control (M = 1000.04, SEM = 40.74), neutral (M = 913.50, SEM = 31.31) and congruent (M = 910.61, SEM = 33.87) conditions. Planned comparisons revealed that all differences were significant (ps < .01) except that between congruent and neutral conditions (p = .86).

Urges to Err

ANOVA analyses revealed that Stroop condition had similar effects on the reported urge to err, F (3, 54) = 17.384, $p < .0001$, in which the greatest urge to err was found for the incongruent condition (M = 2.74, SEM = .32), followed by the control (M = 1.92, SEM = .23), neutral (M = 1.50, SEM = .17) and congruent (M =

1.49, *SEM* = .18) conditions. Planned comparisons revealed that all differences were significant (*p*s < .05) except that between congruent and neutral conditions (*p* = .86). Typing errors and omissions led to the loss of 58 (0.8%) out of 7,600 ratings.

Urges to Quit

We anticipated that, as corroborated below, Stroop condition would affect the urge to quit only during the Early stage. Hence, we were surprised to see that this effect is still somewhat detectable when one aggregates the effect across all 10 blocks. There was a marginally non-significant Stroop condition effect on the reported urge to quit when including all the blocks, F (3, 54) = 2.734, p = .052, in which the strongest urges were found for the incongruent condition (M = 3.13, *SEM* = .51), followed by the control (M = 3.09, *SEM* = .52), congruent (M = 3.05, *SEM* = .51) and neutral (M = 3.04, *SEM* = .53) conditions. Planned comparisons revealed significant differences between congruent and incongruent conditions, and between neutral and incongruent (*p*s < .05). Typing errors and omissions led to the loss of 56 (0.7%) out of 7,600 ratings.

Exerted Control and Willpower

ANOVA analyses revealed that Stroop condition had similar effects on the reported exerted control, F (3, 54) = 10.694, p < .0001, in which the most reported control was found for the incongruent condition (M = 3.60, *SEM* = .49), followed by the control (M = 3.02, *SEM* = .53), neutral (M = 2.76, *SEM* = .56) and congruent (M = 2.69, *SEM* = .56) conditions. Planned comparisons revealed that all differences were significant (*p*s < .05) except those between congruent and neutral conditions, and control and neutral conditions (*p*s > .10). Typing errors and omissions led to the loss of 101 (1.3%) out of 7,600 ratings. ANOVA analyses revealed that Stroop condition had no effects on willpower, F (3, 54) = 1.138, p = .34. Typing errors and omissions led to the loss of 51 (0.7%) out of 7,600 ratings. On the surface, perceived exerted control and reported willpower appear to be closely related constructs, so it might seem puzzling that no significant effects were found for willpower. Yet the willpower question, asked last, could refer more to the participant's general state, and therefore may not be sensitive to transient trial-by-trial changes.

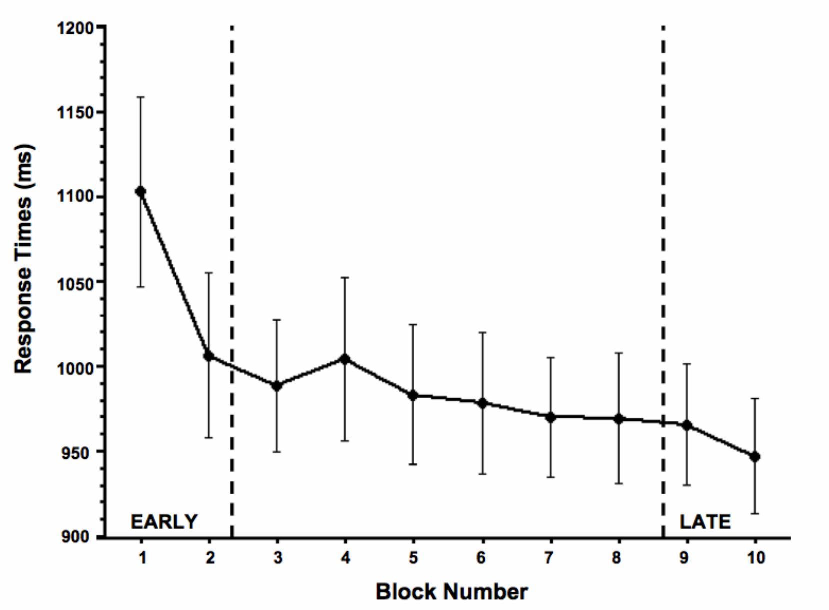

Figure 3. Mean response time (ms) as a function of block number, during the Stroop task. Error bars indicate *SEM*s.

General Trends Arising from Temporal Factors

To examine the effects of temporal factors on the urge to quit, the data from all Stroop conditions were included in the analysis. Block Number was treated as a within-subjects factor. As is clear in Figures 2 through 4, Block Number had a significant effect on several dependent measures, including RT, F (9, 162) = 5.22, p < .0001. This effect was driven only by one significant difference, that between Block 1 and all subsequent blocks (p < .05). Block Number had no effect on urge to err ratings, F (9, 162) = 1.354, p = .21, or willpower, F (9, 162) = 1.223, p = .28, but did have an effect on control ratings, *F* (9, 162) = 2.833, $p < .01$. Importantly, block number had a significant effect on urge to quit, *F* (9, 162) = 8.923, $p < .0001$. The only interesting correlations found between the dependent measures were between RT and exerted control (mean *r* by subject = .22), RT and urge to err ($r = .22$), and exerted control and urge to err ($r = .45$), Fisher's r to z, $p < .05$.

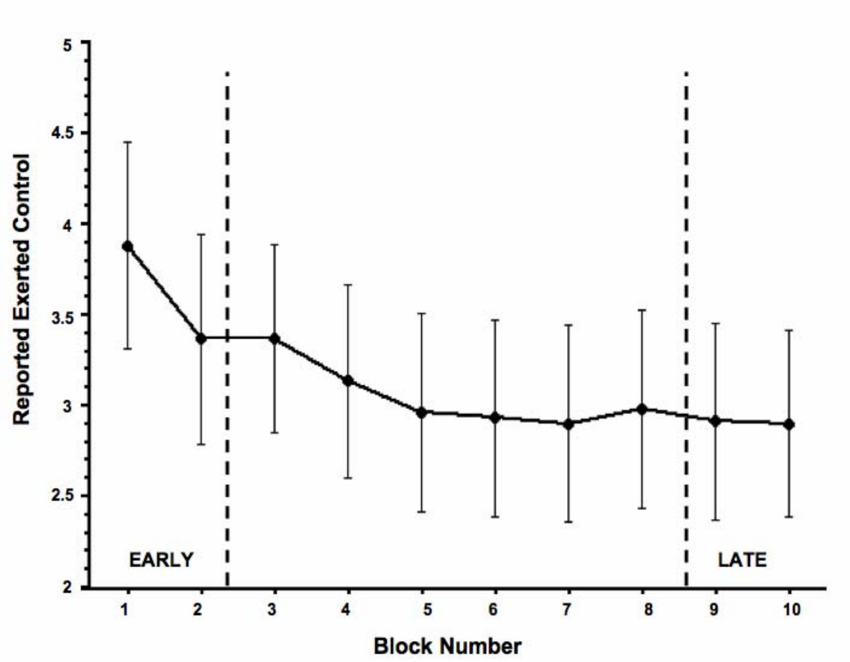

Figure 4. Mean reported exerted control as a function of block number, during the Stroop task. Error bars indicate *SEM*s.

Early versus Late Stages

The factor Stage (Early or Late) had an effect on RT, *F* (1, 18) = 10.821, $p < .01$, in which RTs were greater for Early (*M* = 1053.54, *SEM* = 51.54) than Late (M = 956.23, *SEM* = 33.08) stages, and on urge to quit, *F* (1, 18) = 14.592, $p < .01$, in which urge to quit was stronger for Late (*M* = 4.21, *SEM* = .699) than Early (*M* =

1.97, *SEM* = .36) stages. Stage had no effect on control, although there was a trend, *F* (1, 18) = 3.564, *p* = .0753. There was no effect of Stroop condition on willpower or the urge to err (*p*s > .29).

Interactions between Temporal and Event-Based Factors of the Urge to Quit

Most importantly, we examined the interactions between Stage (Early or Late) and Conflict (congruent or incongruent) conditions. As predicted, there was an interaction between Stage and Conflict condition, *F* (1, 18) = 5.078, $p < .05$ (η_p^2 = .22), in which urges to quit were greater following incongruent (*M* = 1.98, *SEM* = .36) than congruent trials (*M* = 1.86, *SEM* = .36), *t* (18) = -3.004, $p < .01$, during the Early stage, but no such difference was found during the Late stage ($M_{Congruent}$ = 4.25, *SEM* = .70; $M_{\text{Incongruent}}$ = 4.20, SEM = .69), *t* (18) = .733, *p* = .47. The ANOVA also revealed a main effect of Stage on urge to quit, *F* (1, 18) = 15.27, $p < .01$ (η_p^2 = .46), but no main effect of Conflict condition on urge to quit, *F* (1, 18) = .639, *p* = .43. There was no such interaction between Stage and Conflict with RT, exerted control, willpower, or urge to err (*p*s > .26).

General Discussion

To better understand the nature of the urge to quit, which may mysteriously intrude upon consciousness when one carries out a monotonous cognitive task, we examined the strength of this urge as a function of both temporal and event-based factors. Regarding event-based sources, to date there has been little evidence that humans develop an avoidance response toward stimuli eliciting cognitive effort (Study 1) and cognitive conflict (Study 2), as is predicted by the law of least work (13, 15). Consistent with this law, in Study 1, urges to quit were stronger following difficult than easy trials in a working memory task resembling the Simon memory game, and, in Study 2, urges to quit were stronger following incongruent than congruent trials, but only during early/novice phases of performance, when responding is inefficient (10, 32). In both experiments, urges to quit were greater for late task stages than early stages, reflecting the influence of a temporal factor influencing the urge to quit.

It is quite remarkable that, in Study 1, an event-based factor gave rise to changes in the urge to quit on a trial-by-trial basis, in which participants reported a stronger urge to quit when the remembered sequence was longer. Again, *this acute effect on the urge to quit is unlikely to be mediated by metabolic changes in the brain, as such changes are to slow to constitute these fleeting modulations of this subjective state*.

In Study 2, different dimensions of subjective experience were rated differently, and some subjective effects depended on task-stage. Together, this suggests that, when introspecting and rating this and other response-related subjective phenomena (e.g., the urge to quit and exerted control), participants were actually introspecting about an aspect of phenomenal experience and were not simply basing their judgments on folk knowledge about psychology experiments or on heuristics such as "*For the urge to quit, always rate 6 for incongruent trials.*" It seems that the reported changes in urge to quit reflect the actual nature of motivation-related subjective phenomena that change over time, as function of repetition and level of activation (22). While urges to err, RTs, and exerted control tended to decrease as the trials progressed, the urge to quit showed the opposite pattern of effects: Urges to quit were greater for late stages than early task stages. This supports hypotheses regarding the temporal factors of the urge to quit (18, 19, 22). Not having obtained these effects would have cast doubt over several approaches regarding the nature of the phenomenology of quitting.

Again, these findings reveal that participants can reliably introspect about aspects of their experience that are associated with cognitive effort, controlled versus automatic responding, and motivational processes. With this approach, we have only begun to home in on the nature of the urge to quit, an urge whose suppression is essential for many forms of learning. One limitation of our approach is that we focused only on the cognitive (or 'cerebral') *activation* components of the urge to quit (22). It may well be that our subjective effects were driven by autonomic/ visceral changes that went undetected in our study.

Nevertheless, we believe that our basic findings will form a bedrock for future investigations that will eventually unveil how the urge to quit could be weakened in those instances (e.g., skill learning, exercise, or flying an aircraft for several hours) in which it may be distracting and counterproductive. More generally, building on these basic findings, future research may reveal the basic elements of the more 'hot' (1) motivational struggles involving the delay of gratification (e.g., the suppression of addiction-related urges; 3).

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Received November 30, 2011
Revision Received March 10, 2012
Accepted March 15, 2012

중단의 현상학: 반복과 인지적 노력의 효과*

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우리는 단조로운 과제를 할 때 종종 그만두고 싶은 충동을 느낀다. 이러한 중단 충동은 그 일을 얼마나 오래동안 해 왔는지(시간적 요인) 또는 수행하는 과제의 특정 요소(사건 기반 요인)에 따라 달라진다. 이 연구에서는 스트룹 과제와 작업기억 과제를 사용하여 시간적 요인(반복)과 사건 기반 요인(인지적 충돌)의 함수로서의 중단 충동의 변화를 살펴보았다. 최소작업의 법칙을 비롯한 최신 이론과 마찬가지로 기억 과제에서 중단 충동은 어려운 시행 다음에 더욱 큰 것으로 나타난 반면, 스트룹 과제에서는 반응이 비효율적인 시기인 수행의 초기(초심자) 단계에서만 일치 시행보다 불일치 시행 다음에 중단 충동이 더 큰 것으로 나타났다. 이는 인지적 갈등에 대한 회피반응임을 입증하는 결과이다. 시간적 측면에서 보면 중단 충동은 초기 단계보다 후기 단계에서 더 컸다. 이러한 연구 결과는 만족 지연에 관여하는 비교적 강렬한 동기적 노력의 본질을 명확하게 설명하고 있다.

주제어 : 노력, 지속성, 중단, 철회, 최소작업의 법칙, 충동