An Investigation of the Reliability and Self-Regulatory Correlates of Conflict Adaptation

Julia L. Feldman and Antonio L. Freitas

Stony Brook University

In press at *Experimental Psychology* as of 3/18/2016

Word Count: 4930

Direct Correspondence to:
Julia L. Feldman, Department of Psychology
Stony Brook University; Stony Brook, NY 11790-2500
Phone: (631) 632 7855
Email: Julia.Feldman@stonybrook.edu

Keywords: Cognitive control; Conflict adaptation; Self-regulation; Individual differences

Abstract

The study of the conflict-adaptation effect, in which encountering information-processing conflict attenuates the disruptive influence of information-processing conflicts encountered subsequently, is a burgeoning area of research. The present study investigated associations among performance measures on a Stroop-trajectory task (measuring Stroop interference and conflict adaptation), on a Wisconsin card sorting task (WCST; measuring cognitive flexibility), and on self-reported measures of self-regulation (including impulsivity and tenacity). We found significant reliability of the conflict-adaptation effects across a two-week period, for response-time and accuracy. Variability in conflict adaptation was not associated significantly with any indicators of performance on the WCST or with most of the self-reported self-regulation measures. There was substantial covariance between Stroop interference for accuracy and conflict adaptation for accuracy. The lack of evidence of covariance across distinct aspects of cognitive control (conflict adaptation, WCST performance, self-reported self-control) may reflect the operation of relatively independent component processes.

An Investigation of the Reliability and Self-Regulatory Correlates of Conflict Adaptation

A core function of cognitive control is alternating between automatic and controlled responding. The present study focused on a specific aspect of cognitive control termed conflict adaptation (CA), in which the detection of information-processing conflict attenuates the disruptive influence of information-processing conflicts encountered subsequently, presumably because needed mechanisms of cognitive control already have been engaged (Botvinick, Braver, Barch, Carter, & Cohen, 2001). We investigated the reliability of individual differences in CA across time. To evaluate the discriminant and convergent validity of CA as a construct representing individual differences in the contextual modulation of cognitive control, we also investigated its degree of association with other aspects of cognitive control and self-regulation.

Researchers have investigated individual differences in CA by observing whether different populations differentially recruit cognitive control, thereby potentially affecting the CA effect. For example, previous research has sought to examine whether individual differences in CA relate to diagnoses of Parkinson’s disease (Rustamov et al., 2013), generalized anxiety disorder (Larson, Clawson, Clayson, & Baldwin, 2013), major depressive disorder (Clawson, Clayson, & Larson, 2013), mild and severe traumatic brain injury (Larson, Farrer, & Clayson, 2011; Larson, Kaufman, & Perlstein, 2009), and frontal lobe damage (Funes, Lupiáñez, & Humphreys, 2010). Other work has sought to investigate the relationship between CA and other forms of executive control and thought processes (Clayson and Larson, 2012; Keye, Wilhelm, Oberauer, & Ravenzwaaij, 2009; Keye, Wilhelm, Oberauer, & Sturmer, 2013). Furthermore, previous work investigated the psychometric properties of the CA effect by analyzing its test-retest reliability and split-half reliability (Clayson & Larson, 2013). Importantly, these previous investigations used methods that did not allow isolating CA effects from other possible effects and confounds, as described below.

Barriers to Demonstrating Conflict Adaptation

Conflict-adaptation effects previously have been controversial, as researchers have pointed out that putative CA findings could be explained by alternative accounts. For example, repetition-priming appears a more parsimonious explanation than CA for the facilitation of responses to the second of two exact stimulus repetitions (Mayr, Awh, & Laurey, 2003). Furthermore, efforts to remove exact repetitions have introduced new confounds, by affecting participants' expectancies (Schmidt & DeHouwer, 2011). For example, in a Flanker task with more than two responses and equivalent proportions of congruent and incongruent trials, each central cue of a flanker trial appears more often with identical flankers (because there is only one type of congruent array for that target, e.g., "77777") than with non-identical flankers (because there are many different incongruent arrays for that target, e.g., "11711," "22722," etc.). Eliminating stimulus-contingency confounds in a four-response task with .25 congruent and .75 incongruent trials eliminates the CA effect (Schmidt & DeHouwer, 2011). However, administering non-equivalent proportions of congruent and incongruent trials introduces a new expectancy-based confound, because some trial successions occur more often than others. Because congruence-sequence successions are the primary independent variable in CA research, confounding succession type with frequency of occurrence prevents clear interpretation of results. Completing hundreds of trials with non-equivalent proportions of different succession types could facilitate greater acclimation to more frequent than less frequent successions, given evidence that the frequency of occurrence of a phenomenon strongly determines one's cognitive, affective, and physiological responses to it (Donchin & Coles, 1988; Zajonc, 1968).

The above-reviewed studies of individual differences in CA used methods that could not remove stimulus repetitions without introducing stimulus-contingency or trial-succession-probability confounds. Although those studies make important contributions to understanding individual differences in the recruitment of cognitive control, then, their implications for the reliability and validity of the CA effect are unclear. The current study addressed this substantial gap by applying recent methodological innovations that allow examining CA without stimulus repetitions, without introducing stimulus-contingency confounds, and without introducing trial-succession-probability confounds (Freitas & Clark, 2015; Kim & Cho, 2014; Schmidt & Weissman, 2014; for review, see Duthoo, Abrahamse, Braem, Boehler, & Notebaert, 2014).

The Stroop-Trajectory Task

The Stroop-trajectory task (Freitas & Clark, 2015) was designed to examine CA effects while eliminating the above-discussed confounds. In the Stroop-trajectory task, pointing triangles are presented one-at-a-time, yielding an array of slightly overlapping triangles on each trial. Participants’ task is to indicate the location of the smaller triangle that appears at either the top or the bottom of vertically oriented arrays or at the left or right of horizontally oriented arrays (see Figure 1). Trial congruence reflects whether or not the smaller triangle’s location matches the direction indicated by all other triangles in the array. Limiting analyses to trial successions in which stimulus arrays were presented at alternating vertical and horizontal orientations eliminates exact stimulus repetitions without introducing stimulus-contingency confounds. For each (vertical or horizontal) orientation, there are only four possible stimulus arrays, reflecting the two orthogonal factors of stimulus-array congruence and direction of response. Accordingly, stimulus-array congruence is not contingent on any other stimulus or response characteristics.

The Stroop-trajectory task also was designed to minimize two related barriers to detecting CA, negative priming and perceptual-motor binding. As shown by Bugg (2008), CA effects can be obfuscated by negative priming, in which responding to a recently ignored stimulus causes slower and less accurate responding (e.g., Neill, Valdes, Terry, & Gorfein, 1992; Tipper, 1985). In the Stroop-trajectory task (unlike in traditional Flanker tasks and some Stroop tasks), participants never respond to a particular element that they ignored, thereby obviating negative priming. Similarly, generating specific responses to specific stimuli can generate episodic traces that bind perceptual and action features that guide subsequent action, improving performance on exact perceptual/action repetitions but impairing performance on partial perceptual/action repetitions (Hommel, 1998, 2004). Limiting the influence of partial trial repetitions, responses to distracting elements never are cued in the Stroop-trajectory task. Whereas the (larger) distractor triangles may activate particular behavioral responses (e.g., “left” for left-pointing triangles; Kopp, Rist, Mattler, 1996), they do not cue retrieval of representations of recent actions. Moreover, by the time participants respond to the location of the smaller triangle, numerous separable perceptual events have occurred (as each of the seven black triangles has appeared sequentially), allowing decay of representations of prior responses to prior arrays.

Reliability and Correlates of the Conflict-Adaptation Effect

Although the literature on CA has developed rapidly, fundamental questions regarding the correlates and reliability of the effect remain unanswered. In an innovative research program, Clayson and Larson (2013) investigated the psychometric properties of the CA effect through the use of a Flanker task with two responses. As noted above, that study, along with others conducted at that time (including work by Freitas, Banai, & Clark, 2009), could not isolate CA effects from other trial *n*-1 to trial *n* dependencies. We examined the test-retest reliability of CA using the Stroop-trajectory task across a two-week period, in the first investigation of which we are aware of the reliability of the CA effect independent of the confounds and alternative mechanisms reviewed above. To examine the potential associations of CA with other self-regulatory phenomena, we also analyzed CA's associations with the Stroop-interference effect, cognitive flexibility, and self-reported self-control phenomena, as described next.

The Stroop-Interference Effect

The standard Stroop task involves responding to the color of letters rather than the words they comprise, requiring selective attention to disregard task-irrelevant information (Stroop, 1935; for review, see MacLeod, 1991). The Stroop-interference score, calculated by comparing response-time and accuracy on incongruent and congruent trials, has been studied across numerous research domains and has been linked to numerous health outcomes (e.g., Spieler, Balota & Faust, 1996; Streeter et al., 2008). Finding a relationship between the Stroop-interference effect and the CA effect may imply that increases in conflict cause increases in CA, in that individuals experiencing the greatest interference would have the greatest need to adjust their level of cognitive control. Such an effect would be broadly consistent with conflict-monitoring theory's contention that high degrees of information-processing conflict elicit large adaptations of cognitive control (Botvinick et al., 2001).

Cognitive Flexibility

Along with alternating between controlled and automatic responding, alternating between different cognitive strategies is recognized as fundamental to cognitive control. The present study used the Wisconsin Card Sorting Task (WCST; Grant & Berg, 1948), which has been used in clinical assessments to measure flexibility in populations including individuals with multiple sclerosis (Arnett et al., 1994) and schizophrenia diagnoses (Stratta, Daneluzzo, Bustini, Prosperini, & Rossi, 2000). Our measures of flexibility were derived from performance indices on the WCST, which requires participants to infer changing categorization rules based on a stimulus's color, shape and number of elements. Drawing on the logic that the magnitude of CA can be interpreted to positively index the degree of neurocognitive flexibility needed to modulate dynamically between controlled and automatic responding (e.g., Rustamov et al., 2013), we hypothesized a positive relation between CA and cognitive flexibility as measured on the WCST.

Self-Reported Self-Control

Many self-reported measures of self-regulation have been related to a variety of positive health outcomes. More specifically, self- reported self-control measured by the Brief Self-Control Scale has been related to a myriad of positive outcomes, such as higher grade point average (GPA) and fewer reports of psychopathology (Tagney et al., 2004). Grittiness, defined as perseverance for long-term goals and measured by the Grit Scale (Duckworth et al., 2007), has been related to educational attainment and GPA. Impulsivity, measured by the UPPS Impulsivity Scale (Whiteside & Lynam, 2001), has been found to relate to compulsive buying (Billieux et al., 2008) and cigarette cravings (Billieux et al., 2007). Rumination, measured by the Ruminative Response Scale (Nolen-Hoeksema, 2000), has been linked to depressive disorders and to other anxiety-related and depressive symptoms. The formation of habits, as measured by the Habits Scale (Verplanken & Orbell, 2003; see also Verplanken, Friborg, Wang, Trafimow, & Woolf, 2007), has been found to mediate the effect of past behavior on later behavior.

Previous work has found sensation-seeking to relate modestly to the Flanker-interference effect but not to the CA effect (Keye et al., 2009), using a task not intended to distinguish CA effects from repetition-priming and stimulus-contingency effects. The present study used the same impulsivity measure as used by Keye and colleagues (2009) as well as the additional measures of self-regulation reviewed above. Finding that individuals with high self-reported self-control show an increased CA effect could imply a process of strategic allocation of attentional resources involved in CA.

The Present Study

The goal of the present study was to update previous work assessing the psychometric properties of CA (Clayson & Larson, 2013) and individual differences in CA (e.g., Clayson and Larson, 2012; Keye et al., 2009; Keye et al., 2013) using a new task that minimizes previous confounds. More specifically, we investigated whether variability in CA may be associated with Stroop-interference, cognitive flexibility, and self-reported self-regulation, to better understand the utility and validity of the effect. In addition, to assess the stability of the CA effect, we investigated its reliability across a two-week period.

During the first session, participants performed a WCST and the Stroop-trajectory task. Two weeks later, participants again performed the Stroop-trajectory task and completed self-reported self-regulation questionnaires, including the UPPS Impulsivity Scale (Whiteside, & Lynam, 2001), the Grit Scale (Duckworth et al., 2007), as well as others described below.

Methods

Participants

One hundred sixty-four undergraduates from Stony Brook University participated in exchange for course credit. Twenty-one participants did not complete both sessions, and two participants had accuracy scores under 55% across the two sessions of the Stroop-trajectory task (the remainder of participants had accuracy greater than 85%), leaving 142 participants (43 males), aged 18-27 (*M*= 19.5), included in the analyses. The study was approved by the Stony Brook University Institutional Review Board. All participants gave written, informed consent.

Procedure

During Session 1, participants first completed the WCST and then the Stroop-trajectory task.[1] During Session 2, scheduled approximately two weeks later, they again completed the Stroop-trajectory task, followed by measures of individual differences. For the Stroop-trajectory task, participants used a standard keyboard. For the WCST, participants used a standard computer mouse. All individual-difference questionnaires were administered via computer. For all items from the questionnaires, see coding manual, electronic supplementary material (ESM) 3.

Stimuli and Tasks

Stroop-trajectory Task (Freitas & Clark, 2015). The task entails presentation of triangle arrays presented horizontally and vertically across the screen. Using their dominant hands, participants pressed the arrow keys on a standard computer keyboard (positioned near the left hand of left-handed participants and near the right hand of right-handed participants) to indicate the location of a small gray triangle within an array of larger black triangles. A trial begins with a 400 msec fixation cue (".") horizontally and vertically centered on the monitor. Following a 26.67 msec blank screen, vertical or horizontal arrays of seven black triangles (each 83 pixels high x 27 pixels wide) are presented incrementally. For upward-pointing arrays, a single upward-pointing triangle first is presented, centered horizontally. In successive intervals of 26.67 msec,

---

[1] Participants also completed an additional WCST task at the end of Session 1. We included this additional task as part of a separate attempt to investigate fatigue effects on the WCST. However, we were unsuccessful in capturing interpretable fatigue effects; instead, most comparisons across the first and second WCST appeared to suggest learning effects. Consistent with the primary analyses reported below, exploratory analyses indicated that responses to the second WCST did not correlate significantly with any measures from the Stroop-trajectory task (see Supplementary Table1, ESM 1). Data from the second WCST are presented in ESM 2.

five other identical triangles are added to the array, with each triangle appearing immediately above the one presented before it. Finally, 40 msec after the sixth black triangle in the array is visible, the seventh identical triangle appears immediately above the others, and a smaller (24 pixels high x 14 pixels wide) upward-pointing gray triangle appears inside either the top black triangle (on congruent trials) or the bottom black triangle (on incongruent trials) and are presented for 146.67 msec, after which the screen remains blank awaiting the participant's response. The screen remains blank for an interval varying randomly between 125 and 250 msec to end the trial. Participants are given a computer-administered 24-trial practice block. The task consists of 10 blocks (100 trials each), requiring approximately 35 minutes.

To compute response-time and accuracy indices of the CA effect, we subtracted each participant's response-time and accuracy means when the level of information-processing conflict at trial *n* was consistent with that at trial *n*-1 (i.e., incongruent following incongruent trials and congruent following congruent trials) from response-time and accuracy means when the level of information-processing conflict at trial *n* was inconsistent with that at trial *n*-1 (i.e., incongruent following congruent trials and congruent following incongruent trials). CA is indicated by positive scores on the response-time index (slower responses when the level of information-processing conflict at trial *n* was inconsistent rather than consistent with that at trial *n*-1) and by negative scores on the accuracy index (less accurate responses when the level of information-processing conflict at trial *n* was inconsistent rather than consistent with that at trial *n*-1).

The Wisconsin Card-sorting Task (WCST) (Grant & Berg, 1948). The WCST assesses participants' ability to discern fluctuating categorization rules, including the stimuli's color, shape and number of elements. No detailed instructions are given; thus, participants themselves must discover the categorization rules. Importantly, the sorting rules change without notice, and participants' application of no-longer-valid rules constitute a key dependent measure of perseveration on this task. We used a computerized version of this task from the Inquisit library (adapted from Grant & Berg, 1948). The task was altered so that the rules needed to be applied were randomized with the exception that no rule be repeated across consecutive trials. A new rule began after 10 correct sorts. There was a maximum of 264 trials.

The UPPS Impulsive Behavior Scale (Whiteside, & Lynam, 2001). The self-reported scale consists of 46 items that are divided into 4 subdivisions of impulsivity, including premeditation (11 items), urgency (12 items), sensation-seeking (12 items), and perseverance (10 items). Items are rated on a 0 (not at all) to 4 (very much) point scale. The internal consistency coefficients in this study were high for premeditation (Cronbach's α = 0.92), for urgency (Cronbach's α = 0.92), for sensation-seeking (Cronbach's α = 0.93), and for perseverance (Cronbach's α = 0.85).

The Brief Self-control Scale (Tagney et al., 2004). The self-reported scale consists of 12 items to measure self-control. Items are rated on a 1 (Not at all) to 5 (Very much) scale. The internal consistency in this study was high (Cronbach's α = .87).

The Grit Scale (Duckworth et al., 2007). The self-reported scale consists of 12 items measuring passion and perseverance for long term goals. Items are rated on a 1 (Not at all) to 5 (Very much) scale. The internal consistency in this study was high (Cronbach's α = .79).

Rumination Response Scale (Treynor, Gonzalez & Nolen-Hoeksema, 2003). The self-reported scale consists of 10 items in which participants rate a series of statements from 0 (never) to 4 (always) regarding whether they often ruminate. This scale is from a larger 22 item scale;

however, these 10 items we selected for analysis are more specific to rumination rather than depression (Treynor, Gonzalez, & Nolen-Hoeksema, 2003). The internal consistency in this study was high (Cronbach's α = .81). Due to human error, question 13 of the larger 22 item scale was not assessed.

Habits Scale (Verplanken & Orbell, 2003). The self-reported scale consists of two subsections (good and bad habits) consisting of 12 items each, assessing subjective experiences of automaticity of habitual behaviors. The participant reports a good or bad habit and then responds to a series of statements concerning the habit. In this study, the internal consistency was high for good habits (Cronbach's α = .84) and bad habits (Cronbach's α = .85).

Data Analysis

Latency data were not analyzed when erroneous responses were recorded at trials *n* or *n*-1 (resulting in exclusion of 8.54% of trials in Session 1 and of 8.32% of trials in Session 2) or when latencies exceeded 800 msec (resulting in exclusion of 2.73% of remaining trials in Session 1 and of 1.03% of trials in Session 2), and accuracy data were not analyzed when erroneous responses were recorded at trial *n*-1 (resulting in exclusion of 4.73% of trials in Session 1 and of 4.31% of trials in Session 2). Moreover, when computing the CA effect and the interference effect, response latency and accuracy data were analyzed only when the vertical/horizontal orientations of stimulus arrays differed across trials *n* and *n*-1, thereby precluding analysis of exact stimulus repetitions without introducing any confounds.

Zero-order correlations were used to examine relationships among variables. To limit type I errors given our assessment of many individual-difference variables, we used an alpha level of .01 to determine statistical significance of any correlational results.

Results

Session 1

Conflict-adaptation results. During Session 1, for response-times, there was a significant effect of trial *n* congruence, $F(1,141) = 185.56$, MSE = 637.75,$p<.0001$, partial $\eta^2= 0.57$, and of trial *n*-1 congruence, $F(1,141) = 20.26$, MSE= 73.57, $p<.0001$, partial $\eta^2= 0.13$. Indicating the presence of a robust CA effect, the trial *n* x trial *n*-1 congruence interaction was significant, $F(1,141)=210.10$, MSE= 127.78, $p<.0001$, partial $\eta^2=.60$. Average proportions of correct responses also were analyzed in a 2 (congruency status of trial *n*-1) x 2 (congruency of trial *n*) repeated-measures analysis of variance (ANOVA). During Session 1, for accuracy rates, there was a significant effect of trial *n* congruence, $F(1,141) = 159.19$, MSE= .002, $p<.0001$, partial $\eta^2=0.53$, and of trial *n*-1 congruence, $F(1,141) = 73.13$, MSE= .0007, $p<.0001$, partial $\eta^2= 0.34$. Again indicating the presence of a robust CA effect, the trial *n* x trial *n*-1 congruence interaction was significant, $F(1,141)=106.36$, MSE= .0007, $p<.0001$, partial $\eta^2=.43$. As shown in Figure 2, encountering an incongruent trial at trial *n*-1 significantly increased accuracy and decreased response-time on incongruent relative to congruent trials, despite the absence of exact stimulus repetitions or of any stimulus-contingency confounds. For raw data, see ESM4.

Correlations among WCST variables. See Table 1 for inter-correlations, means and standard deviations among WCST variables.

Correlations among Stroop-trajectory task variables. CA on response-time was not associated with the Stroop-interference effect for response-time ($r=.16$, *ns*) or accuracy ($r=.1$, *ns*). CA accuracy was not associated with the Stroop-interference effect for response-time ($r=.15$, *ns*) but was substantially related to the Stroop-interference effect for accuracy ($r=.58$), $p<.01$).

See Table 2 for inter-correlations, means and standard deviations for Stroop-trajectory task variables.

Correlations across WCST variables and Stroop-trajectory task variables.

Correlations between the WCST variables and the Stroop-trajectory variables (Stroop-interference and CA) were not significant. See Table 3 for correlations between WCST variables and Stroop-trajectory task variables.

Session 2

Conflict-adaptation results. During Session 2, for response-times, there was a significant effect of trial *n* congruence, *F*(1,141) = 173.67, MSE = 453.05,*p*<.0001, partial η^2=0.55, and of trial *n*-1 congruence, *F*(1,141) = 11.01, MSE= 64.56, *p*<.0001, partial η^2= 0.07. As in Session 1, and indicating a CA effect, the trial *n* x trial *n*-1 congruence interaction was significant, *F*(1,141)=252.17, MSE= 80.14, *p*<.0001, partial η^2=0.64. During Session 2, for accuracy rates, there was a significant effect of trial *n* congruence, *F*(1,141) = 171.66, MSE= .002, *p*<.0001, partial η^2= 0.55, and of trial *n*-1 congruence, *F*(1,141) = 59.11, MSE= .0006, *p*<.0001, partial η^2= 0.3. As in Session 1, and indicating a CA effect, the trial *n* x trial *n*-1 congruence interaction was significant, *F*(1,141)=62.88, MSE= .0007, *p*<.0001, partial η^2=0.31. As shown in Figure 2, encountering an incongruent trial at trial *n*-1 significantly increased accuracy and decreased response-time on incongruent relative to congruent trials, despite the absence of exact stimulus repetitions or stimulus-contingency confounds. For raw data, see ESM5.

Correlations among self-control measures. There was substantial covariance among several self-reported measures. See Table 4 for correlations, means and standard deviations for self-reported measures.

Correlations among Stroop-trajectory task variables. The CA effect for response-time was not associated with the Stroop-interference effect for response-time (*r*= .15, *ns*) or accuracy (*r*=.19, *ns*). The CA effect for accuracy was significantly correlated with the Stroop effect response-time (*r*=-.29, *p*<01) and accuracy (*r*=.58, *p*<.01). See Table 2 for inter-correlations, means and standard deviations among Stroop-trajectory task variables.

Correlations across self-reported self-regulation measures and Stroop-trajectory task variables. The Stroop-interference effect for response-time was not associated significantly with any of the self-reported measures of self-regulation. The Stroop-interference effect for accuracy was associated only with self-reported grit (*r*=-.22). Variability in CA for response-time was only associated with sensation-seeking (*r*= -.22). Variability in CA for accuracy was not associated significantly with any of the measures of self-reported self-regulation. See Table 5 for correlations between self-regulation measures and Stroop-trajectory task variables. For correlations across self-control measures and Session 1 Stroop-trajectory task variables, see Supplementary Table2 in ESM1.

Test-Retest Reliability across Two Weeks

Regarding the test-retest reliability of the Stroop-interference effect, scores from Session 1 correlated significantly with Stroop-interference effect scores assessed two weeks later for response-time (*r*=.73, *p*<.01) and accuracy (*r*= .58, *p*<.01). For CA effects, scores from Session 1 correlated significantly with CA scores assessed two weeks later, both for response-time (*r* =.24, *p*<.01) and for accuracy (*r* =.25, *p*<.01). For full table with test retest correlations, see Table 2. For means, standard deviations and psychometrics of trial types, interference effect and CA effect across sessions, see Supplementary Table3 and Supplementary Table4 in ESM1. For master data file, see ESM6.

Discussion

These findings make several contributions to understanding cognitive control and its correlates. First, we replicated recent findings of CA effects on response time and accuracy (Freitas & Clark, 2015). Addressing recent doubts about the robustness of this effect (Mayr & Awh, 2009; Schmidt, 2013), the present results support an emerging consensus that the CA effect indeed is quite robust (for review, see Duthoo et al., 2014).

Moreover, we found significant test-retest reliability of CA across a two-week period. The reliabilities of this effect for reaction time (*r*=.24) and accuracy (*r*=.25) were significant statistically but modest in magnitude, particularly when compared with the reliability of the Stroop-interference effects for reaction time (*r*=.73) and accuracy (*r*=.58). As the first study to examine the reliability of the CA effect independent of the confounds reviewed above, the current work found test-retest correlations for specific trial types (see Supplementary Table 2) that were quite similar in magnitude to those found in an earlier study that used a traditional Flanker task and did not attempt to remove those confounds (Clayson & Larson, 2013). The consistency of these studies' results, despite their different methods, suggests that they may reflect the same underlying phenomenon. Further investigation of test-retest reliability using other confound-minimized CA tasks is needed, as is further investigation of contextual factors, independent of stable individual differences, that may modulate the magnitude of CA (e.g., Duthoo, Abrahamse, Braem, & Notebaert, 2014).

We did not observe substantial correlations between the CA effect and cognitive flexibility, as assessed on the WCST. Although deriving from a new task well-suited to analyzing CA and from the first study that assessed WCST performance as a possible correlate of CA, these findings appear generally consistent with earlier findings of minimal covariation across CA and executive function (Keye et al., 2009) and working memory capacity (Keye et al., 2013). One interpretation of these findings is that individual differences underlying trial-by-trial modulation of cognitive control to information-processing conflict are independent of those underlying cognitive-flexibility processes assessed at broader timescales, as in the WCST. To assess whether CA relates to categorical flexibility at a commensurate time scale, future research profitably may examine whether variability in CA relates to variability in the long-studied and robust effect whereby people often mistakenly apply at trial *n* the same category label that was appropriate at trial *n*-1, in speeded-categorization tasks (e.g., Wagner & Baird, 1981).

Turning to our Stroop-interference results, we found an interesting correlation between the Stroop-interference effect for accuracy and the CA effect for accuracy. Using Cohen's (1992) standards of small (r=.10), medium (r=.30) and large (r=.50) correlations, we found a large correlation of .58 between the Stroop-interference effect for accuracy and CA for accuracy. This same particular value was found during Session 1 and during Session 2, implying a consistent and robust relationship. Previous work has concluded that the magnitude of congruence and CA effects do not depend strongly on one another, based on evidence drawn from three tasks administered separately, in which a Simon task yielded a larger CA effect, yet a smaller congruency effect, than did Stroop and Flanker tasks (Weissman, Jiang, & Egner, 2014). However, across-task differences in CA magnitude may reflect a number of task differences besides the magnitudes of their congruency effects (e.g., Kornblum, Hasbroucq, & Osman, 1990). Accordingly, a valuable direction for future research will be examining the extent to which congruency and CA effects covary across and within tasks (cf. Kan et al., 2013).

There are several potential explanations for our intriguing finding of a relationship between Stroop-interference and CA. As Keye et al. (2009) have proposed, perhaps the need for a high degree of control implies a strong need for monitoring conflict continuously. Consistent with that possibility, Kan and colleagues (2013) found CA effects only for individuals with large conflict effects and attributed that result to the degree of cognitive control recruited as a function of chronically low or high levels of information-processing conflict. In a related vein, Desender, Opstal, and Bussche (2014) found that when participants reported that they had detected conflict on the previous trial (whether or not falsely remembered), they showed CA effects; in contrast, when participants claimed no conflict had been experienced on the previous trial (whether or not falsely remembered), the CA effect was not observed. Those results could imply that the experience of conflict is related to the CA effect (Abrahamse & Braem, 2015). Future work can more directly test this hypothesis by investigating the relationship between conflicts of varying difficulty. In a related vein, Kleiman, Hassin and Trope (2013) have suggested that conflict of greater (e.g., social) importance may lead to an increased CA. Future work may examine that possibility by manipulating importance in conflict tasks.

Another possibility is that, at least on the presently used laboratory tasks, high CA scores might lead to lower accuracy scores. From this standpoint, CA may be interpreted as a bias and likened to classic work on functional fixedness (Duncker, 1945), in that individuals may suffer performance decrements when they apply at trial *n* a cognitive operation that was optimal at trial *n*-1 (see also Brown, Reynolds, & Braver, 2007). Outside of the laboratory, CA might increase overall accuracy, given the assumption that natural environments entail task demands that typically are correlated across time, so that engaging a particular mechanism of cognitive control at a particular point in time generally will equip one to successfully accomplish whatever comes next. In the laboratory, where demands for cognitive control at trials *n* and *n*-1 are unconfounded, applying what worked at trial *n*-1 could prove a hindrance rather than a help to trial *n* accuracy. To explore this possibility, future research may use methods of implicit learning to examine correlates of CA as a function of the contingency between levels of information-processing conflict across trials *n* and *n*-1.

Regarding potential relations between self-reported self-regulation measures and CA, we found only a single significant correlation, between sensation-seeking and CA for response-time (and not for accuracy). Sensation-seeking was the only sub-scale of impulsivity that correlated significantly with any CA effect, indicating that replication of that single association would be needed before integrating the finding with theory. More generally, the overall lack of evidence of covariance across these variables as well as those deriving from the WCST may reflect the operation of relatively independent component processes of cognitive control (cf. Baddley, 1986; Miyake & Shah, 1999).

Electronic Supplementary Material

ESM1. Supplementary Tables
(SupplementaryTables.docx)

ESM2. WCST_Time2
(Session2RAWWCSTData_Feldman_&_Freitas,2015.xlsx)

ESM3. Coding Manual for Individual Differences
(CodingManual_Feldman_&_Freitas,2015.docx)

ESM4. Session1 Raw Stroop-trajectory data
(Session1RAWStroop_trajectoryData_Feldman_&_Freitas,2015.xlsx)

ESM5. Session2 Raw Stroop-trajectory data
(Session2RAWStroop_trajectoryData_Feldman_&_Freitas,2015.xlsx)

ESM6. Master File (MasterFile_Feldman&Freitas,2015.sav)

References

Abrahamse, E., & Braem, S. (2015). Experience a conflict—either consciously or not (commentary on Desender, Van Opstal, and Van den Bussche, 2014).*Frontiers in Psychology, 6,* 179. doi:10.3389/fpsyg.2015.00179

Arnett, P. A., Rao, S. M., Bernardin, L., Grafman, J., Yetkin, F. Z., & Lobeck, L. (1994). Relationship between frontal-lobe lesions and Wisconsin Card Sorting Test performance in patients with multiple-sclerosis. *Neurology, 44*, 420-425. doi: 10.1212/WNL.44.3_Part_1.420

Baddeley, A. (1996). Exploring the central executive. *Quarterly Journal of Experimental Psychology Section a-Human Experimental Psychology, 49,* 5-28. doi: 10.1080/713755608

Billieux, J., Rochat, L., Rebetez, M. M. L., & Van der Linden, M. (2008). Are all facets of impulsivity related to self-reported compulsive buying behavior? *Personality and Individual Differences, 44,* 1432-1442. doi:10.1016/j.paid.2007.12.011

Billieux, J., Van der Linden, M., & Ceschi, G. (2007). Which dimensions of impulsivity are related to cigarette craving? *Addictive Behaviors*, *32*, 1189-1199. doi:10.1016/j.addbeh.2006.08.007

Botvinick, M. M., Braver, T. S., Barch, D. M., Carter, C. S., & Cohen, J. D. (2001). Conflict monitoring and cognitive control. *Psychological Review, 108,* 624-652. doi:10.1037//0033-295x.108.3.624

Brown, J. W., Reynolds, J. R., & Braver, T. S. (2007). A computational model of fractionated conflict-control mechanisms in task-switching. *Cognitive psychology, 55*, 37-85. doi:10.1016/j.cogpsych.2006.09.005

Bugg, J. M. (2008). Opposing influences on conflict-driven adaptation in the Eriksen flanker task. *Memory & Cognition, 36*, 1217-1227. doi:10.3758/mc.36.7.1217

Clawson, A., Clayson, P. E., & Larson, M. J. (2013). Cognitive control adjustments and conflict adaptation in major depressive disorder. *Psychophysiology, 50*, 711-721. doi:10.1111/psyp.12066

Clayson, P. E., & Larson, M. J. (2012). Cognitive performance and electrophysiological indices of cognitive control: A validation study of conflict adaptation. *Psychophysiology, 49*, 627-637. doi:10.1111/j.1469-8986.2011.01345.x

Clayson, P. E., & Larson, M. J. (2013). Psychometric properties of conflict monitoring and conflict adaptation indices: Response time and conflict N2 event-related potentials. *Psychophysiology, 50*, 1209-1219. doi: 10.1111/psyp.12138

Cohen, J. (1992). A Power Primer. *Psychological Bulletin, 112,* 155-159. doi:10.1037/0033-2909.112.1.155

Desender, K., Van Opstal, F., & Van den Bussche, E. (2014). Feeling the Conflict The Crucial Role of Conflict Experience in Adaptation. *Psychological science, 25*, 675-683. doi:10.1177/095679761351146

Donchin, E., Coles, M.G.H., 1988. Is the P300 component a manifestation of context updating? *Behavioural and Brain Sciences*, 11, 357–374. doi: 10.1017/S0140525X00058027

Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: Perseverance and passion for long-term goals. *Journal of Personality and Social Psychology, 92*, 1087-1101. doi:10.1037/0022-3514.92.6.1087

Duncker, K. (1945). On problem-solving. *Psychological monographs*, *58*. doi: 10.1037/h0093599

Duthoo, W., Abrahamse, E. L., Braem, S., Boehler, C. N., & Notebaert, W. (2014). The heterogeneous world of congruency sequence effects: an update. *Frontiers in Psychology, 5*. doi:10.3389/fpsyg.2014.01001

Duthoo, W., Abrahamse, E. L., Braem, S., & Notebaert, W. (2014). Going, going, gone? Proactive control prevents the congruency sequence effect from rapid decay. *Psychological Research*, *78*, 483-493.doi: 10.1007/s00426-013-0498-4

Freitas, A. L., Banai, R., & Clark, S. L. (2009). When cognitive control is calibrated: Event-related potential correlates of adapting to information-processing conflict despite erroneous response preparation. *Psychophysiology*, *46*, 1226-1233. doi: 10.1111/j.1469-8986.2009.00864.x

Freitas, A. L., & Clark, S. L. (2015). Generality and specificity in cognitive control: conflict adaptation within and across selective-attention tasks but not across selective-attention and Simon tasks. *Psychological Research-Psychologische Forschung, 79*, 143-162. doi:10.1007/s00426-014-0540-1

Funes, M. J., Lupianez, J., & Humphreys, G. (2010). Top-down and bottom-up deficits in conflict adaptation after frontal lobe damage. *Cognitive Neuropsychology*, *27*, 360-375. doi:10.1080/02643294.2010.532618

Grant, D. A., & Berg, E. (1948). A behavioral analysis of degree of reinforcement and ease of shifting to new responses in a Weigl-type card-sorting problem. *Journal of experimental psychology*, *38*, 404.doi: 10.1037/h0059831

Hommel, B. (1998). Event files: Evidence for automatic integration of stimulus-response episodes. *Visual Cognition, 5*, 183-216. doi: 10.1080/713756773

Hommel, B. (2004). Event files: feature binding in and across perception and action. *Trends in Cognitive Sciences, 8*, 494-500. doi:10.1016/j.tics.2004.08.007

Kan, I. P., Teubner-Rhodes, S., Drummey, A. B., Nutile, L., Krupa, L., & Novick, J. M. (2013). To adapt or not to adapt: The question of domain-general cognitive control. *Cognition*, *129*, 637-651. doi:10.1016/j.cognition.2013.09.001

Keye, D., Wilhelm, O., Oberauer, K., & van Ravenzwaaij, D. (2009). Individual differences in conflict-monitoring: Testing means and covariance hypothesis about the Simon and the Eriksen Flanker task. *Psychological Research-Psychologische Forschung, 73,* 762-776. doi:10.1007/s00426-008-0188-9

Keye, D., Wilhelm, O., Oberauer, K., & Stürmer, B. (2013). Individual differences in response conflict adaptations. *Frontiers in psychology, 4*. doi: 10.3389/fpsyg.2013.00947

Kim, S., & Cho, Y. S. (2014). Congruency sequence effect without feature integration and contingency learning. *Acta psychologica*, *149*, 60-68. doi:10.1016/j.actpsy.2014.03.004

Kleiman, T., Hassin, R. R., & Trope, Y. (2013). The Control-Freak Mind: Stereotypical Biases Are Eliminated Following Conflict-Activated Cognitive Control. *Journal of Experimental Psychology-General, 143*, 498-503. doi:10.1037/a0033047

Kopp, B., Rist, F., Mattler, U., 1996. N200 in the flanker task as a neurobehavioral tool for investigating executive control. Psychophysiology 33, 282–294. doi: 10.1111/j.1469-8986.1996.tb00425.x

Kornblum, S., Hasbroucq, T., & Osman, A. (1990). Dimensional overlap: cognitive basis for stimulus-response compatibility--a model and taxonomy. *Psychological Review, 97*, 253. doi: 10.1037/0033-295X.97.2.253

Larson, M. J., Clawson, A., Clayson, P. E., & Baldwin, S. A. (2013). Cognitive conflict adaptation in generalized anxiety disorder. *Biological Psychology, 94*, 408-418. doi:10.1016/j.biopsycho.2013.08.006

Larson, M. J., Forrer, T. J., & Clayson, P. E. (2011). Cognitive control in mild traumatic brain injury: Conflict monitoring and conflict adaptation. *International Journal of Psychophysiology, 82*, 69-78. doi:10.1016/j.ijpsycho.2011.02.018

Larson, M. J., Kaufman, D. A. S., & Perlstein, W. M. (2009). Conflict adaptation and cognitive control adjustments following traumatic brain injury. *Journal of the International Neuropsychological Society, 15*, 927-937. doi:10.1017/s1355617709990701

Macleod, C. M. (1991). Half a century of research on the Stroop Effect- An integrative review. *Psychological Bulletin, 109*, 163-203. doi:10.1037//0033-2909.109.2.163

Mayr, U., & Awh, E. (2009). The elusive link between conflict and conflict adaptation. *Psychological Research-Psychologische Forschung, 73*, 794-802. doi:10.1007/s00426-008-0191-1

Mayr, U., Awh, E., & Laurey, P. (2003). Conflict adaptation effects in the absence of executive control. *Nature Neuroscience, 6*, 450-452. doi:10.1038/nn1051

Miyake, A., & Shah, P. (1999). *Models of working memory: Mechanisms of active maintenance and executive control*. Cambridge University Press.

Neill, W. T., Valdes, L. A., Terry, K. M., & Gorfein, D. S. (1992). Persistence of negative priming: II. Evidence for episodic trace retrieval. *Journal of Experimental Psychology-Learning Memory and Cognition, 18*, 993-1000. doi:10.1037/0278-7393.18.5.993

Nolen-Hoeksema, S. (2000). The role of rumination in depressive disorders and mixed anxiety/depressive symptoms. *Journal of Abnormal Psychology, 109*, 504-511. doi:10.1037/0021-843x.109.3.504

Rustamov, N., Rodriguez-Raecke, R., Timm, L., Agrawal, D., Dressler, D., Schrader, C., Tacik, P., Wegner, F., Dengler, R., Wittfoth, M. and Kopp, B. (2013). Absence of congruency sequence effects reveals neurocognitive inflexibility in Parkinson's disease. *Neuropsychologia*, *51*(14), 2976-2987. doi:10.1016/j.neuropsychologia.2013.10.025

Schmidt, J. R. (2013). Questioning conflict adaptation: Proportion congruent and Gratton effects reconsidered. *Psychonomic Bulletin & Review*, *20*, 615-630. doi:10.3758/s13423-012-0373-0

Schmidt, J. R., & De Houwer, J. (2011). Now you see it, now you don't: Controlling for contingencies and stimulus repetitions eliminates the Gratton effect. *Acta Psychologica*, *138*, 176-186. doi:10.1016/j.actpsy.2011.06.002

Schmidt, J. R., & Weissman, D. H. (2014). Congruency sequence effects without feature integration or contingency learning confounds. PLoS ONE 9: e102337. doi:10.1371/journal.pone.0102337

Spieler, D. H., Balota, D. A., & Faust, M. E. (1996). Stroop performance in healthy younger and older adults and in individuals with dementia of the Alzheimer's type. *Journal of Experimental Psychology-Human Perception and Performance, 22*, 461-479. doi:10.1037/0096-1523.22.2.461

Stratta, P., Daneluzzo, E., Bustini, M., Prosperini, P., & Rossi, A. (2000). Processing of context information in schizophrenia: relation to clinical symptoms and WCST performance. *Schizophrenia Research, 44*, 57-67. doi:10.1016/s0920-9964(99)00142-5

Streeter, C. C., Terhune, D. B., Whitfield, T. H., Gruber, S., Sarid-Segal, O., Silveri, M. M., Tzilos, G., Afshar, M., Rouse, E. D., Tian, H., Renshaw, F., Ciraulo, D. A., Yurgelun-

Todd, D. A. (2008). Performance on the Stroop predicts treatment compliance in cocaine-dependent individuals. *Neuropsychopharmacology, 33*, 827-836. doi:10.1038/sj.npp.1301465

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology, 18*, 643-662. doi:10.1037/0096-3445.121.1.15

Tangney, J. P., Baumeister, R. F., & Boone, A. L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality, 72*, 271-324. doi:10.1111/j.0022-3506.2004.00263.x

Tipper, S. P. (1985). The negative priming effect- Inhibitory priming by ignored objects. *Quarterly Journal of Experimental Psychology Section a-Human Experimental Psychology, 37*, 571-590. doi: 10.1080/14640748508400920

Treynor, W., Gonzalez, R., & Nolen-Hoeksema, S. (2003). Rumination reconsidered: A psychometric analysis. *Cognitive Therapy and Research, 27*, 247-259. doi:10.1023/a:1023910315561

Verplanken, B., Friborg, O., Wang, C. E., Trafimow, D., & Woolf, K. (2007). Mental habits: Metacognitive reflection on negative self-thinking. *Journal of Personality and Social Psychology, 92*, 526-541. doi:10.1037/0022-3514.92.3.526

Verplanken, B., & Orbell, S. (2003). Reflections on past behavior: A self-reported index of habit strength. *Journal of Applied Social Psychology, 33*, 1313-1330. doi:10.1111/j.1559-1816.2003.tb01951.x

Wagner, M., & Baird, J. C. (1981). A quantitative analysis of sequential effects with numeric stimuli. *Perception and Psychophysics*, *29*, 359-364. doi:10.3758/BF03207345

Weissman, D. H., Jiang, J., & Egner, T. (2014). Determinants of congruency sequence effects without learning and memory confounds. *Journal of Experimental Psychology: Human Perception and Performance*, *40*, 2022-2037. doi: 10.1037/a0037454

Whiteside, S. P., & Lynam, D. R. (2001). The Five Factor Model and impulsivity: using a structural model of personality to understand impulsivity. *Personality and Individual Differences*, *30*, 669-689. doi:10.1016/s0191-8869(00)00064-7

Zajonc, R. B. (1968). Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology*, *9*, 1-27. doi: 10.1037/h0025848

Table 1

Summary of Intercorrelations, Means, and Standard Deviations for Wisconsin Card Sorting Task Variables

Variable	1	2	3	4	5	6	7
1. Total Trials	-	.35*	.78*	-.42*	-.63*	.52*	.38*
2. Total Correct		-	-.32*	.05	.4*	.73*	.2
3. Total Error			-	-.45*	-.90*	.04	.26*
4. Percent Perseverative Errors				-	.44*	-.13	-.17
5. Completed Categories					-	-.11	-.28*
6. Sum Failure to Maintain Set						-	.23*
7. Trials to Complete First Category							-
M	105.23	74.70	30.53	17.91	5.21	1.17	17.65
SD	19.69	13.01	19.45	13.68	1.46	1.34	13.2

Note. *N*=142. **p*<.01.

Table 2

Summary of Intercorrelations, Means, and Standard deviations for Stroop-trajectory Task Variables from Session 1 and 2

Variable		1	2	3	4	5	6	7	8
1. Stroop RT S1		-	-.49*	-.16	-.15	.73*	-.41*	.07	- .2
2. Stroop Cor S1			-	-.1	.58*	-.38*	.58*	-.18	.36*
3. Conflict Adaptation RT S1				-	-.23*	-.13	-.05	.24*	-.06
4. Conflict Adaptation Cor S1					-	-.15	.41*	-.14	.25*
5. Stroop RT S2						-	-.51*	.15	-.29*
6. Stroop Cor S2							-	-.19	.58*
7. Conflict Adaptation RT S2								-	-.24*
8. Conflict Adaptation Cor S2									-
	M	-28.87	.05	-13.75	.02	-23.54	.05	-11.93	.02
	SD	25.25	.05	11.30	.03	21.28	.04	8.96	.03

Note. N=142. RT= response-time scores; Cor= accuracy scores; S1 indicates data from Session 1; S2 indicates data from Session 2;**p*<.01.

Table 3

Correlations between Wisconsin Card Sorting Task Variables and Stroop-trajectory Task Variables

	Total trials	Total Correct	Total Errors	Completed Categories	Sum Failure to Maintain Set
Stroop Effect Response-Time	.11	.03	.09	-.05	-.04
Stroop Effect Accuracy	-.18	-.02	-.17	.18	-.09
Conflict Adaptation Response-Time	.08	-.17	.19	-.19	-.11
Conflict Adaptation Accuracy	-.09	.06	-.14	.15	-.08
M	105.23	74.7	30.53	5.21	1.17
SD	19.69	13.01	19.45	1.46	1.34

Note. N=142. **p*<.01

Table 4

Summary of Intercorrelations, Means, Standard Deviations and Alpha Coefficients for Self Report Self-Regulation Measures

Variable	1	2	3	4	5	6	7	8	9
1.Grit	-	.70*	.41*	-.44*	.71*	-.08	-.07	.32*	-.27*
2. Brief Self Control		-	.49*	-.61*	.61*	-.22*	-.23*	.3*	-.35*
3. Premeditation			-	-.27*	.48*	-.36*	-.01	.18	-.05
4. Urgency				-	-.31*	.09	.43*	-.11	.25*
5. Perseverance					-	-.01	.01	.26*	- .19
6. Sensation Seeking						-	-.09	.1	-.09
7. Ruminate							-	.01	.21
8. Good Habits								-	-.14
9. Bad Habits									-
M	3.21	3.05	3.41	2.43	3.33	3.18	2.03	4.57	4.11
SD	.57	.76	.83	.88	.74	1.06	.58	.69	.80
Alpha	.79	.87	.92	.92	.85	.93	.81	.84	.85

Note. N=142. For all scales, higher scores are indicative of more extreme responding in the direction of the construct assessed. Grit= The Grit Scale; Brief Self Control= The Brief Self-Control Scale; Premeditation= Premeditation subscale of larger UPPS Impulsivity scale; Urgency= Urgency subscale of larger UPPS Impulsivity scale; Perseverance= Perseverance subscale of larger UPPS Impulsivity Scale; Sensation Seeking= Sensation Seeking subscale of larger UPPS Impulsivity Scale; Ruminate= Rumination Response Scale; Good Habits= Good Habits subscale of larger Habits Scale; Bad Habits= Bad Habits subscale of larger Habits Scale.
**p*<.01

Table 5

Correlations Between Self Report Self-Regulation Measures and Session 2 Stroop-trajectory Task Variables

	Grit	Brief Self Control	Premeditation	Urgency	Perseverance	Sensation Seeking	Ruminate	HabitG	HabitB
Stroop Effect RT	.11	.08	-.04	-.1	.07	.02	-.09	.02	.04
Stroop Effect Cor	-.22*	-.18	-.12	.13	-.04	.2	.04	-.14	.01
Conflict Adaptation RT	.12	.07	.11	-.02	.06	-.22*	-.01	.1	-.02
Conflict Adaptation Cor	-.08	-.08	.05	.11	-.08	.14	-.05	.01	-.01

Note. N=142. Grit= The Grit Scale; Brief Self Control= The Brief Self-Control Scale; Premedication= Premeditation subscale of larger UPPS Impulsivity scale; Urgency= Urgency subscale of larger UPPS Impulsivity scale; Perseverance= Perseverance subscale of larger UPPS Impulsivity Scale; Sensation Seeking= Sensation Seeking subscale of larger UPPS Impulsivity Scale; Ruminate= Rumination Response Scale; HabitG= Good Habits subscale of larger Habits Scale; HabitB= Bad Habits subscale of larger Habits Scale; RT= response-time scores; Cor= accuracy scores.
*p<.01

Figure Captions

Figure 1. Illustration of an upward-pointing Stroop-trajectory array, in which the participant indicates the location of the smaller gray triangle among congruently (top right) or incongruently (bottom right) oriented larger black triangles.

Figure 2. Session 1 and Session 2 conflict-adaptation effects on accuracy (top) and response time (bottom), on the Stroop-trajectory task. Error bars represent ±1 standard error of the mean.

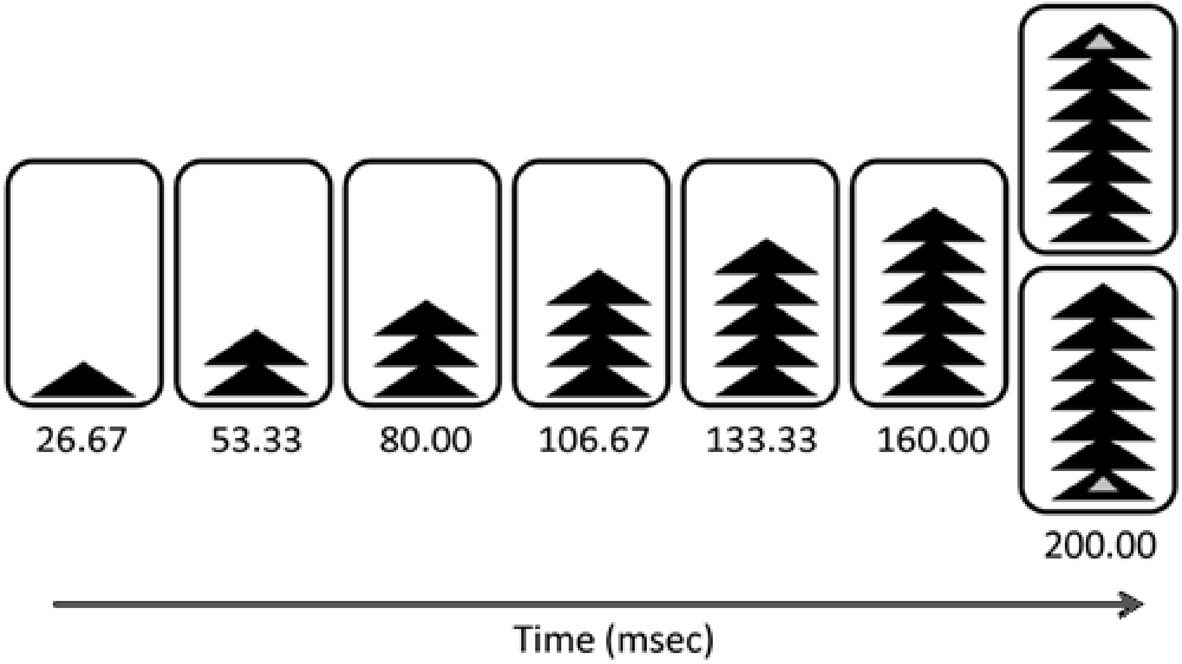

Figure 1. Illustration of an upward-pointing Stroop-trajectory array, in which the participant indicates the location of the smaller gray triangle among congruently (top right) or incongruently (bottom right) oriented larger black triangles.

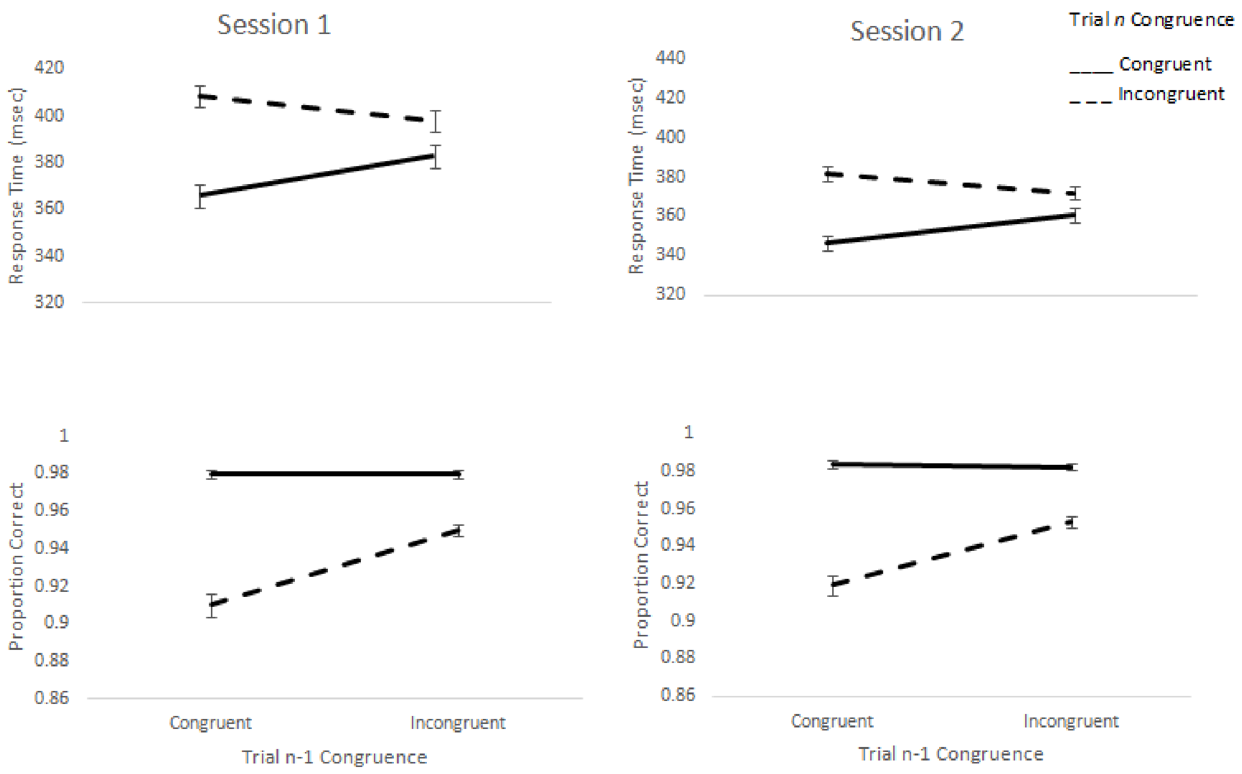

Figure 2. Session 1 and Session 2 conflict-adaptation effects on response time (top) and accuracy (bottom), on the Stroop-trajectory task. Error bars represent ±1 standard error of the mean.