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The Relationship Between Briefly Induced Affect and Cognitive Control Processes: An Event-Related Potential (ERP) Study

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ABSTRACT

The Relationship Between Briefly-Induced Affect and Cognitive Control Processes:
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Positive affect is generally associated with improvements in cognitive abilities; however, few studies have addressed positive affect and its relation to specific cognitive control processes. Previous research suggests positive affect conditions are more flexible/distractible states, suggesting cognitive control processes are perhaps decreased in context maintenance and increased in conflict detection/resolution. To measure the cognitive control processes, specific components of the scalp-recorded event-related potentials (ERPs) called the cue slow wave (context maintenance), the N450 (conflict detection), and conflict SP (conflict resolution) were acquired in response to an affective single-trial, cued-Stroop task. Participants were presented with pleasant, neutral, and unpleasant images prior to Stroop instruction (i.e., respond to "color" or "word") and response. Participants had greater accuracy during the pleasant condition when given a longer delay for extra time to process the high conflict task, $t(36) = 3.09$, $p = .004$, *95% CI* (0.07, 0.02) compared to the unpleasant condition. Additionally, the unpleasant condition resulted in greater context maintenance than pleasant (increased cue-related slow wave amplitude; $t(40) = 2.38$, $p = .02$). Unpleasant conditions were associated with greater conflict resolution processes (as measured by the conflict SP) with high conflict trials, $t(40) = 2.55$, $p = .015$; whereas pleasant did in congruent trials, $t(40) = 2.707$, $p = .010$. Findings suggest negative affective states increase participants' focus on the task in avoidance of the distracting unpleasant picture. Our findings lay the foundation for understanding the differences between state and trait affect on cognitive control processes.

Keywords: context maintenance, conflict detection/resolution, affective conditions, event-related potential

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The Relationship Between Briefly Induced Affect and Cognitive Control Processes: An Event-Related Potential (ERP) Study

Affective states are defined as momentary emotional responses to an experience (Cohen, Pressman, 2006). Positive affect specifically reflects the extent to which a person feels enthusiastic, active, and alert (Watson, Clark, & Tellegen, 1985). Negative affect reflects general distress and unpleasant experiences characterized by aversive mood states (e.g., anger, contempt, disgust, fear, and nervousness; Watson, Clark, & Tellegen, 1985). Multiple studies indicate that positive affect is associated with improvements in cognitive abilities. Specific positive affect-related improvements in cognition are seen in creative problem-solving (Isen, Daubman, & Nowicki, 1987), verbal fluency (Phillips, Bull, Adams, & Fraser, 2002), flexibility in problem solving (Green & Noice, 1988), the incorporation of information for strategic decision-making (Estrada, Isen, & Young, 1997), and executing analytic decision-making strategies (Isen & Means, 1983). Few studies, however, have specifically addressed the relationship between cognitive control and positive affect (Dreisbach, 2006; Dreisbach & Goschke, 2004; Isen, 2009; Phillips, Bull, Adams, & Fraser, 2002; Wenzel, 2013). Findings from the studies to date concerning the relationship between cognitive control processes and positive affect are inconsistent with no observed pattern between enhancing or decreasing cognitive control abilities. One aim of the current study was to address the relationship between brief changes in affective state, including positive affect, in cognitive control processes.

Cognitive Control

Cognitive control refers to the ability to direct thoughts and actions to complete goal-directed behaviors (Miller & Cohen, 2001). Successful goal-directed behavior requires the suppression of inappropriate thoughts or actions while maintaining the use of task-related goal information (i.e., maintenance and utilization of task context) and flexibly switching between task requirements (Botvinick, Carter, Braver, Barch, & Cohen, 2001; Reimer, Radvansky, Lorsbach, Armendarez, 2015). Cognitive control is generally thought to include at least two component processes, regulative and evaluative, that work together for optimal implementation of goals and behavior (Botvinick, Carter, Braver, Barch, & Cohen, 2001).

Regulative processes. The regulative component of cognitive control implements top-down support for task-relevant processes and preparing to execute cognitive tasks to override automatic response tendencies (Cohen, Barch, Carter, & Servan-Schreiber, 1999). An example of increased regulative control can be seen within the Stroop task (Stroop, 1935), which is one of the most cited and replicated studies in experimental psychology (MacLeod, 1991). The Stroop task requires participants to selectively attend to one stimulus attribute of a color-word (e.g., the word RED written in green ink wherein the participant reads the word or names the color in which a color-word is written). The word-reading task is a more practiced (i.e., more prepotent) response relative to naming the color of the word since our culture is much more practiced and adept at reading than naming colors (Stroop, 1935). In other words, the more readily-available response is to attend specifically to the meaning of the word rather than the surface characteristics (i.e., color; MacLeod, 1991). Alternatively, the color-naming task is more attentionally-demanding because the response is not as automatic as the word-reading task; thus, longer color-naming reaction times and increased error rates on the Stroop color-naming condition (MacLeod, 1991). The color-naming task requires increased regulative control to inhibit the tendency to read the word and accurately name the color of the word. Spatially, regulative control has been observed in the dorsolateral prefrontal cortex (DLPFC) on tasks such as the Stroop (Braver, 2012; De Pisapia & Braver, 2006; Kim, Kroger, & Kim, 2011; MacDonald, Cohen, Stenger, & Carter, 2000).

An important aspect of the regulative control component process is context maintenance. Context maintenance refers to the ability to keep in mind task context, instructions, and cues to facilitate successful task completion (Cohen, Carter, & Servan-Schreiber, 1999). One way of measuring context maintenance is through the cued-Stroop task (Cohen, Barch, Carter, & Servan-Schreiber, 1999). The cued-Stroop task is a unique single-trial version of the Stroop task where a color-naming or word-reading instruction is presented prior to the Stroop color-word. The participant is required to maintain the context of the task instruction (i.e., is it a color-naming or word-reading trial) and prepare to accurately respond over a delay (the cued-Stroop task is described in greater detail below; Cohen, Barch, Carter, & Servan-Schreiber, 1999). Accurate context maintenance involves an increase in allocation of attention toward the color rather than the word of the Stroop color-word stimulus in order to follow the directions of the task on color-naming trials, biasing the selection of the appropriate behavioral response (Cohen, Barch, Carter, & Servan-Schreeiber, 1999; Cohen & Servan-Schreiber, 1992). Through increased context maintenance and implementation of control necessary for the color-naming than that of the word-reading task, the participant manages to successfully complete the task despite the competition of an automatic, if task-irrelevant, option to read the word (Dubin, Maia, Peterson, Koob, le Moal, & Thompson, 2010).

Evaluative processes. Evaluative control is the second component of cognitive control that specifically involves conflict detection and monitoring performance. Conflict refers to the simultaneous activation of competing stimuli or responses (Botvinick et al., 2001, 2004). Evaluative control processes are sensitive to conflict and are thought to signal for adjustments of top-down control used to adapt to the constantly changing task demands (Kerns, Cohen, MacDonald, Cho, Stenger, & Carter, 2004). An example of conflict is found in the incongruent stimuli of a Stroop task (e.g., the word RED written in green font) with both color-naming and word-responses present simultaneously. High conflict trials result in poorer performance (e.g., worse accuracy and longer response times) because of the inclination to respond in more than one way (Cohen, Dunbar, & McClelland, 1990). Evaluative control is needed to detect conflict and then signal for compensatory strategies to maintain the task demands for better performance.

The evaluative control component of conflict detection is thought to be reflected in the activity of the anterior cingulate cortex (ACC; Egner, 2011; Kim, Kroger, Kim, 2011; MacDonald, Cohen, Stenger, & Carter, 2000). The ACC is suggested to signal the presence of conflict and the need for compensatory adjustments in control to overcome the conflict and accurately respond to the task (De Pisapia & Braver, 2006; Botvinick, Cohen, & Carter, 2004; Braver, 2013; MacDonald, Cohen, Stenger, & Carter, 2000). Specifically, ACC activation is greater during conflict such as incongruent versus congruent trials in the Stroop task as well as during the color-naming task relative to the word-reading task (Botvinick, Cohen, & Carter, 2004; MacDonald, Cohen, Stenger, & Carter, 2000; Taylor, Densmore, Neufeld, Rajakumar, Williamson, & Theberge, 2015).

Dissociation of Cognitive Control Processes

A modified single-trial version of the Stroop paradigm (i.e., the cued-Stroop task mentioned above) was created to dissociate the regulative and evaluative component processes of cognitive control (Cohen, Barch, Carter, & Servan-Schreiber, 1999). Specifically, within this cued-Stroop task participants are given an instruction before each trial to either read the word (more automatic) or name the color (less automatic). After a delay (500 milliseconds [ms] or

1500 ms), the Stroop color-word stimulus is presented. The cued-Stroop task temporally dissociates the instruction-related regulative processes (the context/goal of the task in the color-naming or word-reading trials) from the stimulus-related evaluative processes (detection of conflict on incongruent trials) through the delay between the instruction cue and the Stroop color-word stimulus (MacDonald, Cohen, Stenger, & Carter, 2000). The participant must keep in mind the context of the task over the delay while preparing their response. The color-word interference in the color-naming task requires more preparation for the more difficult stimulus. Increased top-down control is needed to maintain task instructions with the competing responses, therefore requiring increased context maintenance (Cohen, Barch, Carter, & Servan-Schreiber, 1999).

Using the cued-Stroop paradigm, MacDonald and colleagues (2000) found a double dissociation of the evaluative and regulative cognitive control process in the DLPFC and ACC brain regions. Specifically, they found that the left DLPFC was more active following instructions to perform the color-naming task relative to the word-reading task, consistent with the observed role the DLPFC has in preparing to execute the more demanding color-naming task. In contrast, ACC activity was increased upon presentation of the incongruent color-word stimuli compared to the congruent trials. The ACC activity is consistent with the control process of detecting response conflict (as there is increased conflict on incongruent relative to congruent trials). The complementary roles of the two brain regions create a feedback loop from the DLPFC to ACC, which maintains optimal performance in cognitive control (MacDonald, Cohen, Stenger, & Carter, 2000). Specifically, the ACC detects conflict and evaluates when control is needed more strongly whereas the DLPFC provides the support and implements additional cognitive resources (Kim, Kroger, Kim, 2011; MacDonald, Cohen, Stenger, & Carter, 2000).

A disproportionate increase in evaluative control processes compared to regulative control processes may be associated with increased distractibility, as seen with elicited positive affect before engaging in a task (Dreisbach, 2006; Dreisbach & Goschke, 2004; Marien, Aarts, & Custers, 2012). Too much evaluative control is associated with a decreased ability to protect task goals from interfering stimuli (i.e., participants are over-evaluating multiple aspects of the task), leading to distractibility and impulsivity in responses (Dreisbach, 2006; Dreisbach & Goschke, 2004). Given these findings in previous tasks emphasizing induced positive affect, we hypothesized that positive affect may increase distractibility (reduced activation of the regulative processes) and could play a significant role in altering the balance between regulative and evaluative cognitive control processes.

Event-Related Potentials

One means of measuring the neural activity associated with cognitive control processes is through event-related potentials (ERPs). ERPs reflect neural responses associated with specific sensory, cognitive, and motor events (Luck, 2005). Neurons communicate through electrical impulses that can be picked up through electrodes placed on the scalp. The electrical activity of active neurons is recorded at the level of the scalp through an electroencephalogram (EEG). EEG provides an overall assessment of electrical activity in the brain, whereas ERPs are the averaged electrical activity collected from EEG that is time-locked to the presentation of stimuli or responses. ERP waveforms are created for each unique stimulus type (e.g., in the cued-Stroop task there are separate ERPs time-locked to the instruction cue and the Stroop stimulus) and electrode locations on the scalp.

ERPs reflect individual cognitive processes beyond what can be gathered through behavioral (i.e., response time and error rate) data alone. Specifically, ERPs provide a measure of the brain's processing between a stimulus and a response which makes it possible to determine what stage/s of processing are affected by experimental manipulations. An example with the cued-Stroop paradigm would be when subjects have slower responses with incompatible color-word combinations. Behavioral data may only provide vague possibilities of the underlying cognitive processes based off of error rates and response times, whereas ERPs can show whether these slow responses are indicative of slowing perceptual processes or disproportionate changes in regulative or evaluative cognitive control processes (Luck, 2005).

The activity of neurons associated with the generation of ERPs is primarily due to post-synaptic potentials. Post-synaptic potentials are the voltages that are elicited when neurotransmitters bind to receptors on the membrane of the postsynaptic cell, therefore causing ion channels to open or close leading to a graded change in the potential across the cell membrane (Luck, 2005). Postsynaptic potentials occur largely in the apical dendrites and cell body and occur immediately following neurotransmitters being released from the presynaptic terminals. The postsynaptic potentials summate, making it possible to record them at a greater distance (i.e., the scalp) differing from the action potentials which are harder to see in reflections of electrical activity. The surface electrodes cannot detect the action potentials due to their timing with the inflow and outflow of the axons, but do reflect post-synaptic electrical activity of neurons (Luck, 2005).

EEG specifically measures large groups of synchronously active apical dendrites that form dipoles. If an excitatory neurotransmitter is released at the apical dendrites of a cortical pyramid cell, current flows from the extracellular space into the cell. The current flow results in a net negativity outside of the cell, in the apical dendrites. To complete the circuit, current will also flow out of the cell body and basal dendrites, yielding positive at the cell body to create a dipole. A dipole is a pair of positive and negative electrical charges separated by a small distance. The dipole produced from a single neuron is too small to record from a distant electrode. However, under certain conditions many neuron dipoles will sum making it possible to measure the voltage at the scalp if they occur at approximately the same time. Since the brain is highly conductive, ERPs spread out as they travel through the brain. An ERP generated in one area of the brain may lead to large voltages reflected at another location due to the conducting nature of the sodium-saturated neural tissue and fluid; therefore, ERPs cannot confidently represent the cognitive processes spatially (i.e., EEG/ERPs have poor spatial localization). Rather the reflections provided by the voltages have excellent temporal resolution and allow researchers to test hypotheses with millisecond accuracy. Through ERPs we are able to temporally dissociate the regulative and evaluative processes of cognitive control (Luck, 2005).

ERP waveforms are characterized by peaks and troughs that usually are described by polarity (positive or negative) and latency (duration in time of the peak or trough), such as the N450 component of the ERP. The component is labelled the N450 with the “N” for “negative” polarity, and the “450” for the amount of milliseconds at which the wave peaks (approximately 450 ms from the time of Stroop stimulus presentation; Luck, 2005). Three specific components used in this study were the cue-related slow wave, the N450, and the conflict SP. Each of these ERPs are described below.

ERPs and Cognitive Control

ERPs were used to temporally dissociate the neural underpinnings of regulative and evaluative cognitive control processes with regard to the timing and level of processing. Given previous research noted above regarding the dissociation of cognitive control processes, the single-trial cued Stroop task with recorded ERPs can be used to differentiate the cognitive processes between regulative and evaluative cognitive control components (Perlstein, Larson, Dotson, & Kelly, 2006).

Electrophysiological Correlates of Regulative Processes

Regulative cognitive control component processes have been examined using ERPs. For example, Curtin and Fairchild (2003) demonstrated the increased allocation of attentional resources under more challenging task conditions and the maintenance of task representations through ERP slow-wave activity. Specifically, the cue-related slow wave is a component of the ERP thought to be associated with context maintenance (West, 2003). The cued-Stroop paradigm demonstrates context maintenance while preparing for the color-naming task. The color-naming task is more demanding than the word-reading component of the test due to the instinct to read the word rather than the name of the color of the ink. The cue-related slow-wave exhibits negativity over the occipital-parietal regions and positivity over the frontal-central region (West, 2003) and is more negative for color-naming relative to word-reading instruction cues (Perlstein et al., 2006). The cue-related slow wave reflects implementation of control processes by showing increased activity when greater control is needed, such as following incorrect trials of the cued Stroop task (West, 2003). Thus, a more positive cue-related slow wave reflects increased context-maintenance type processes relative to a lower amplitude in the cue-related slow wave. In the current task, disruption in context maintenance would be reflected in a lower amplitude (i.e., less positive amplitude) cue-related slow wave.

Electrophysiological Correlates of Evaluative Processes

Evaluative components of cognitive control associated with conflict detection and conflict resolution are the N450 and the conflict SP. The N450 component of the ERP reflects the increased electrical activity associated with the presentation of conflict-laden stimuli (e.g., the word red written in green font) relative to non-conflict stimuli (e.g., the word red written in red font; West, 2003). The N450 peaks at approximately 450 ms following stimulus presentation and is seen at frontocentral electrode locations (Appelbaum, 2014; Larson, Clayson, Clawson, 2014; Larson, Kaufman, & Perlstein, 2009; Liotti, Woldorff, Perez, & Mayberg, 2000; West & Alain, 2000a). Conflict is greatest when incongruent trials are rare compared to frequent incongruent trials. The N450 generally shows increased congruency effects when incongruent trials are rarely presented rather than frequently presented because participants have not implemented sufficient control for the unexpected response conflict in the incongruent stimulus (Lansbergen et al., 2007; West & Alain, 2000). The N450 is consistent with the role of the ACC as identified with hemodynamic-based neuroimaging as being involved in conflict monitoring (Liotti, Woldoroff, Perez, & Mayberg, 2000; West & Alain, 2000a). Decreased-amplitude N450 (i.e, less negative N450) to the Stroop stimulus would indicate decreased conflict detection in the current paradigm.

The conflict slow-potential (conflict SP; also known as the conflict slow wave) follows the N450 and reflects the signaling for increased implementation of regulative control to resolve response conflict and select the appropriate response from task instruction (Larson, Clayson, Clawson, 2014; Larson et al., 2009; West & Alain, 1999, 2000). The conflict SP begins at about 500 ms after the stimulus and is thought to be activated when the ACC signals for increased recruitment of cognitive resources to improve performance on the next trial. This activity is observed over the lateral frontal and posterior cortices (Hanslmayr et al., 2008; West, 2003). The amplitude of the conflict SP is more positive for incongruent trials than congruent, and appears to reflect a signal for increased recruitment of cognitive resources and adjustments to correctly complete the task (Larson et al., 2009b; West and Alain, 1999, 2000). Greater amplitudes of the conflict SP amplitude during incongruent trials has been associated with increased response times and accuracy (West et al., 2005), which supports the idea that conflict SP reflects conflict resolution or perhaps response selection. Thus, attenuated conflict SP amplitude (i.e., less negative) would be indicative of poor signaling for the resolution of conflict.

Dissociation of Cognitive Control Component Processes using ERPs

Using a variation of the modified Stroop task (cued-Stroop) as described above (MacDonald et al., 2000), West (2003) suggests it is possible to temporally dissociate between the regulative and evaluative component processes through the use of ERPs. Following the task instruction, regulative processes are implemented and observed by a slow wave that differentiates the correct (compatible with task instruction) and incorrect (not compatible with task instruction) responses. Implementation of control is also associated with the slow wave that differentiates color-naming trials as being more attentionally-demanding than the more automatic word-reading response (West, 2003). Conflict detection is associated with the N450, showing greater amplitude for the incongruent versus congruent trials. The signaling for increased attentional resources for future incongruent trials is associated with the conflict SP (West, 2003). West's findings suggest that the regulative and evaluative component processes of cognitive control can be temporally dissociated using ERPs.

Brief changes in affective states between each trial of the cued-Stroop task may alter regulative and evaluative component processes. One way to induce brief changes in affective state is through the presentation of affective pictures. The International Affective Picture System (IAPS) was developed for the purposes of studying emotion and attention and is used worldwide. The pictures reliably evoke brief positive, neutral, and negative emotional states (Lang, Bradley, & Cuthbert, 1995). The pictures may depict a pleasant landscape or puppies to induce a positive response, as opposed to an accident, mutilation, or loss to arouse a negative response. The IAPS has been used to provide insight into aspects of emotion such as differences in heart rate, skin conductance, and facial electromyographic activity (Bradley & Lang, 2000; Lang, Bradley, & Cuthbert, 1998). We used the IAPS pictures and the cued-Stroop task to study the effects of brief changes in emotional state, and specifically positive affect, on the regulative and evaluative components of cognitive control.

Previous research indicates that positive affect elicits greater amplitudes in other types of ERP waves that reflect the evaluative components of control. For example, the error-related negativity (ERN) and N2 amplitudes associated with incorrect responses and response inhibition are increased in response to induced positive affect (Larson, Perlstein, Stigge-Kaufman, Kelly, & Dotson, 2006; van Wouve, Band, & Ridderinkhof, 2011). Alternatively, Phillips and colleagues (2002) suggest that positive affect results in slower performance in a switching condition of the Stroop task. Larson and colleagues (2013) did not find any difference between short-term induced positive and negative affective states and ERN amplitude. To date, research is scarce in regard to neurological measurements of the cognitive control processes with regard to positive affect. To address the gap in the literature, attempted to dissociate the processes of context maintenance and conflict-related processing with the cued-Stroop task through ERPs to determine how positive affect presented between the instructional cue and Stroop stimulus alters the regulative or evaluative processes.

Affect and Cognitive Control

With regard to the cognitive control components of context maintenance and conflict detection, studies suggest that positive affect biases attention toward novel information. The resulting heightened levels of conflict monitoring/detection may enable better flexibility in response to stimuli, or create an imbalance where the individual is unable to efficiently perform task demands by becoming distracted (Dreisbach, 2006; Dreisbach & Goschke, 2004). The increased conflict monitoring/detection could be helpful by appropriately disengaging attention towards new, relevant stimuli. Increased conflict monitoring/detection could also be a distraction that causes increased error rates and longer response times to the task. A Stroop-like cognitive set-switching paradigm (the cued-Stroop task) distinguishes between the cognitive control component processes in a task while incorporating affective states to see their impact. Positive affect biases the participants toward novel information, which could be harmful or helpful depending on the task demands (Dreisbach, 2006; Dreisbach & Goschke, 2004). When the task requires increased stability in responses, positive affect impairs performance by eliciting increased distractibility toward irrelevant information (Dreisbach, 2006; Dreisbach & Goschke, 2004; Wenzel, 2013). When the task requires increased flexibility, positive affect improves performance. What may be seen as distracting may facilitate flexible thinking and problem solving (Ashby, Isen, & Turken, 1999; Fredrickson, 2001; Isen, 2009; Phillips, Bull, Adams, & Fraser, 2002; Wenzel, 2013). The finding of positive affect enhancing performance suggests that being more aware of potential conflict keeps the individual ready to respond more quickly to the competing tendencies, recruiting more control to maintain task demands. Currently, the few research findings on the topic do not indicate a clear association with affect and the regulative and evaluative processes of cognitive control on performance.

Specific Aims and Predictions

The aim of the study was to understand the specific role positive affect plays on the different cognitive control processes. Conflict detection, signaling for increased attentional resources, and implementing control to override prepotent responses following induced affective states were evaluated. Although previous research did not evaluate high negative affect trait levels (such as anxiety and depression) in relation to a similar task (Dreisbach 2006; Dreisbach & Goschke, 2004), we included measures of anxiety and depressive symptoms to assess their potential interference. Anxiety (often characterized by high arousal) and depression (often characterized by low arousal) are considered high negative affect-trait which may differentially influence how people behave (Ellsworth & Scherer, 2003). In addition, using ERPs expanded on previous findings by allowing us to see the specific neural aspects of cognitive control that are being affected by emotional pictures giving us increased specificity beyond what the behavioral (i.e., reaction times, error rates) studies alone could provide.

This study examined the effects of brief affective states using the IAPS picture set and the cued-Stroop task. Previous findings suggest that positive affective stimuli would appear to enhance conflict detection and impair context maintenance. Authors suggest the effect on cognitive control results in increased distractibility, while others found improved performance perhaps by flexible thinking (Ashby, Isen, & Turken, 1999; Dreisbach, 2006; Dreisbach & Goschke, 2004; Fredrickson, 2001; Isen, 2009; Phillips, Bull, Adams, & Fraser, 2002; Wenzel, 2013). Thus, we examined the relationship between affective stimuli and modulations of the ERPs associated with maintaining task context (cue slow wave) and conflict processing (N450 and conflict SP). The goal was to address the conflicting findings in the literature as to whether positive affect is beneficial or detrimental on cognitive control. We hypothesized that: (1)

participants would have worse behavioral performance during a long delay condition of 1500 milliseconds (versus short delay at 500 milliseconds) where they will have to maintain task context longer as well as when presented with a positive picture as opposed to a negative or neutral picture. Additionally, positive affect conditions would result in (2) lower amplitudes for the cue-related slow wave component (reduced context maintenance processes) in the color-naming condition of the Stroop (requires greater control than the word reading) and (3) that the induced positive affect conditions would result in increased negative ERP amplitude with the N450 and conflict SP wave components (increased conflict detection/resolution processes) compared to the neutral and negative affect conditions. That is, interference effects from valence-controlled picture stimuli will be more distracting in the positive affect condition relative to the other conditions, disrupting context maintenance.

Method

Participants

All study procedures were approved by the Brigham Young University Institutional Review Board and participants provided written informed consent. See Table 1 for a summary of participant demographic information ("Appendix A: Demographics" for data output). The current project is an archival analysis of previously-collected data. A total of 36 healthy, right-handed, undergraduates were recruited via the Brigham Young University SONA undergraduate research participation system in exchange for course credit. Participants included 12 (33.33%) males and 24 (66.67%) females, with ages ranging from 18 to 25 years (*M* = 20.14, *SD* = 1.99). Participants' education ranged from 12 years to 17 years (*M* = 13.57; *SD* = 1.44).

To assess negative affective traits in the psychiatrically healthy participants, the Beck Depression Inventory- 2nd Edition (BDI-II; Beck, Steer, & Brown, 1996) and State-Trait Anxiety

Inventory (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) were administered to evaluate the range of affective functioning. For the BDI-II, participants' scores ranged from 0 to 35 (M = 5.53, SD = 6.13), with the mean score falling in the healthy range (specific ranges and classifications described below). The STAI state scores ranged from 20 to 55 (M = 30.97, SD = 8.07), and STAI trait scores ranged from 22 to 65 (M = 38.31, SD = 11.00), with the mean average score falling below the cut off for anxiety in each scale (described further below; Speilberger, Gorsuch, & Lushene, 1983). Despite most participants maintaining healthy scores of depressive and anxiety symptoms, a few participants are outside of the healthy range.[1] Exclusion criteria included previous or current psychiatric diagnosis, use of psychiatric medication, history of substance abuse or dependence, acquired brain dysfunction (e.g., traumatic brain injury or stroke), neurological disorders, or uncorrected visual impairment.

Table 1

Demographics

	Mean	*SD*	Minimum	Maximum
Age	20.14	1.99	18	25
Education	13.57	1.44	12	17
BDI II	5.53	6.13	0	35
STAI- State	30.97	8.07	20	55
STAI- Trait	38.51	11.00	22	65

Measures

Depressive symptoms. A common, validated instrument for measuring depressive symptoms is the Beck Depression Inventory, 2nd Edition (BDI-II; Beck, Steer, & Brown, 1996). Beck and his colleagues revised the BDI to a 21-item version (BDI-II). Each item includes four statements indicating increased severity of a symptom of depression, according to the DSM-IV criteria. The self-report requires participants to respond to each item on a 4-point scale, ranging from 0 to 3. A total score of 0 to 13 is indicative of a minimal range of symptoms, 14 to 19 as mild, 20 to 28 as moderate, and 29 to 63 as severe depressive symptoms. Therefore, a higher total score suggests more severe symptoms (Beck, Steer, & Brown, 1996). The BDI-II has excellent internal consistency (α = .92 for clinical, α = .93 for nonclinical) and test-retest reliability (α = .93; Beck, Steer, & Brown, 1996).

Anxiety symptoms. The State-Trait Anxiety Inventory (STAI) is a 40-item questionnaire that consists of two 20-item subscales: one of which measuring state anxiety (rate their anxiety "in the moment"), and the other, trait anxiety (rate their anxiety "in general"; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). Both subscales are on a 4-point scale. The state anxiety scores range from 1 ("not at all") to 4 ("very much so"), while the trait anxiety ranges from 1 ("almost never") to 4 ("almost always"). Higher scores indicate higher levels of anxiety. A cut-off score of 40 (range from 20 to 80 in each subtest) has been suggested as clinically significant symptoms of anxiety in either scale (Spielberger, Gorsuch, & Lushene, 1983). Internal consistency coefficients are high (α = .89 to .92) as well as the test-retest reliability (α = .73 to .86; Speilberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983).

Affective states. Picture numbers from the IAPS picture system that we used in the current study are included in Table 2. The International Affective Picture System (IAPS) is a commonly used measure consisting of a standardized set of pictures to evaluate affective/emotional states and attention (Bradley & Lang, 2007; Lang, Bradley, & Cuthbert, 1998; see "Appendix A: Normative IAPS Data" for data output). 100 pictures from the IAPS were used to present at the beginning each trial of the task. Pictures were selected for each of the 3 categories of affective states: pleasant (e.g., a picture of a happy baby), neutral (e.g., a picture of a basket), and unpleasant (e.g., a picture of a burn victim; Lang, Bradley, & Cuthbert, 1998).

Valence and arousal ratings were assessed using the Self-Assessment Manikin (SAM; Bradley & Lang, 1994) by each participant to see if the selection of IAPS images were reliably representative of the desired affective state. Initial valence and arousal ratings from the IAPS (Lang, Bradley, & Cuthbert, 1998) were assessed through a one-way ANOVA demonstrating a main effect of valence, $F(2, 117) = 694.54$, $p < .001$. The Tukey post hoc test revealed that pleasant had higher valence ratings than neutral, $M = 2.57$, $SE = .12$, $p < .001$, *95% CI* (2.23, 2.87), and unpleasant, $M = 4.63$, $SE = 0.12$, $p < .001$, *95% CI* (4.33, 4.92). Additionally, neutral pictures demonstrated greater valence than unpleasant, $M = 2.05$, $SE = .12$, $p < .001$, *95% CI* (1.76, 2.35. Arousal ratings also differed between conditions, $F(2, 117) = 105.92$, $p < .001$. A Tukey post hoc test indicated that compared to neutral pictures, pleasant, $M = 2.34$, $SE = .20$, $p < .001$, and unpleasant, $M = 2.65$, $SE = 0.20$, $p < .001$, were significantly more arousing. No significant difference between the pleasant and unpleasant were observed, $M = -0.31$, $SE = 0.20$, $p = .27$, *95% CI* (-0.78, 0.16). Pictures were chosen in this study so that valence significantly differed between all conditions, whereas arousal remained similar between the pleasant and unpleasant conditions.

Table 2

IAPS Picture Numbers

UNPLEASANT	PLEASANT	NEUTRAL
1052	1440	2190
1120	1463	2200
1201	1540	2383
1300	1710	2575
1301	1722	5455
1302	1811	6150
1321	2040	7000
1930	2050	7002
1931	2057	7010
2120	2058	7020
2205	2070	7025
2700	2080	7030
2800	2092	7031
2900	2311	7034
3022	2340	7040
6230	2345	7050
6244	2530	7060
6250	2550	7090
6260	4533	7100
6350	4610	7110
6510	4641	7130
6550	5621	7140
6560	5623	7150
6830	5629	7170
6940	5830	7175
9000	7502	7190
9001	8030	7211
9041	8040	7217
9102	8080	7224
9140	8161	7234
9220	8180	7235
9280	8190	7500
9290	8210	7503
9470	8370	7510
9500	8400	7550
9560	8470	7560
9561	8496	7590
9570	8501	7705
9611	8510	7950
9921	8531	8010

Materials and Procedure

The participants performed a single-trial, affective version of the modified single-trial Stroop task (the cued-Stroop task) originally developed by Cohen et al. (1999). In this task, each trial started with the presentation of a fixation cross for 800 ms. Next, a pleasant, neutral, or unpleasant picture was presented from the International Affective Picture System (IAPS) for 500 ms to invoke an affective response before the demands of the cued-Stroop task. The IAPS is consistently associated with changes in positive, negative, and neutral emotional states (Lang, Bradley, & Cuthbert, 1998). Valence of the picture presented at the beginning of each trial was random. Next, a blank screen was presented for 100 ms, followed by the instructional cue (the word “color” or “word”) for 300 ms. Participants then viewed a fixation cross for either a short delay (500 ms) or long delay (1500 ms). Finally, the Stroop stimulus (congruent or incongruent color-word) was presented for 2000 ms; participants were instructed to respond to the Stroop stimulus as quickly and accurately as possible with a button press to one of three color-coded keys, as designated by the instructional cue. The task involved 156 short-delay trials and 156 long-delay trials, each picture stimulus was shown twice. Altogether the task consisted of 624 total trials, with more incongruent (62%) than congruent (38%) Stroop trials. The difference in congruency was to increase the level of conflict on incongruent trials (West & Alain, 1999). See Figure 1 for the flow of task sequence.

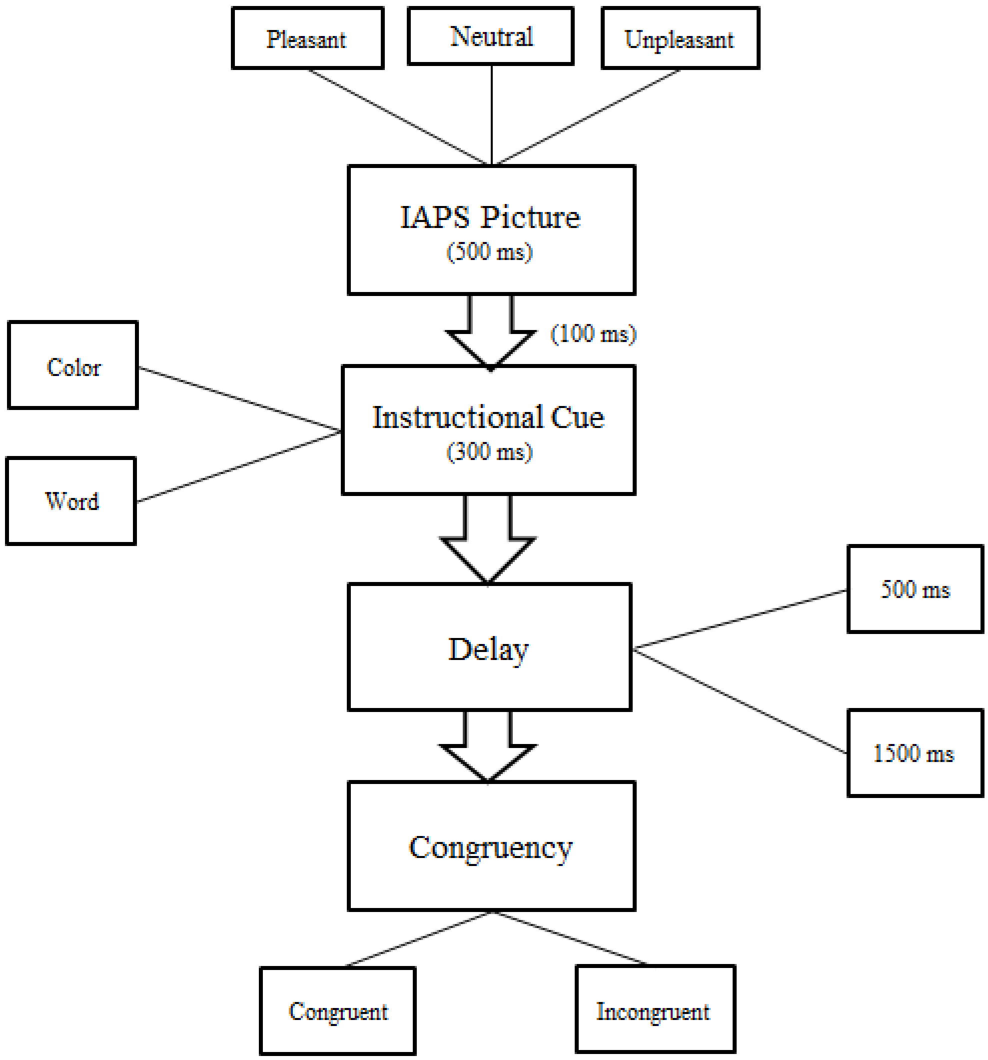

Figure 1. Schema of the single-trial Stroop task. After participants were presented with a an IAPS picture, an instructional cue ("Color" or "Word") appeared, followed by a delay (500 or 1500 seconds) before the Stroop stimulus (congruent or incongruent).

Following completion of the task, participants took approximately ten minutes to rate the valence and arousal of each picture. Ratings were conducted using the Self-Assessment Manikin (SAM) in which each participant indicated their perceptions of valence and arousal of each picture through depictions of a character exhibiting the associated response (Bradley & Lang, 1994). In the ratings for valence, participants were instructed to respond from a range of 1 (happy) to 9 (sad). Ratings for arousal ranged from 1 (calm) to 9 (excited). The SAM has become a widely used measurement of the dimensions of valence and arousal (Bradley & Lang, 1994) collecting over 3900 citations since its publication (through an electronic search of google scholar).

Affective Manipulation Check

A comparison between the normative and current data set with IAPS images are summarized in Table 3 to demonstrate how our sample differed from previous research (see “Appendix A: IAPS Current Data” for output). After completing the Stroop task, participants provided valence (how pleasant/unpleasant) and arousal (how attention-grabbing) ratings on a 9-point scale for each randomly presented IAPS image. Mean ± SD valence ratings were 6.89±.73 for pleasant, 4.74±.81 for neutral, and 2.37±.69 for unpleasant images. Valence ratings were significantly different between conditions, $F(2,108) = 340.05$, $p < .001$, in which post-hoc Tukey tests indicated pleasant pictures had higher valence ratings than neutral, $M = 2.15$, $SE = 0.17$, $p < .001$, *95% CI* (1.74, 2.56), and unpleasant images, $M = 4.52$, $SE = 0.17$, $p < .001$, *95% CI* (4.11, 4.93). Neutral images also had higher valence ratings than unpleasant images, $M = 2.37$, $SE = 0.17$, $p < .001$, *95% CI* (1.96, 2.78). Mean ± SD arousal ratings were 4.43±1.51 for pleasant, 2.19±1.04 for neutral, and 5.82±1.21 for unpleasant images. Arousal ratings were also significantly different between conditions, $F(2,108) = 76.80$, $p < .001$. Post-hoc Tukey tests indicated pleasant pictures to have greater arousal ratings than neutral pictures, $M = 2.24$, $SE = 0.30$, $p < .001$, *95% CI* (1.53, 2.94), but not as arousing as unpleasant pictures, $M = -1.39$, $SE = 0.30$, $p < .001$, *95% CI* (-2.09, -0.69). As expected, neutral pictures were also not as arousing in relation to unpleasant pictures, $M = -3.63$, $SE = 0.30$, $p < .001$, *95% CI* (-4.33, -2.93).

Table 3

Normative and current IAPS valence and arousal ratings

Image Type from IAPS	Normative IAPS Mean(*SD*) Valence	Normative IAPS Mean *(SD)* Arousal	Current Sample IAPS Mean *(SD)* Valence	Current Sample IAPS Mean *(SD)* Arousal
Pleasant	7.52(0.52)	5.44(0.85)	6.89(0.73)	4.43(1.51)
Neutral	4.95(4.95)	3.10(0.81)	4.74(0.81)	2.19(1.04)
Unpleasant	2.90(2.90)	5.75(1.00)	2.37(0.69)	5.82(1.21)

EEG Acquisition and Reduction

EEG Acquisition

Electroencephalogram was recorded from 128 scalp sites using a 128-channel geodesic sensor net and amplified at 20K using an Electrical Geodesics Incorporated (EGI) amplifier system (nominal bandpass .10-100Hz). The electrode placements allowed recording electrical activity in the regions associated with cognitive control, for example the fronto-central region (West, 2003). EEG was referenced to the vertex electrode and digitized constantly at 250 Hz with a 24-bit analog-to-digital converter. A posterior electrode served as common ground. As encouraged by the EEG system manufacturer (Electrical Geodesics Inc.), impedances were maintained below 50kΩ.

EEG Data Reduction

Eye-blinks were removed using independent components analysis (ICA) from the ERP PCA Toolkit (Dien, 2010). Individual ICA components were compared with two blink templates (one generated from the data and one from the ERP PCA Toolkit). If the ICA components correlated at .9 or higher, they were removed (Dien, Michelson, & Franklin, 2010). If channels exceeded the fast average amplitude of 100 microvolts (μV), or if the differential average amplitude exceeded 50 μV, that channel was defined as bad.

A region-of-interest (ROI) approach was used to look at each ERP component in which multiple electrodes were averaged together, to provide increased reliability estimates relative to only looking at single sensors (Baldwin, Larson, Clayson, 2015; Bertrand, Perrin, & Pernier, 1985; Larson, Baldwin, Good, & Fair, 2010; Larson, Clayson, & Clawson, 2014). See Figure 2 for electrode sites used in the current analyses. ERP averages from each subject were divided into four categories. The P300 activity is a positive-going peak extracted from the average of electrode sites 62, 67, 72, and 77. The segmentation for the P300 was measured at 100 ms before picture stimulus presentation (from the IAPS), and ends 600 ms after picture presentation. The mean peak amplitude was then calculated from 150ms to 225 ms after picture presentation. The cue-related slow wave data is a positive peak measurement from electrode 24. Prior research has suggested that the cue-related slow wave is strongly left-lateralized in the frontal region, therefore only electrode 24 became relevant to cue-related slow wave analyses (Perlstein, Larson, Dotson, & Kelly, 2005). The segment starts from 100 ms before the cue-related stimulus presentation to 800 ms following presentation. The mean amplitude was gathered within the window of 600 and 800 ms after the cue-related stimulus. The N450 was measured post-Stroop stimulus with the average amplitude across electrode sites 6, 7, 106, and 129. The segmentation for the N450 began 100 ms before Stroop stimulus presentation to 1000 ms after stimulus presentation, with the mean peak amplitude extracted from 375 ms to 425 ms after Stroop stimulus presentation. The conflict SP was averaged across electrode sites 62, 67, 72, and 77. The segmentation of the conflict SP was the same as the N450 (100 ms before stimulus presentation to 1000 ms after), but with the mean amplitude at 600 ms to 800 ms following stimulus presentation. In addition to the confound of error trials affecting response times, error-related activity also influenced the ERP latencies of interest. Therefore, error trials were excluded from the data (e.g., Egner & Hirsch, 2005; Larson, Kaufman, & Perlstein, 2009a, 2009b).

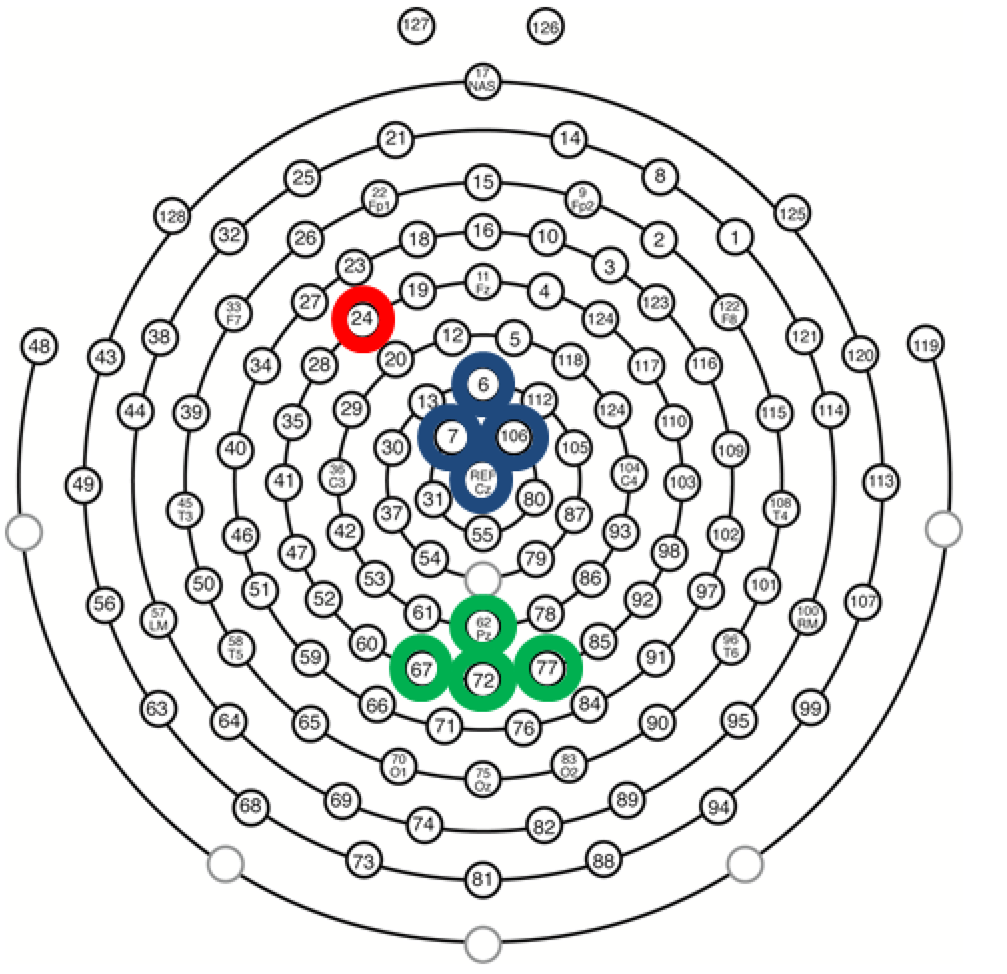

Figure 2. Sensor layout of 128-channel Geodesic sensor net

Note. P300 activity was quantified at electrode sites 62, 67, 72, and 77 (green); slow-wave activity at site 24 (red); N450 at sites 6, 7, 106, and 129 (blue); and conflict SP sites 62, 67, 72, and 77 (green). See "EEG Data Reduction" section in text for details.

Statistical Analyses

Power Analyses

To calculate the needed sample size, we conducted a one group, repeated measures, within factors power analysis in G*Power (v3.1) based on general suggested *F* effect sizes (Cohen, 1988; see Appendix B for each power estimate) as previous research has not directly addressed the current study aims. Correlations among repeated measures were set to a 0.5 and we pursued power of 0.80 with the conventional alpha = 0.05 (Cohen, 1988). Power estimates smaller than 0.80 would increase risk of Type II error, while a larger power value often exceeds researchers' means for data collection (Cohen, 1988). Since ERPs are our main interest, we calculated the number of measurements by our relevant manipulations (3 valence conditions and 2 congruency conditions), therefore leading to six measurements per participant. To reach 80% power, we needed at least 109 participants for small effects, 19 for medium, and 8 participants to detect large effects. Therefore, our sample of 35 participants was sufficient for measuring medium and large effects, but not for small effects.

Behavioral Data Analyses

We expected worse accuracy in the pleasant versus unpleasant conditions, color-naming condition relative to the word-reading condition, the long delay versus the short delay, and on incongruent trials versus congruent trials. These predictions were tested using a within-subjects, repeated-measures, analysis of variance (ANOVA) with 3-Valence x 2-Instructional Cue x 2-Delay. If a significant trend was identified, paired-samples *t*-tests were administered to unpack the nature of the trend.

Response times (RTs) were collected from the correct-trials only as errors are associated with faster and more impulsive responses, introducing a potential confound. With each trial type and participant, we calculated the median RT for correct responses and the proportion of errors. The median RT was used rather than the mean since it is less influenced by outliers that would disproportionately skew the value (Barnett & Lewis, 1978). Since it has previously been established that RTs are predictably longer in incongruent trials rather than congruent (MacLeod, 1991), we confirmed that pattern in our results with a separate *t* test before running the next analysis. We then proceeded with our analyses only including the incongruent trials. We ran a 3-Valence (pleasant, neutral, unpleasant) x 2-Cue x 2-Delay (short or long) repeated-measures ANOVA Follow-up *t*-tests to elucidate the specific differences between conditions. For all ANOVA analyses (both behavioral and ERP), *partial-eta*^{2} (η_p^2) is reported for ANOVA effect sizes and the Greenhouse-Geisser correction was applied when necessary for possible violations of sphericity.

ERP Data Analyses

Electroencephalogram waveforms were analyzed based on mean voltages from ROI electrode sites (as noted above) in instruction-related, stimulus-related, and response-related activity. Initial ERP analyses were focused on the P300 part of the waveform for the picture to assess participants' processing of valence conditions. A repeated-measures ANOVA was conducted for each valence condition. Post hoc *t*-tests were conducted to compare valence conditions in the P300.

Next, we tested the instruction-related activity of the task. We assessed whether context maintenance as evidenced by the cue-related slow wave of the task instruction (color vs word) was affected by valence conditions. Given our sample size, we chose to focus only on the left side electrodes, since this side of electrode sites has exclusively demonstrated significant differences for instruction-related activity (Perlstein, Larson, Dotson, & Kelly, 2006). A 2-Task (color vs word) x 3- Valence (Pleasant, Neutral, or Unpleasant) repeated measures ANOVA was conducted, in which we collapsed across delay and congruency types (as these components of the task have not yet occurred to influence the cue-related slow wave).

Assessment of stimulus-related activity followed in which conflict detection (N450) and conflict resolution (conflict SP) were evaluated. Consistent with previous research, we focused on congruency within the color-naming condition (Perlstein, Larson, Dotson, & Kelly, 2006). The N450 and conflict SP were evaluated according to a 3-Valence (pleasant, neutral, unpleasant) x 2-Congruency repeated measures ANOVA. Rather than including both cue instruction conditions, we focused only on the color-naming task. The reason we only focused on the color-naming task for this analysis is that our primary interests were in how responses differ in high conflict situations (i.e., the color-naming task; Perlstein, Larson, Dotson, & Kelly, 2006). To see the impact of particular valence types on conditions when significant, follow-up *t*-tests were applied which revealed the particular effects of each valence type.

Results

Behavioral Analyses

Accuracy analyses. Accuracy information is presented in Table 4. As expected, accuracy was poorer on the incongruent trials compared to the congruent trials, $t(36) = 9.94$, $p < .001$, *95% CI* (0.07, 0.11). To assess if participants have worse accuracy on the long delay compared to the short delay, a 3-Valence x 2-Cue x 2-Delay within subjects ANOVA was performed only on the incongruent trials. A main effect of cue emerged, in which the word-reading condition resulted in greater accuracy than the color-naming condition, $F(1,36) = 28.94$, $p < .001$, $\eta_p^2 = 0.45$, and a main effect of delay in which longer delay resulted in better accuracy than the short delay condition, $F(1,36) = 7.22$, $p = .01$, $\eta_p^2 = 0.17$. There was no main effect of valence, $F(2,72) = 2.63$, $p = .09$, $\eta_p^2 = 0.13$.

An interaction of valence, cue, and delay was also present, $F(2,72) = 4.75$, $p = .015$, $\eta_p^2 = 0.21$, in which follow up *t*-tests indicated the pleasant condition with the color-naming cue had increased accuracy in the long delay compared to the short delay, $t(36) = 3.09$, $p = .004$, *95% CI* (0.07, 0.02). The neutral condition demonstrated the same pattern, $t(36) = 2.22$, $p = .03$, *95% CI*(0.07, 0.003). There were no significant differences between the unpleasant color conditions and length of the delay, $t(36) = 0.79$, $p = .43$, *95% CI* (0.04, 0.02). No significant differences were observed between the word-reading cue types with pleasant, $t(36) = 0.33$, $p = .74$, *95% CI* (-0.015, 0.02), neutral, $t(36) = 0.52$, $p = .61$, *95% CI* (-0.03, 0.02), or unpleasant, $t(36) = 1.94$, $p = .06$, *95% CI* (-0.04, 0.001) conditions with delay. Overall, pleasant and neutral conditions with the color-naming task had increased accuracy in the long delay compared to the short delay, but no observed differences in the valence conditions and delay with the word-reading task.

Table 4

Mean accuracy rates for incongruent trials

Valence	Cue	Delay	Mean(*SD*) Accuracy	Minimum Value	Maximum Value
Pleasant	Color	Short	0.82(0.12)	0.50	0.97
		Long	0.86(0.11)	0.59	0.97
	Word	Short	0.91(0.05)	0.81	1.00
		Long	0.91(0.07)	0.75	1.00
Neutral	Color	Short	0.82(0.11)	0.53	1.00
		Long	0.86(0.11)	0.56	1.00
	Word	Short	0.90(0.09)	0.59	1.00
		Long	0.91(0.09)	0.66	1.00
Unpleasant	Color	Short	0.85(0.10)	0.63	1.00
		Long	0.86(0.11)	0.59	1.00
	Word	Short	0.90(0.07)	0.72	1.00
		Long	0.92(0.07)	0.69	1.00

Response time analyses. Response time information is presented in Table 5 (see "Appendix A: Behavioral Data" for output on accuracy rates and RTs). We focused on the correct trials for response time analyses as noted above. A paired samples *t* test indicated longer responses in the incongruent versus congruent trials, $t(36) = 17.27$, $p < .001$, *95% CI* (200.69, 158.50). Thus, we only used the incongruent trials in subsequent analyses. A 3-Valence (pleasant, neutral, unpleasant) x 2-Cue (color-naming vs. word-reading) x 2-Delay (500 ms vs. 1500 ms) repeated measures ANOVA revealed a main effect of cue, in which the color-naming condition had longer response times than the word-reading condition, $F(1,36) = 9.61$, $p = .004$, $\eta_p^2 = 0.21$. There were no main effects of valence, $F(2,72) = 0.36$, $p = .70$, $\eta_p^2 = 0.02$ or delay, $F(1,36) = 0.28$, $p = .60$, $\eta_p^2 = 0.01$. No significant interactions were observed between valence and cue, $F(2,72) = 0.67$, $p = .52$, $\eta_p^2 = 0.04$, valence and delay, $F(2,72) = 0.79$, $p = .46$, $\eta_p^2 = 0.04$, cue and delay, $F(1,36) = 0.13$, $p = .72$, $\eta_p^2 = 0.004$, or valence, cue, and delay, $F(2,72) = 0.93$, $p = .40$, $\eta_p^2 = 0.05$. Collectively, RT analyses indicated that incongruent trials (vs. congruent) as well as the color-naming task (vs. word-reading) resulted in longer RTs, with no significant differences in RTs between valence or delay conditions.

Table 5

Mean RTs for incongruent trials

Valence	Cue	Delay	Mean(*SD*) RT	Minimum Value	Maximum Value
Pleasant	Color	Short	945.16(171.08)	606.06	1308.91
		Long	938.07(177.23)	629.25	1249.84
	Word	Short	898.40(148.92)	592.44	1204.66
		Long	908.76(171.53)	580.13	1292.53
Neutral	Color	Short	940.17(166.38)	612.47	1397.97
		Long	941.63(188.51)	565.78	1332.25
	Word	Short	911.61(157.34)	604.38	1235.75
		Long	889.16(162.67)	582.31	1266.81
Unpleasant	Color	Short	944.80(186.67)	589.00	1324.50
		Long	933.78(169.81)	576.31	1192.47
	Word	Short	923.77(160.26)	607.63	1218.00
		Long	905.42(175.50)	516.06	1253.16

ERP Analyses

Picture-related activity. Mean amplitudes for the P300 are presented in Table 6, and the ERP component presented in Figure 3 ("Appendix A, ERP Data: P300" for output). To assess the participants' processing of valence conditions, we analyzed the P300 ERP component for pleasant, neutral, and unpleasant stimuli in which there was a significant main effect of picture valence, $F(2,80) = 17.75$, $p < .001$, $\eta_p^2 = 0.31$. Results suggest that the neutral condition had greater amplitude than pleasant, $t(40) = 4.96$, $p < .001$, *95% CI* (1.27, 0.53), and the unpleasant condition, $t(40) = 3.87$, $p < .001$, *95% CI* (0.23, 0.72); the conditions proposed to have greater valence. Additionally, unpleasant conditions had greater P300 amplitude than pleasant, $t(40) = 2.97$, $p = .05$, *95% CI* (0.72, 0.14).

Table 6

The P300 amplitude in microvolts (µV)

Valence Type	Mean(*SD*)	Minimum	Maximum
Pleasant (µV)	4.00(2.50)	-2.85	10.71
Neutral (µV)	4.90(2.47)	-2.34	10.39

Unpleasant (μV)	4.43(2.68)	-2.54	10.94

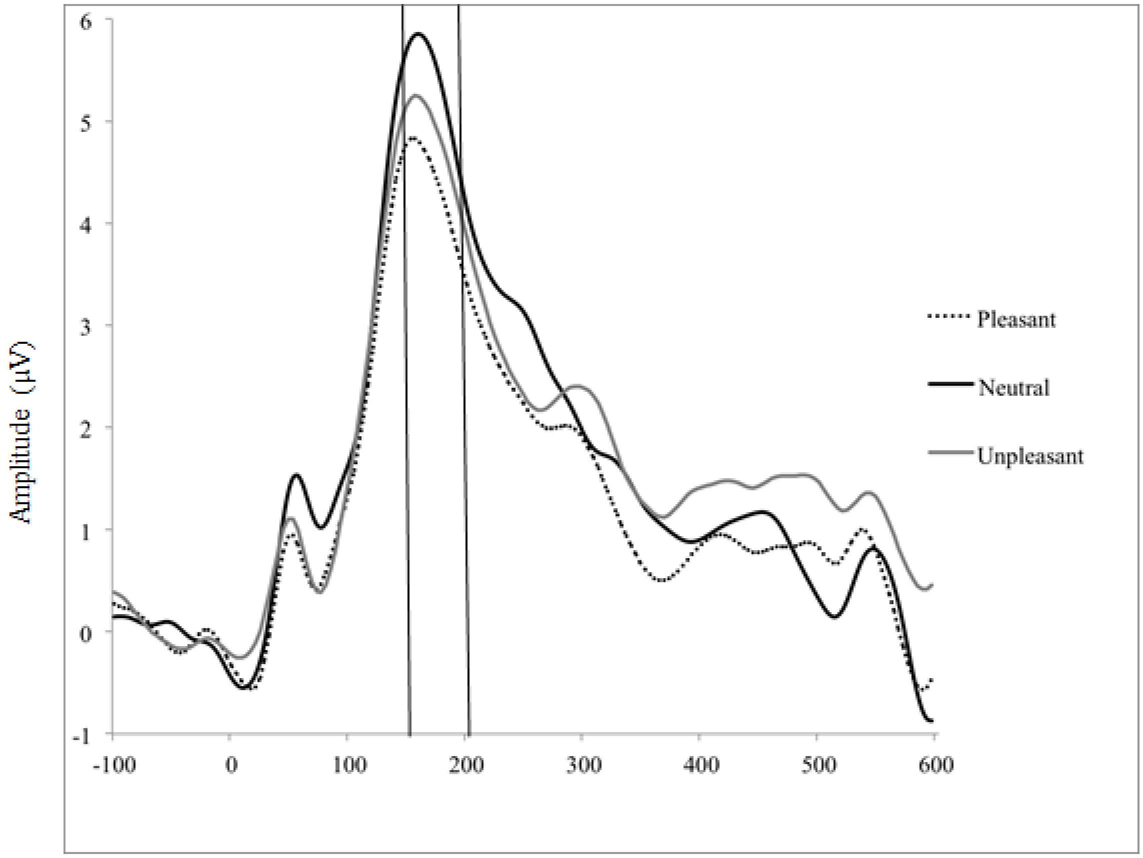

Figure 3. The P300 component.

Note. The P300 component was extracted between 150 ms and 225 ms following valence condition presentation.

Instruction-related activity. Mean amplitudes in microvolts (μV) of the cue-related slow wave are presented in Table 7. Figure 4 presents the grand-averaged cue-related slow wave ERP component (see "Appendix A, ERP Data: Cue-Related Slow Wave" for output). The cue-related slow wave was tested to assess context maintenance of the task instruction (color vs word) as affected by emotional pictures. A 3-Valence (Pleasant, Neutral, or Unpleasant) x 2-Cue (color vs word) within subjects ANOVA was conducted which determined there was a significant main effect of valence, $F(2,80) = 3.29$, $p = .04$, $\eta_p^2 = 0.076$. However, post-hoc t tests indicated that unpleasant valence conditions were characterized by more positive amplitude of the cue-related slow wave component compared to the pleasant conditions, $t(40) = 2.38$, $p = .02$. Neutral pictures were not significantly different from either pleasant, $t(40) = 0.59$, $p = .56$ or unpleasant, $t(40) = 1.87$, $p = .07$. Task instruction (color vs. word) did not differ significantly in the cue-related slow wave, $F(2, 80) = 0.05$, $p = .83$, $\eta_p^2 = 0.001$. There was no significant difference with valence on the instructional cue for the cue-related slow wave, $F(2, 39) = 0.08$, $p = .93$, $\eta_p^2 = 0.004$. In sum, presentation of the unpleasant picture condition was related to greater slow wave amplitude than pleasant or neutral conditions, while task instruction (color vs. word) did not affect the amplitude of the cue-related slow wave.

Table 7

Context maintenance: Amplitude of the cue-related slow wave (µV)

Valence Type	Cue	Mean(*SD*)	Minimum	Maximum
Pleasant (µV)	Color	1.20(1.75)	-2.44	6.32
	Word	1.23(1.91)	-2.89	5.69
Neutral (µV)	Color	1.33(1.38)	-1.08	4.29
	Word	1.26(1.76)	-2.84	5.40
Unpleasant (µV)	Color	1.60(1.69)	-1.79	5.10
	Word	1.55(1.97)	-2.12	6.36

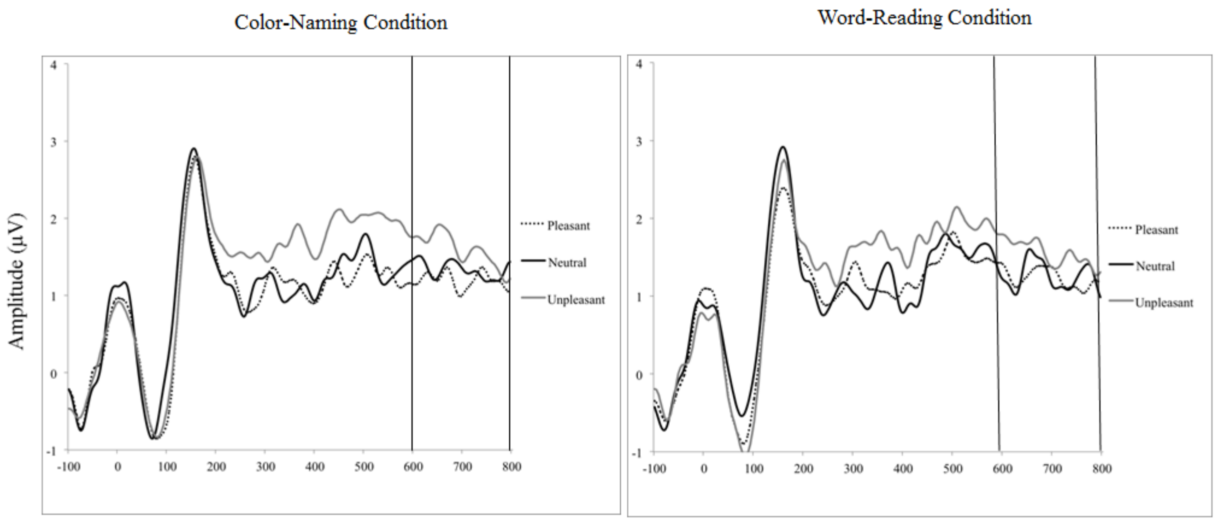

Figure 4. The cue-related slow wave ERP component.

Note. The difference between valence conditions in each instructional cue trial type (color-naming versus word-reading). The mean amplitude was derived from 600 ms to 800 ms post-cue.

Stimulus-related activity. Mean amplitudes (in µV) of the N450 and conflict SP ERP components are presented in Table 8, with the grand-average N450 waveforms in Figure 5. The N450 (measure of conflict detection) was assessed using a 3-Valence (pleasant, neutral, and unpleasant) x 2-Congruency (incongruent vs congruent) repeated measures ANOVA (see "Appendix A, ERP Data: N450" for output). There were no significant main effects of valence type, $F(2, 80) = .93$, $p = .40$, $\eta_p^2 = .02$, or congruency, $F(1, 40) = .16$, $p = .69$, $\eta_p^2 = .004$, or an interaction of valence and congruency, $F(2, 80) = 1.31$, $p = .28$, $\eta_p^2 = .03$. Presentation of the valence condition did not affect conflict detection differentially, nor the congruency of the stimulus.

Conflict resolution was measured using the conflict slow-wave potential (conflict SP; see Figure 6), which was also focused on the color-naming task (Larson, Clayson, Clawson, 2014; Perlstein, Larson, Dotson, & Kelly, 2006; see "Appendix A, ERP Data: Conflict SP" for output).

The 3-Valence (pleasant, neutral, unpleasant) x 2-Congruency ANOVA demonstrated a significant main effect of congruency, $F(1, 40) = .21.397$, $p < .001$, $\eta_p^2 = .349$, with incongruent trials more augmented than congruent trials. A significant main effect of valence, $F(2, 80) = 3.046$, $p = .053$, $\eta_p^2 = .071$, was present with a quadratic trend ($p = .06$). Follow-up *t*-tests indicated that the neutral condition was more negative than the pleasant condition, $t(40) = 2.350$, $p = .024$, *95% CI* (0.06, 0.85). However, there was no significant relationship between the unpleasant condition with neutral, $t(40) = 0.81$, $p = .42$, *95% CI* (-0.49, 0.21), or pleasant conditions, $t(40) = 1.58$, $p = .12$, *95% CI* (-0.09, 0.73). Additionally there was a significant interaction between congruency and valence, $F(2, 80) = 4.788$, $p = .011$, $\eta_p^2 = .107$. For congruent trials, only the pleasant condition had a significantly larger conflict SP amplitude than the unpleasant valence condition, $t(40) = 2.707$, $p = .010$, There were no significant differences with the neutral valence condition and the pleasant, $t(40) = 1.91$, $p = .06$, *95% CI* (-0.03, 1.16), or neutral and the unpleasant condition, $t(40) = 0.95$, $p = .35$, *95% CI* (-0.31, 0.85). For incongruent trials, only the unpleasant condition had a significantly greater conflict SP amplitude than the neutral condition, $t(40) = 2.547$, $p = .015$. There were no significant differences with the unpleasant and pleasant, $t(40) = 0.91$, $p = .37$, *95% CI* (-0.65, 0.25), and pleasant and neutral conditions, $t(40) = 1.66$, $p = .11$, *95% CI* (-0.08, 0.78). In sum, although congruency and valence independently influenced conflict SP amplitude, there was an interaction of valence in which pleasant had augmented conflict SP amplitude compared to unpleasant when congruent trials, but unpleasant had greater conflict SP amplitude compared to neutral when incongruent.

Table 8

Evaluative processes: Amplitudes of the N450 and conflict SP in µV

Valence	Congruency	N450 Mean(*SD*)	N450 Min.	N450 Max.	Conflict SP Mean(*SD*)	Conflict SP Min.	Conflict SP Max.
Pleasant (µV)	Congruent	-0.34(2.43)	-7.67	5.66	1.64(2.06)	-4.25	6.57
	Incongruent	-0.08(2.09)	-4.86	3.90	2.11(1.71)	-1.48	6.19
Neutral (µV)	Congruent	0.12(2.18)	-3.82	5.13	1.07(2.31)	-2.75	7.06
	Incongruent	-0.08(1.91)	-3.45	4.07	1.75(1.82)	-1.76	6.22
Unpleasant (µV)	Congruent	-0.08(2.27)	-6.62	4.03	0.80(2.00)	-4.09	4.94
	Incongruent	-0.32(2.61)	-8.34	3.71	2.31(1.96)	-2.24	6.83

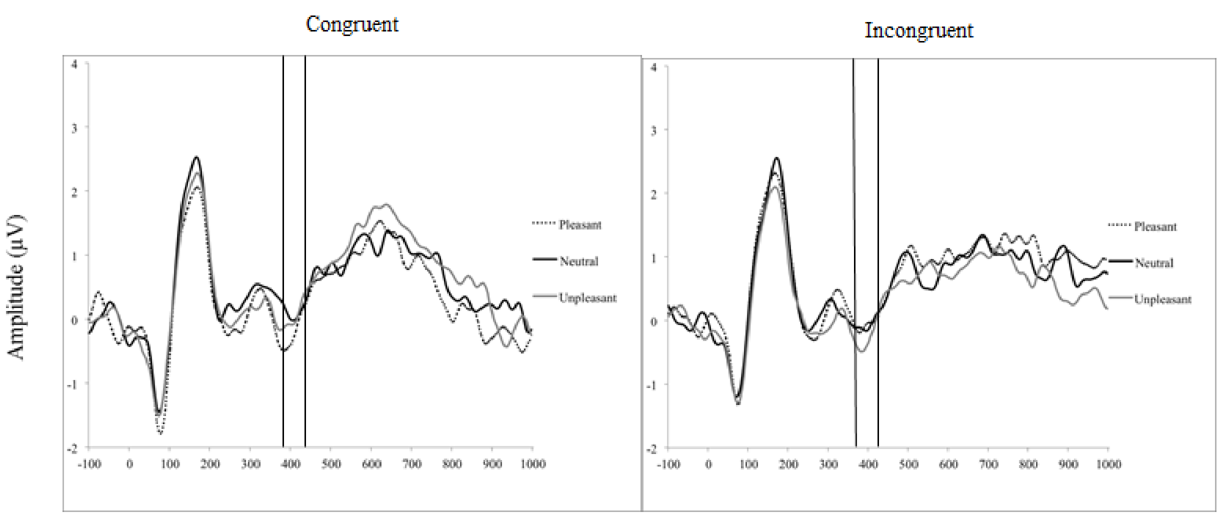

Figure 5. The N450 component.

Note. The N450 mean amplitude was derived from 375 to 425 ms post-stimulus from the color-naming task

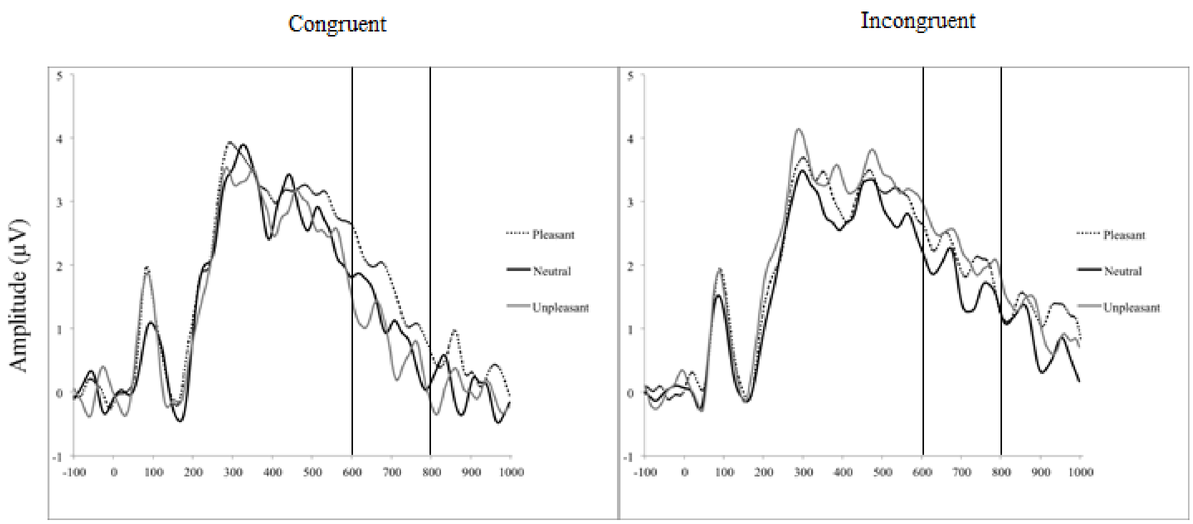

Figure 6. The conflict SP component.

Note. The conflict SP amplitude was derived from 600 to 800 ms post-stimulus from the color-naming task

Discussion

The primary aims of this study were to assess if positive affect would increase evaluative cognitive control processes and decrease regulative control as indicated by attenuated amplitudes in the cue-related slow wave when the pleasant-valence picture type was present. For increased evaluative control, the pleasant-valenced stimuli were expected to have a more negative amplitude in the N450 and conflict SP, compared to the neutral and unpleasant-valenced stimuli.

Behavioral Data

Incongruent trials resulted in worse accuracy as well as longer RTs than congruent trials, consistent with previous research (MacDonald, Cohen, Stenger, & Carter, 2000; West, 2003). With that in mind, we assessed the relationship between valence conditions (pleasant, neutral, unpleasant), instructional cue (color-naming vs. word-reading), and delay (short or long) with exclusively the incongruent trials. Evaluating exclusively the incongruent trials is easier for interpretation as there will be drastic differences between congruent and incongruent trials.

Accuracy. As expected from previous research (MacDonald, Cohen, Stenger, & Carter, 2000; West, 2003), participants had decreased accuracy with the color-naming conditions than the word-reading conditions. The color-naming condition requires more attentional resources to respond than the word-reading, given that participants are acting against the prepotent response to read the word (MacDonald, Cohen, Stenger, & Carter, 2000). We hypothesized that participants would have worse accuracy during a longer delay as well as decreased accuracy with the presentation of a pleasant stimulus. However, the long delay resulted in increased accuracy compared to the short delay condition, perhaps because the longer time allows for more rehearsal of task instruction (Stanners, Meunier, & Headley, 1969) and therefore implementation of the task context. Implementation of control or preparation to override a potentially prepotent response requires some period of time for context representations to be sufficiently strong enough to improve accuracy (Braver, Barch, & Cohen, 1999). Other studies including healthy adults have also demonstrated increased accuracy rates in the longer delay condition as well (Perlstein, Larson, Dotson, & Kelly, 2006). Although Baddeley (1983) has suggested working memory tasks result in rapid decay, it appears this may depend on whether or not sufficient time has been allowed to manipulate and use the context of the information for a correct response. Additionally, maintaining attentional demands of the task instruction is suggested to reduce the Stroop interference effects (MacDonald, Cohen, Stenger, & Carter, 2000), which in this case may benefit accuracy rates. Our findings suggest that longer delays may allow for the implementation of cognitive resources to improve accuracy rates.

Contrary to our prediction, positive affect (induced through pleasant-valenced images) did not result in worse accuracy (collapsed across instructional cue and delay). However, trials with the pleasant and neutral valence conditions had increased accuracy within the color-naming condition following a long delay. Trials with unpleasant stimuli, that did not demonstrate this pattern, may have been distracted by the presentation of a negative condition (Ekman, 1992), resulting in worse accuracy. With pleasant pictures, they may have had similar low arousal levels similar to the neutral condition, and thus negative pictures evoked higher arousal compared to the other two. Therefore, increased accuracy observed in the pleasant and neutral conditions may be in part because individuals are less distracted by the less arousing conditions (unlike the higher arousal level of unpleasant conditions).

Response times (RTs). Consistent with previous research, participants demonstrated shorter RTs when exposed to congruent versus incongruent trials (West, 2003) as well as the word-reading versus the color-naming (MacDonald, Cohen, Stenger, & Carter, 2000; West, 2003). Contrary to our hypothesis, there were no significant differences observed between valence conditions or delay in RTs. These findings suggest that RTs did not differ between delay conditions (unlike accuracy rates), suggesting that delay lengths were processed similarly regardless of valence. Previous findings of RTs and valence conditions suggest that RTs increase when highly-arousing valence conditions are present, even if task irrelevant (Larson, Perlstein, Strigge-Kaufman, Kelly, & Dotson, 2006). Our behavioral findings suggest that accuracy, but not RTs, is improved when pleasant images bias attention towards the instructional cue and where longer rehearsal time is allowed before responding. Response times were not affected by task characteristics beyond instructional cue and congruency of stimuli. Furthermore since unpleasant pictures were associated with decreased accuracy, it is possible that we were unable to see a difference between valence types on RTs since we only examined correct trial RTs. When participants did successfully complete the task correctly, there were no differences between valence types.

ERP Data

Amplitude of the P300 did not follow its traditional amplitude pattern following the presentation of valence stimuli. Specifically, we hypothesized that the P300 would have increased amplitude when viewing emotional stimuli (pleasant and unpleasant) compared to neutral; however, our results showed no differences in the P300. The P300 can be attenuated when viewing emotional stimuli due to the stimuli being irrelevant to task instruction, therefore resulting in decreased attention to the emotional pictures (Bradley, Codispoti, & Lang, 2006; Hajcak, MacNamara, & Olvet, 2010). Given these findings, it is likely that the P300 is not an effective manipulation check for the present task. A preferred means of assessing the valence manipulation would be through the late positive potential (LPP). The LPP is proposed to measure the processing of emotional stimuli. The LPP is more sensitive to emotion regulation regardless of task instruction (Hajcak, MacNamara, & Olvet, 2010). The LPP peaks around 850 and 1600 ms, whereas the P300 peaks around 350 ms after picture onset (Hajcak, MacNamara, & Olvet, 2013). In our study, there was not sufficient time to gather LPP data between our presentation of picture stimuli and the instructional cue.

Regulative processes. Consistent with our hypothesis, the pleasant-valenced conditions had lower cue-related slow wave amplitudes than the unpleasant condition. However, there were no differences between the color versus word instructional cue conditions, suggesting that the color-naming condition did not follow the expected path of greater context maintenance compared to the word-reading condition (West, 2003). However, it is possible that the distractor of valence conditions may have attenuated the typical differences in context maintenance observed between instructional (color vs. word) cues. As such, task instructions were processed similarly regardless of the valence condition in the cognitive process of context maintenance.

Context maintenance is differentially affected by valence conditions, in that pleasant-valenced stimuli distract from the task, resulting in reduced context maintenance. Findings also suggest that introducing valence conditions attenuate the typical difference of the color-naming condition having increased context maintenance (as indicated by the cue-related slow wave) than the word-reading condition. Pleasant trials appear to encourage flexible thinking in participants to better respond to attentional demands of instructional cue, by weakening the context maintenance towards the task compared to unpleasant trials. These findings support that of Dreisbach and Goschke (2004) who proposed that positive affect either distracts or creates flexible thinking in individuals in relation to task instruction (2004; 2006). With our behavioral findings, pleasant conditions also increased accuracy, suggesting that positive affect may under high conflict conditions encourage flexible thinking to improve performance (accuracy rates) to the same level of neutral stimuli.

Evaluative processes. Additionally, we hypothesized that the conflict detection (N450) and resolution processes (conflict SP) would be especially activated after presentation of the pleasant valence conditions. In this study, the N450 did not have any significant differences across valence types. The lack of influence of valence conditions on the N450 may be explained by which electrode sites were used to measure the N450 component. Previous research has suggested measurement of the N450 is best measured at the fronto-central region (Liotti, Woldorff, Perez, & Mayberg, 2000; Perstein, Larson, Dotson, & Kelly, 2006, West, 2003). However, one study found the N450 to have greater amplitude *difference* between congruency conditions over the parietal region, utilizing the Stroop task as well (Ergen, Saban, Kirmizi-Alsan, Uslu, Keskin-Ergen, & Dermiralp, 2014). It is possible that had we measured the N450 over the parietal region as well (rather than the more common fronto-central region), we may have had a bigger picture of the differences in amplitude that are more apparent at different locations. Additionally, the N450 not being influenced by valence may just be reflective of situations where valence doesn't matter, like RTs (at least as seen in our correct-trials).

Unlike the conflict detection of the N450, the conflict resolution of the conflict SP was influenced differently depending on the level of conflict and valence. When trials were incongruent, the unpleasant condition resulted in increased negativity of the conflict SP amplitude. Conflict and negative affect (as elicited by the unpleasant condition) is considered aversive, and therefore in trials with unpleasant stimuli in aversive situations (i.e., conflict), participants engage in avoidance of mistakes that promotes a more focused mode of processing (Fiedler, 2001). However, without the influence of incongruent trials, the unpleasant stimuli did not bias attention towards the task. For congruent trials, the conflict resolution mechanism was stronger in pleasant than unpleasant trials. Fiedler (2001) has also suggested that positive affect (as elicited by the pleasant condition) encourages flexibility in the absence of obstacles to goals. Our findings suggest that congruency potentially determines the extent to which affective states signal for increased cognitive resources in response to task demands.

The conflict SP findings suggest that conflict resolution among valence conditions depend on the level of congruency. Previous research suggests that negative affect is more prone to adjusting responses for better performance to incongruent stimuli after a few trials (van Steenburgen, 2010), therefore explaining the difference in conflict resolution. Positive stimuli did not differentially adjust to conflict.

Overall, these findings support Dreisbach and Goschke (2004; 2006) in that positive and negative affective states differ in performance (accuracy). However, negative affect resulted in decreased accuracy while positive affect matched the neutral condition (reflective of low arousal) in accuracy, suggestive of greater flexibility in the positive affect condition compared to negative. When evaluating the associated cognitive processes, it appears that negative affective states are better able to maintain task context as well as recruit more cognitive resources following incongruent trials. However, positive affect was found to have greater conflict resolution on the congruent trials, with less engagement in context maintenance. With pleasant conditions being more prone to distraction, positive affective states are more equipped for better performance in the congruent, less distracting trials.

With negative affective states, individuals increase focus elsewhere in order to avoid negative images (Ekman, 1992). Additionally, it is likely that participants during the unpleasant trials recognize they have difficulty being accurate; therefore, their signaling of cognitive resources increases in response to negative incongruent trials. With the negative states, participants are already more engaged in the task (increased context maintenance) in an effort to avoid dwelling on the exposure to unpleasant stimuli, and therefore are more aware and prepared to signal for increased recruitment which is needed in incongruent trials to better perform.

Historically, there has been confusion in the literature differentiating between state and trait affect (Boyle, Saklofske, & Matthews, 2014). However, responses do differ between state and trait negative affect. Trait anxiety (i.e., high negative affect) typically results in increased vulnerability to finding unpleasant stimuli distracting (Henderson, Snyder, Gupta, & Banich, 2012; Tanji & Hoshi, 2008). Unlike negative trait, our findings suggest negative state situations result in greater focus on the task as indicated by increased context maintenance to combat the distraction of the negative stimuli presented.

Limitations and Future Directions

A major limitation of our study was the manipulation check. The selection of IAPS picture stimuli resulted in different ratings by participants on arousal than the original dataset demonstrated. Participants did not consider the pleasant and unpleasant stimuli to be equally as arousing, suggesting that differences between valence conditions may be due to level of arousal rather than valence. It is recommended that future studies establish valence and arousal ratings of the selected picture stimuli prior to testing the task, eliminating the potential confound of insufficient differences between picture categories. Since pleasant and unpleasant stimuli did differ in the level of arousal, findings could be attributed to the level of arousal rather than the valence conditions.

Additionally, the P300 was not sensitive to valence conditions. In the future, the LPP may be a better evaluation of the processing of affective stimuli as it is not as influenced by task instruction (Hajcak, MacNamara, & Olvet, 2010; Bradley, Codispoti, & Lang, 2006).

Although, we assessed the anxiety and depressive symptoms in our sample, our sample was too small to create additional groups and evaluate differences (i.e., high and low trait-negative affect). Prior research has not addressed symptoms that are high negative affect-trait (Dreisbach 2006; Dreisbach & Goschke, 2004). We hoped to claim our psychiatrically-healthy participants did not endorse symptoms above the clinical cut-off, therefore eliminated this possible confound of high-trait negative affect. However, our participants included a number of elevated anxiety and depressive symptoms, with a portion above the clinical cut off. We cannot make additional claims beyond that of Dreisbach & Goschke (2004). Future research would benefit from anticipating the confound of a high range of negative affect-related symptoms in undiagnosed individuals.

Strengths of the Current Study

Although our sample size is relatively small, we maximized our data collection from each participant by using within-subject design. Each participant was exposed to each condition (valence type, cue, delay and congruency) which also allowed us to control for individual differences in response to the task.

Additionally, Driesbach and Goeschke (2004) were unable to look at neural correlates in their analyses of valence conditions on performance. This study attempted to locate the underlying cognitive mechanisms underlying performance changes due to affective states. Evaluation of ERPs allowed for further understanding of the performance differences due to valence conditions. Specifically, negative affect elicits greater task maintenance, but not always with greater conflict resolution processes. Therefore, negative affect does not demonstrate as high of rates of accuracy as positive affective states, which may be seen as a more flexible condition.

Conclusions

Our study aimed to evaluate if positive affect is helpful or harmful to overall task performance. This was assessed by differentiating how positive and negative affective states influence how participants implement cognitive control processes. Altogether, findings suggest that exposure to the pleasant and neutral stimuli resulted in greater accuracy in task performance but only when exposed to the higher conflict task (color-naming) when allowed longer rehearsal time of task instruction. Additionally, exposure to pleasant stimuli resulted in less context maintenance compared to neutral and negative affective states, as well as greater conflict resolution processes in congruent trials. Positive affect allowed for more flexible thinking towards the task, perhaps explaining the higher accuracy with the above task characteristics.

However, conflict resolution and affective states are modulated by congruency. Our findings demonstrated that positive affect can enhance performance through flexible thinking when allowed extra rehearsal time for the high conflict tasks with congruent trials. Additionally, negative affective states increase attention to the task to avoid distraction by unpleasant stimuli.

Our findings lay the foundation for future studies to provide increased clarity between state and trait affective states in differences of cognitive control implementation. Comparisons of state and trait affective states would provide insight into the differences of psychiatrically healthy individuals as well as those with psychiatric conditions relevant to affective traits (e.g., depression and anxiety).

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Appendix A

Demographics

```
 >Warning # 5281.  Command name: GET FILE
>SPSS Statistics is running in Unicode encoding mode.  This file is encoded in
>a locale-specific (code page) encoding.  The defined width of any string
>variables are automatically tripled in order to avoid possible data loss.  Yo
u
>can use ALTER TYPE to set the width of string variables to the width of the
>longest observed value for each string variable.
FREQUENCIES VARIABLES=Sex Age Education BDI2 STAI_State STAI_Trait
  /STATISTICS=STDDEV VARIANCE RANGE MINIMUM MAXIMUM MEAN MEDIAN MODE
  /ORDER=ANALYSIS.
```

Frequencies

Notes

Output Created		29-FEB-2016 19:23:45
Comments		
Input	Data	/Users/larsonresearch1/Downloads/PosAffect_Behav_Ratings_03-23-10.sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	37
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data.
Syntax		FREQUENCIES VARIABLES=Sex Age Education BDI2 STAI_State STAI_Trait /STATISTICS=STDDEV VARIANCE RANGE MINIMUM MAXIMUM MEAN MEDIAN MODE /ORDER=ANALYSIS.
Resources	Processor Time	00:00:00.01
	Elapsed Time	00:00:00.00

```
[DataSet1] /Users/larsonresearch1/Downloads/PosAffect_Behav_Ratings_03-23-10.s
av
```

Statistics

		Sex	Age	Education	BDI2	STAI_State	STAI_Trait
N	Valid	36	36	36	36	36	36
	Missing	1	1	1	1	1	1
Mean		1.6667	20.1389	13.5694	5.5278	30.9722	38.3056
Median		2.0000	20.0000	13.2500	4.0000	30.5000	37.0000
Mode		2.00	18.00	12.00	2.00	31.00	27.00[a]
Std. Deviation		.47809	1.98786	1.44000	6.12949	8.06575	10.99563
Variance		.229	3.952	2.074	37.571	65.056	120.904
Range		1.00	7.00	5.00	35.00	35.00	43.00
Minimum		1.00	18.00	12.00	.00	20.00	22.00
Maximum		2.00	25.00	17.00	35.00	55.00	65.00

a. Multiple modes exist. The smallest value is shown

Frequency Table

Sex

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	12	32.4	33.3	33.3
	2.00	24	64.9	66.7	100.0
	Total	36	97.3	100.0	
Missing	System	1	2.7		
Total		37	100.0		

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18.00	11	29.7	30.6	30.6
	19.00	5	13.5	13.9	44.4
	20.00	6	16.2	16.7	61.1
	21.00	4	10.8	11.1	72.2
	22.00	4	10.8	11.1	83.3
	23.00	5	13.5	13.9	97.2
	25.00	1	2.7	2.8	100.0
	Total	36	97.3	100.0	
Missing	System	1	2.7		
Total		37	100.0		

Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	12.00	12	32.4	33.3	33.3
	13.00	6	16.2	16.7	50.0
	13.50	1	2.7	2.8	52.8
	14.00	6	16.2	16.7	69.4
	15.00	8	21.6	22.2	91.7
	16.00	2	5.4	5.6	97.2
	17.00	1	2.7	2.8	100.0
	Total	36	97.3	100.0	
Missing	System	1	2.7		
Total		37	100.0		

BDI2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	3	8.1	8.3	8.3
	1.00	1	2.7	2.8	11.1
	2.00	7	18.9	19.4	30.6
	3.00	5	13.5	13.9	44.4
	4.00	3	8.1	8.3	52.8
	5.00	5	13.5	13.9	66.7
	7.00	5	13.5	13.9	80.6
	8.00	2	5.4	5.6	86.1
	9.00	1	2.7	2.8	88.9
	10.00	2	5.4	5.6	94.4
	17.00	1	2.7	2.8	97.2
	35.00	1	2.7	2.8	100.0
	Total	36	97.3	100.0	
Missing	System	1	2.7		
Total		37	100.0		

STAI_State

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20.00	2	5.4	5.6	5.6
	21.00	1	2.7	2.8	8.3
	22.00	3	8.1	8.3	16.7
	23.00	1	2.7	2.8	19.4
	24.00	1	2.7	2.8	22.2
	25.00	2	5.4	5.6	27.8
	26.00	1	2.7	2.8	30.6
	27.00	2	5.4	5.6	36.1
	28.00	2	5.4	5.6	41.7
	29.00	1	2.7	2.8	44.4
	30.00	2	5.4	5.6	50.0
	31.00	4	10.8	11.1	61.1
	32.00	1	2.7	2.8	63.9
	33.00	1	2.7	2.8	66.7
	34.00	2	5.4	5.6	72.2
	35.00	2	5.4	5.6	77.8
	36.00	1	2.7	2.8	80.6
	38.00	2	5.4	5.6	86.1
	39.00	2	5.4	5.6	91.7
	43.00	1	2.7	2.8	94.4
	51.00	1	2.7	2.8	97.2
	55.00	1	2.7	2.8	100.0
	Total	36	97.3	100.0	
Missing	System	1	2.7		
Total		37	100.0		

STAI_Trait

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	22.00	1	2.7	2.8	2.8
	23.00	1	2.7	2.8	5.6
	24.00	1	2.7	2.8	8.3
	27.00	3	8.1	8.3	16.7
	28.00	2	5.4	5.6	22.2
	29.00	2	5.4	5.6	27.8
	30.00	1	2.7	2.8	30.6
	31.00	2	5.4	5.6	36.1
	32.00	1	2.7	2.8	38.9
	33.00	1	2.7	2.8	41.7
	34.00	1	2.7	2.8	44.4
	36.00	1	2.7	2.8	47.2
	37.00	2	5.4	5.6	52.8
	38.00	1	2.7	2.8	55.6
	39.00	1	2.7	2.8	58.3
	40.00	2	5.4	5.6	63.9
	41.00	2	5.4	5.6	69.4
	44.00	1	2.7	2.8	72.2
	48.00	1	2.7	2.8	75.0
	49.00	1	2.7	2.8	77.8
	50.00	3	8.1	8.3	86.1
	51.00	1	2.7	2.8	88.9
	55.00	1	2.7	2.8	91.7
	56.00	1	2.7	2.8	94.4
	57.00	1	2.7	2.8	97.2
	65.00	1	2.7	2.8	100.0
	Total	36	97.3	100.0	
Missing	System	1	2.7		
Total		37	100.0		

Internal Consistency of Measures

```
GET
  FILE="/Users/larsonresearch1/Desktop/Hilary/SPSS for Master's Thesis/PosAffe
ct_Behav_Ratings_Rev.sav".
DATASET NAME DataSet1 WINDOW=FRONT.
RELIABILITY
  /VARIABLES=BDI2 STAI_State STAI_Trait
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA
  /SUMMARY=MEANS VARIANCE COV CORR.
```

Reliability

Notes

Output Created		05-MAR-2017 22:45...
Comments		
Input	Data	/Users/larsonresearch1/Desktop/Hilary/SPSS for Master's Thesis/PosAffect_Behav_Ratings_Rev.sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	37
	Matrix Input	/Users/larsonresearch1/Desktop/Hilary/SPSS for Master's Thesis/PosAffect_Behav_Ratings_Rev.sav
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the procedure.
Syntax		RELIABILITY /VARIABLES=BDI2 STAI_State STAI_Trait /SCALE('ALL VARIABLES') ALL /MODEL=ALPHA /SUMMARY=MEANS VARIANCE COV CORR.
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00

```
[DataSet1] /Users/larsonresearch1/Desktop/Hilary/SPSS for Master's Thesis/PosA
ffect_Behav_Ratings_Rev.sav
```

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	36	97.3
	Excluded[a]	1	2.7
	Total	37	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.740	.772	3

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	24.935	5.528	38.306	32.778	6.930	295.930	3
Item Variances	74.510	37.571	120.904	83.333	3.218	1803.144	3
Inter-Item Covariances	36.296	25.244	45.094	19.851	1.786	81.856	3
Inter-Item Correlations	.530	.508	.572	.063	1.125	.001	3

Normative IAPS Data

```
>Warning # 5281.  Command name: GET FILE
>SPSS Statistics is running in Unicode encoding mode.  This file is encoded in
>a locale-specific (code page) encoding.  The defined width of any string
>variables are automatically tripled in order to avoid possible data loss.  Yo
u
>can use ALTER TYPE to set the width of string variables to the width of the
>longest observed value for each string variable.
ALTER TYPE ALL(A=AMIN).
```

Alter Type

Notes

Output Created		05-NOV-2016 20:18...
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Resources	Processor Time	00:00:00.01
	Elapsed Time	00:00:00.00

/Users/larsonresearch1/Desktop/PosAffect_IAPSRatings (1).sav

Altered Types

Picture_Name	A36	AMIN

```
ONEWAY Arousal BY Picture_Type
  /POLYNOMIAL=2
  /STATISTICS DESCRIPTIVES
  /MISSING ANALYSIS
  /POSTHOC=TUKEY ALPHA(0.05).
```

Oneway

Notes

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Comments		
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	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	120
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on cases with no missing data for any variable in the analysis.
Syntax		ONEWAY Arousal BY Picture_Type /POLYNOMIAL=2 /STATISTICS DESCRIPTIVES /MISSING ANALYSIS /POSTHOC=TUKEY ALPHA(0.05).
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.00

Descriptives

Arousal

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
pleasant	40	5.4403	.85199	.13471	5.1678	5.7127	3.99	7.35
neutral	40	3.0978	.80809	.12777	2.8393	3.3562	1.72	5.24
unpleasant	40	5.7492	1.00141	.15834	5.4290	6.0695	3.67	7.35
Total	120	4.7624	1.48115	.13521	4.4947	5.0301	1.72	7.35

ANOVA

Arousal

			Sum of Squares	df	Mean Square	F	Sig.
Between Groups	(Combined)		168.177	2	84.088	105.917	.000
	Linear Term	Contrast	1.910	1	1.910	2.405	.124
		Deviation	166.267	1	166.267	209.429	.000
	Quadratic Term	Contrast	166.267	1	166.267	209.429	.000
Within Groups			92.887	117	.794		
Total			261.064	119			

Post Hoc Tests

Multiple Comparisons

Dependent Variable: Arousal
Tukey HSD

(I) Picture_Type	(J) Picture_Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
pleasant	neutral	2.34250*	.19924	.000	1.8695	2.8155
	unpleasant	-.30900	.19924	.271	-.7820	.1640
neutral	pleasant	-2.34250*	.19924	.000	-2.8155	-1.8695
	unpleasant	-2.65150*	.19924	.000	-3.1245	-2.1785
unpleasant	pleasant	.30900	.19924	.271	-.1640	.7820
	neutral	2.65150*	.19924	.000	2.1785	3.1245

*. The mean difference is significant at the 0.05 level.

Homogeneous Subsets

Arousal

Tukey HSD[a]

Picture_Type	N	Subset for alpha = 0.05: 1	2
neutral	40	3.0978	
pleasant	40		5.4403
unpleasant	40		5.7492
Sig.		1.000	.271

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 40.000.

```
ONEWAY Valence BY Picture_Type
 /POLYNOMIAL=2
 /STATISTICS DESCRIPTIVES
 /MISSING ANALYSIS
```

```
/POSTHOC=TUKEY ALPHA(0.05).
```

Oneway

Notes

Output Created		05-NOV-2016 21:26...
Comments		
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	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	120
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on cases with no missing data for any variable in the analysis.
Syntax		ONEWAY Valence BY Picture_Type /POLYNOMIAL=2 /STATISTICS DESCRIPTIVES /MISSING ANALYSIS /POSTHOC=TUKEY ALPHA(0.05).
Resources	Processor Time	00:00:00.01
	Elapsed Time	00:00:00.00

Descriptives

Valence

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
pleasant	40	7.5205	.51991	.08221	7.3542	7.6868	6.22	8.34
neutral	40	4.9480	.40592	.06418	4.8182	5.0778	4.23	6.05
unpleasant	40	2.8953	.70204	.11100	2.6707	3.1198	1.68	4.32
Total	120	5.1213	1.97856	.18062	4.7636	5.4789	1.68	8.34

IAPS Current Data

```
GLM Ple_SAM_Valence Neu_SAM_Valence Unp_SAM_Valence
 /WSFACTOR=Valence 3 Polynomial
 /METHOD=SSTYPE(3)
 /PLOT=PROFILE(Valence)
 /EMMEANS=TABLES(OVERALL)
 /EMMEANS=TABLES(Valence) COMPARE ADJ(LSD)
 /PRINT=DESCRIPTIVE OPOWER
 /CRITERIA=ALPHA(.05)
 /WSDESIGN=Valence.
```

General Linear Model

Notes

Output Created		09-JAN-2017 20:10:08
Comments		
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	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	37
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the model.
Syntax		GLM Ple_SAM_Valence Neu_SAM_Valence Unp_SAM_Valence /WSFACTOR=Valence 3 Polynomial /METHOD=SSTYPE(3) /PLOT=PROFILE (Valence) /EMMEANS=TABLES (OVERALL) /EMMEANS=TABLES (Valence) COMPARE ADJ (LSD) /PRINT=DESCRIPTIVE OPOWER /CRITERIA=ALPHA(.05) /WSDESIGN=Valence.

Notes

Resources	Processor Time	00:00:00.16
	Elapsed Time	00:00:00.00

Within-Subjects Factors

Measure: MEASURE_1

Valence	Dependent Variable
1	Ple_SAM_Valence
2	Neu_SAM_Valence
3	Unp_SAM_Valence

Descriptive Statistics

	Mean	Std. Deviation	N
Ple_SAM_Valence	6.8892	.73211	37
Neu_SAM_Valence	4.7412	.80821	37
Unp_SAM_Valence	2.3689	.69253	37

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Noncent. Parameter	Observed Power[c]
Valence	Pillai's Trace	.943	289.342[b]	2.000	35.000	.000	578.685	1.000
	Wilks' Lambda	.057	289.342[b]	2.000	35.000	.000	578.685	1.000
	Hotelling's Trace	16.534	289.342[b]	2.000	35.000	.000	578.685	1.000
	Roy's Largest Root	16.534	289.342[b]	2.000	35.000	.000	578.685	1.000

a. Design: Intercept
Within Subjects Design: Valence

b. Exact statistic

c. Computed using alpha =

Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Valence	.897	3.789	2	.150	.907	.952	.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept
Within Subjects Design: Valence

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power[a]
Valence	Sphericity Assumed	378.318	2	189.159	387.701	.000	775.402	1.000
	Greenhouse-Geisser	378.318	1.814	208.566	387.701	.000	703.251	1.000
	Huynh-Feldt	378.318	1.905	198.623	387.701	.000	738.454	1.000
	Lower-bound	378.318	1.000	378.318	387.701	.000	387.701	1.000
Error(Valence)	Sphericity Assumed	35.129	72	.488				
	Greenhouse-Geisser	35.129	65.300	.538				
	Huynh-Feldt	35.129	68.569	.512				
	Lower-bound	35.129	36.000	.976				

a. Computed using alpha =

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	Valence	Type III Sum of Squares	df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power[a]
Valence	Linear	378.008	1	378.008	593.117	.000	593.117	1.000
	Quadratic	.310	1	.310	.917	.345	.917	.154
Error(Valence)	Linear	22.944	36	.637				
	Quadratic	12.185	36	.338				

a. Computed using alpha =

Tests of Between-Subjects Effects

Measure: MEASURE_1
Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power[a]
Intercept	2417.100	1	2417.100	3487.920	.000	3487.920	1.000
Error	24.948	36	.693				

a. Computed using alpha =

Estimated Marginal Means

1. Grand Mean

Measure: MEASURE_1

Mean	Std. Error	95% Confidence Interval	
		Lower Bound	Upper Bound
4.666	.079	4.506	4.827

2. Valence

Estimates

Measure: MEASURE_1

Valence	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	6.889	.120	6.645	7.133
2	4.741	.133	4.472	5.011
3	2.369	.114	2.138	2.600

Pairwise Comparisons

Measure: MEASURE_1

(I) Valence	(J) Valence	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	2.148*	.142	.000	1.860	2.436
	3	4.520*	.186	.000	4.144	4.897
2	1	-2.148*	.142	.000	-2.436	-1.860
	3	2.372*	.156	.000	2.055	2.690
3	1	-4.520*	.186	.000	-4.897	-4.144
	2	-2.372*	.156	.000	-2.690	-2.055

Based on estimated marginal means

*. The mean difference is significant at the

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Multivariate Tests

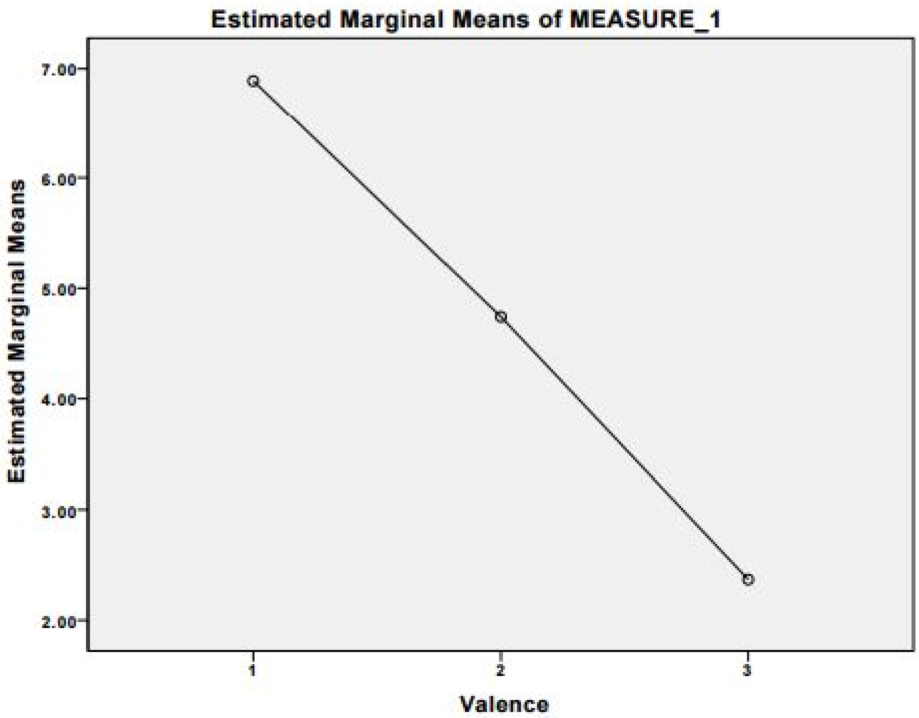
	Value	F	Hypothesis df	Error df	Sig.	Noncent. Parameter	Observed Power[b]
Pillai's trace	.943	289.342[a]	2.000	35.000	.000	578.685	1.000
Wilks' lambda	.057	289.342[a]	2.000	35.000	.000	578.685	1.000
Hotelling's trace	16.534	289.342[a]	2.000	35.000	.000	578.685	1.000
Roy's largest root	16.534	289.342[a]	2.000	35.000	.000	578.685	1.000

Each F tests the multivariate effect of Valence. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

b. Computed using alpha =

Profile Plots

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General Linear Model

Notes

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Warnings

The HOMOGENEITY specification in the PRINT subcommand will be ignored because there are no between-subjects factors.

Within-Subjects Factors

Measure: MEASURE_1

Arousal	Dependent Variable
1	Ple_SAM_Arousal
2	Neu_SAM_Arousal
3	Unp_SAM_Arousal

Descriptive Statistics

	Mean	Std. Deviation	N
Ple_SAM_Arousal	4.4304	1.51278	37
Neu_SAM_Arousal	2.1946	1.04134	37
Unp_SAM_Arousal	5.8216	1.21095	37

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Noncent. Parameter	Observed Power[c]
Arousal	Pillai's Trace	.879	127.245[b]	2.000	35.000	.000	254.491	1.000
	Wilks' Lambda	.121	127.245[b]	2.000	35.000	.000	254.491	1.000
	Hotelling's Trace	7.271	127.245[b]	2.000	35.000	.000	254.491	1.000
	Roy's Largest Root	7.271	127.245[b]	2.000	35.000	.000	254.491	1.000

a. Design: Intercept
Within Subjects Design: Arousal

b. Exact statistic

c. Computed using alpha =

Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b] Greenhouse-Geisser	Epsilon[b] Huynh-Feldt	Epsilon[b] Lower-bound
Arousal	.846	5.840	2	.054	.867	.907	.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept
Within Subjects Design: Arousal

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power[a]
Arousal	Sphericity Assumed	247.772	2	123.886	125.077	.000	250.154	1.000
	Greenhouse-Geisser	247.772	1.734	142.926	125.077	.000	216.830	1.000
	Huynh-Feldt	247.772	1.814	136.627	125.077	.000	226.827	1.000
	Lower-bound	247.772	1.000	247.772	125.077	.000	125.077	1.000
Error(Arousal)	Sphericity Assumed	71.315	72	.990				
	Greenhouse-Geisser	71.315	62.409	1.143				
	Huynh-Feldt	71.315	65.286	1.092				
	Lower-bound	71.315	36.000	1.981				

a. Computed using alpha =

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	Arousal	Type III Sum of Squares	df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power[a]
Arousal	Linear	35.806	1	35.806	30.576	.000	30.576	1.000
	Quadratic	211.966	1	211.966	261.725	.000	261.725	1.000
Error(Arousal)	Linear	42.159	36	1.171				
	Quadratic	29.156	36	.810				

a. Computed using alpha =

Tests of Between-Subjects Effects

Measure: MEASURE_1
Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power[a]
Intercept	1910.660	1	1910.660	668.455	.000	668.455	1.000
Error	102.900	36	2.858				

a. Computed using alpha =

Estimated Marginal Means

1. Grand Mean

Measure: MEASURE_1

Mean	Std. Error	95% Confidence Interval	
		Lower Bound	Upper Bound
4.149	.160	3.823	4.474

2. Arousal

Estimates

Measure: MEASURE_1

Arousal	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
1	4.430	.249	3.926	4.935
2	2.195	.171	1.847	2.542
3	5.822	.199	5.418	6.225

Pairwise Comparisons

Measure: MEASURE_1

(I) Arousal	(J) Arousal	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b] Lower Bound	95% Confidence Interval for Difference[b] Upper Bound
1	2	2.236*	.180	.000	1.870	2.602
	3	-1.391*	.252	.000	-1.901	-.881
2	1	-2.236*	.180	.000	-2.602	-1.870
	3	-3.627*	.254	.000	-4.143	-3.111
3	1	1.391*	.252	.000	.881	1.901
	2	3.627*	.254	.000	3.111	4.143

Based on estimated marginal means

*. The mean difference is significant at the

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Multivariate Tests

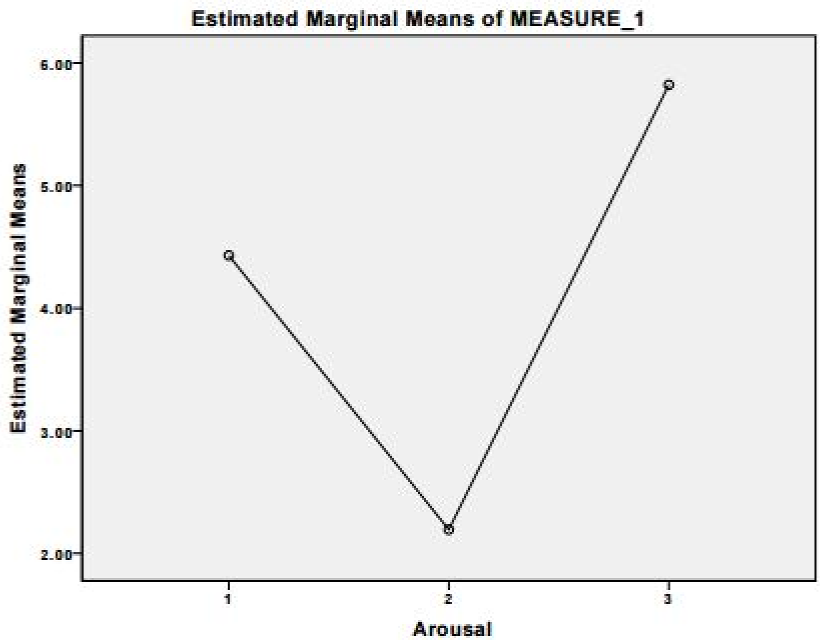
	Value	F	Hypothesis df	Error df	Sig.	Noncent. Parameter	Observed Power[b]
Pillai's trace	.879	127.245[a]	2.000	35.000	.000	254.491	1.000
Wilks' lambda	.121	127.245[a]	2.000	35.000	.000	254.491	1.000
Hotelling's trace	7.271	127.245[a]	2.000	35.000	.000	254.491	1.000
Roy's largest root	7.271	127.245[a]	2.000	35.000	.000	254.491	1.000

Each F tests the multivariate effect of Arousal. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

b. Computed using alpha =

Profile Plots



Behavioral Data

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General Linear Model

Notes

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	Cases Used	Statistics are based on all cases with valid data for all variables in the model.

Notes

Syntax		GLM ACCPlea_Col_Short_Incon ACCPlea_Col_Long_Incon ACCPlea_Word_Short_Incon ACCPlea_Word_Long_Incon ACCNeu_Col_Short_Incon ACCNeu_Col_Long_Incon ACCNeu_Word_Short_Incon ACCNeu_Word_Long_Incon ACCUnp_Col_Short_Incon ACCUnp_Col_Long_Incon ACCUnp_Word_Short_Incon ACCUnp_Word_Long_Incon /WSFACTOR=Valence 3 Polynomial Cue 2 Simple Delay 2 Simple /METHOD=SSTYPE(3) /EMMEANS=TABLES(OVERALL) /EMMEANS=TABLES(Valence) /EMMEANS=TABLES(Cue) /EMMEANS=TABLES(Delay) /EMMEANS=TABLES(Valence*Cue) /EMMEANS=TABLES(Valence*Delay) /EMMEANS=TABLES(Cue*Delay) /EMMEANS=TABLES(Valence*Cue*Delay) /PRINT=DESCRIPTIVE ETASQ /CRITERIA=ALPHA(.05) /WSDESIGN=Valence Cue Delay Valence*Cue Valence*Delay Cue*Delay Valence*Cue*Delay.
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Within-Subjects Factors

Measure: MEASURE_1

Valence	Cue	Delay	Dependent Variable
1	1	1	ACCPlea_Col_Short_Incon
		2	ACCPlea_Col_Long_Incon
	2	1	ACCPlea_Word_Short_Incon
		2	ACCPlea_Word_Long_Incon
2	1	1	ACCNeu_Col_Short_Incon
		2	ACCNeu_Col_Long_Incon
	2	1	ACCNeu_Word_Short_Incon
		2	ACCNeu_Word_Long_Incon
3	1	1	ACCUnp_Col_Short_Incon
		2	ACCUnp_Col_Long_Incon
	2	1	ACCUnp_Word_Short_Incon
		2	ACCUnp_Word_Long_Incon

Descriptive Statistics

	Mean	Std. Deviation	N
ACCPlea_Col_Short_Incon	.8150	.11771	37
ACCPlea_Col_Long_Incon	.8598	.10664	37
ACCPlea_Word_Short_Incon	.9139	.05018	37
ACCPlea_Word_Long_Incon	.9105	.06677	37
ACCNeu_Col_Short_Incon	.8226	.11293	37
ACCNeu_Col_Long_Incon	.8606	.11063	37
ACCNeu_Word_Short_Incon	.9020	.08532	37
ACCNeu_Word_Long_Incon	.9088	.08789	37
ACCUnp_Col_Short_Incon	.8539	.09745	37
ACCUnp_Col_Long_Incon	.8640	.10628	37
ACCUnp_Word_Short_Incon	.9029	.07171	37
ACCUnp_Word_Long_Incon	.9248	.06689	37

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Valence	Pillai's Trace	.131	2.634[b]	2.000	35.000	.086	.131
	Wilks' Lambda	.869	2.634[b]	2.000	35.000	.086	.131
	Hotelling's Trace	.150	2.634[b]	2.000	35.000	.086	.131
	Roy's Largest Root	.150	2.634[b]	2.000	35.000	.086	.131
Cue	Pillai's Trace	.446	28.939[b]	1.000	36.000	.000	.446
	Wilks' Lambda	.554	28.939[b]	1.000	36.000	.000	.446
	Hotelling's Trace	.804	28.939[b]	1.000	36.000	.000	.446
	Roy's Largest Root	.804	28.939[b]	1.000	36.000	.000	.446
Delay	Pillai's Trace	.167	7.223[b]	1.000	36.000	.011	.167
	Wilks' Lambda	.833	7.223[b]	1.000	36.000	.011	.167
	Hotelling's Trace	.201	7.223[b]	1.000	36.000	.011	.167
	Roy's Largest Root	.201	7.223[b]	1.000	36.000	.011	.167
Valence * Cue	Pillai's Trace	.096	1.866[b]	2.000	35.000	.170	.096
	Wilks' Lambda	.904	1.866[b]	2.000	35.000	.170	.096
	Hotelling's Trace	.107	1.866[b]	2.000	35.000	.170	.096
	Roy's Largest Root	.107	1.866[b]	2.000	35.000	.170	.096
Valence * Delay	Pillai's Trace	.011	.202[b]	2.000	35.000	.818	.011
	Wilks' Lambda	.989	.202[b]	2.000	35.000	.818	.011
	Hotelling's Trace	.012	.202[b]	2.000	35.000	.818	.011
	Roy's Largest Root	.012	.202[b]	2.000	35.000	.818	.011
Cue * Delay	Pillai's Trace	.097	3.880[b]	1.000	36.000	.057	.097
	Wilks' Lambda	.903	3.880[b]	1.000	36.000	.057	.097
	Hotelling's Trace	.108	3.880[b]	1.000	36.000	.057	.097
	Roy's Largest Root	.108	3.880[b]	1.000	36.000	.057	.097
Valence * Cue * Delay	Pillai's Trace	.213	4.749[b]	2.000	35.000	.015	.213
	Wilks' Lambda	.787	4.749[b]	2.000	35.000	.015	.213
	Hotelling's Trace	.271	4.749[b]	2.000	35.000	.015	.213
	Roy's Largest Root	.271	4.749[b]	2.000	35.000	.015	.213

a. Design: Intercept
Within Subjects Design: Valence + Cue + Delay + Valence * Cue + Valence * Delay + Cue * Delay + Valence * Cue * Delay

b. Exact statistic

Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b] Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Valence	.929	2.591	2	.274	.933	.982	.500
Cue	1.000	.000	0	.	1.000	1.000	1.000
Delay	1.000	.000	0	.	1.000	1.000	1.000
Valence * Cue	.889	4.102	2	.129	.900	.945	.500
Valence * Delay	.922	2.833	2	.243	.928	.976	.500
Cue * Delay	1.000	.000	0	.	1.000	1.000	1.000
Valence * Cue * Delay	.872	4.785	2	.091	.887	.929	.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept
Within Subjects Design: Valence + Cue + Delay + Valence * Cue + Valence * Delay + Cue * Delay + Valence * Cue * Delay

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Valence	Sphericity Assumed	.015	2	.007	2.883	.062	.074
	Greenhouse-Geisser	.015	1.867	.008	2.883	.066	.074
	Huynh-Feldt	.015	1.965	.008	2.883	.063	.074
	Lower-bound	.015	1.000	.015	2.883	.098	.074
Error(Valence)	Sphericity Assumed	.186	72	.003			
	Greenhouse-Geisser	.186	67.205	.003			
	Huynh-Feldt	.186	70.740	.003			
	Lower-bound	.186	36.000	.005			
Cue	Sphericity Assumed	.461	1	.461	28.939	.000	.446
	Greenhouse-Geisser	.461	1.000	.461	28.939	.000	.446
	Huynh-Feldt	.461	1.000	.461	28.939	.000	.446
	Lower-bound	.461	1.000	.461	28.939	.000	.446
Error(Cue)	Sphericity Assumed	.574	36	.016			
	Greenhouse-Geisser	.574	36.000	.016			
	Huynh-Feldt	.574	36.000	.016			
	Lower-bound	.574	36.000	.016			
Delay	Sphericity Assumed	.043	1	.043	7.223	.011	.167
	Greenhouse-Geisser	.043	1.000	.043	7.223	.011	.167
	Huynh-Feldt	.043	1.000	.043	7.223	.011	.167
	Lower-bound	.043	1.000	.043	7.223	.011	.167

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Error(Delay)	Sphericity Assumed	.215	36	.006			
	Greenhouse-Geisser	.215	36.000	.006			
	Huynh-Feldt	.215	36.000	.006			
	Lower-bound	.215	36.000	.006			
Valence * Cue	Sphericity Assumed	.007	2	.004	1.349	.266	.036
	Greenhouse-Geisser	.007	1.801	.004	1.349	.265	.036
	Huynh-Feldt	.007	1.890	.004	1.349	.266	.036
	Lower-bound	.007	1.000	.007	1.349	.253	.036
Error(Valence*Cue)	Sphericity Assumed	.195	72	.003			
	Greenhouse-Geisser	.195	64.830	.003			
	Huynh-Feldt	.195	68.035	.003			
	Lower-bound	.195	36.000	.005			
Valence * Delay	Sphericity Assumed	.001	2	.000	.170	.844	.005
	Greenhouse-Geisser	.001	1.856	.000	.170	.828	.005
	Huynh-Feldt	.001	1.952	.000	.170	.839	.005
	Lower-bound	.001	1.000	.001	.170	.682	.005
Error (Valence*Delay)	Sphericity Assumed	.168	72	.002			
	Greenhouse-Geisser	.168	66.805	.003			
	Huynh-Feldt	.168	70.284	.002			
	Lower-bound	.168	36.000	.005			
Cue * Delay	Sphericity Assumed	.014	1	.014	3.880	.057	.097
	Greenhouse-Geisser	.014	1.000	.014	3.880	.057	.097
	Huynh-Feldt	.014	1.000	.014	3.880	.057	.097
	Lower-bound	.014	1.000	.014	3.880	.057	.097
Error(Cue*Delay)	Sphericity Assumed	.131	36	.004			
	Greenhouse-Geisser	.131	36.000	.004			
	Huynh-Feldt	.131	36.000	.004			
	Lower-bound	.131	36.000	.004			
Valence * Cue * Delay	Sphericity Assumed	.018	2	.009	3.273	.044	.083
	Greenhouse-Geisser	.018	1.773	.010	3.273	.050	.083
	Huynh-Feldt	.018	1.859	.010	3.273	.047	.083
	Lower-bound	.018	1.000	.018	3.273	.079	.083
Error (Valence*Cue*Delay)	Sphericity Assumed	.195	72	.003			
	Greenhouse-Geisser	.195	63.842	.003			
	Huynh-Feldt	.195	66.911	.003			
	Lower-bound	.195	36.000	.005			

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	Valence	Cue	Delay	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Valence	Linear			.002	1	.002	4.692	.037	.115
	Quadratic			.001	1	.001	1.620	.211	.043
Error(Valence)	Linear			.019	36	.001			
	Quadratic			.027	36	.001			
Cue		Level 1 vs. Level 2		.461	1	.461	28.939	.000	.446
Error(Cue)		Level 1 vs. Level 2		.574	36	.016			
Delay			Level 1 vs. Level 2	.043	1	.043	7.223	.011	.167
Error(Delay)			Level 1 vs. Level 2	.215	36	.006			
Valence * Cue	Linear	Level 1 vs. Level 2		.007	1	.007	3.775	.060	.095
	Quadratic	Level 1 vs. Level 2		2.749E-5	1	2.749E-5	.008	.930	.000
Error(Valence*Cue)	Linear	Level 1 vs. Level 2		.069	36	.002			
	Quadratic	Level 1 vs. Level 2		.126	36	.003			
Valence * Delay	Linear		Level 1 vs. Level 2	.000	1	.000	.137	.714	.004
	Quadratic		Level 1 vs. Level 2	.000	1	.000	.226	.637	.006
Error (Valence*Delay)	Linear		Level 1 vs. Level 2	.105	36	.003			
	Quadratic		Level 1 vs. Level 2	.063	36	.002			
Cue * Delay		Level 1 vs. Level 2	Level 1 vs. Level 2	.056	1	.056	3.880	.057	.097
Error(Cue*Delay)		Level 1 vs. Level 2	Level 1 vs. Level 2	.522	36	.015			
Valence * Cue * Delay	Linear	Level 1 vs. Level 2	Level 1 vs. Level 2	.067	1	.067	9.565	.004	.210
	Quadratic	Level 1 vs. Level 2	Level 1 vs. Level 2	.004	1	.004	.288	.595	.008
Error (Valence*Cue*Delay)	Linear	Level 1 vs. Level 2	Level 1 vs. Level 2	.250	36	.007			
	Quadratic	Level 1 vs. Level 2	Level 1 vs. Level 2	.538	36	.015			

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	85.614	1	85.614	6073.101	.000	.994
Error	.508	36	.014			

Estimated Marginal Means

1. Grand Mean

Measure: MEASURE_1

Mean	Std. Error	95% Confidence Interval	
		Lower Bound	Upper Bound
.878	.011	.855	.901

2. Valence

Measure: MEASURE_1

Valence	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	.875	.011	.852	.898
2	.874	.013	.847	.900
3	.886	.011	.864	.909

3. Cue

Measure: MEASURE_1

Cue	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	.846	.015	.815	.877
2	.910	.009	.892	.929

4. Delay

Measure: MEASURE_1

Delay	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	.868	.012	.844	.892
2	.888	.012	.864	.912

5. Valence * Cue

Measure: MEASURE_1

Valence	Cue	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
1	1	.837	.017	.803	.872
	2	.912	.008	.895	.929
2	1	.842	.016	.809	.875
	2	.905	.013	.880	.931
3	1	.859	.016	.828	.890
	2	.914	.010	.894	.934

6. Valence * Delay

Measure: MEASURE_1

Valence	Delay	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
1	1	.864	.012	.840	.889
	2	.885	.012	.860	.910
2	1	.862	.014	.834	.891
	2	.885	.014	.857	.912
3	1	.878	.012	.854	.903
	2	.894	.012	.870	.919

7. Cue * Delay

Measure: MEASURE_1

Cue	Delay	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
1	1	.831	.016	.797	.864
	2	.861	.016	.828	.895
2	1	.906	.010	.887	.926
	2	.915	.011	.893	.936

8. Valence * Cue * Delay

Measure: MEASURE_1

Valence	Cue	Delay	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
1	1	1	.815	.019	.776	.854
		2	.860	.018	.824	.895
	2	1	.914	.008	.897	.931
		2	.910	.011	.888	.933
2	1	1	.823	.019	.785	.860
		2	.861	.018	.824	.898
	2	1	.902	.014	.874	.930
		2	.909	.014	.879	.938
3	1	1	.854	.016	.821	.886
		2	.864	.017	.829	.899
	2	1	.903	.012	.879	.927
		2	.925	.011	.903	.947

```
T-TEST PAIRS=ACC_Col_Sh_IncongWITH ACC_Col_Long_Incong(PAIRED)
 /CRITERIA=CI(.9500)
 /MISSING=ANALYSIS.
```

T-Test

Notes

Output Created		18-NOV-2016 09:15...
Comments		
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	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	37
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST PAIRS=ACC_Col_Sh_Incong WITH ACC_Col_Long_Incong (PAIRED) /CRITERIA=CI(.9500) /MISSING=ANALYSIS.
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	ACC_Col_Sh_Incong	.8305	37	.09921	.01631
	ACC_Col_Long_Incong	.8615	37	.09958	.01637

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	ACC_Col_Sh_Incong & ACC_Col_Long_Incong	37	.794	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	ACC_Col_Sh_Incon - ACC_Col_Long_Incong	-.03097	.06381	.01049	-.05224	-.00969	-2.952	36	.006

```
T-TEST PAIRS=ACCPlea_Col_Short_InconACCNeu_Col_Short_InconACCUnp_Col_Short_I
ncon
    ACCPlea_Word_Short_InconACCNeu_Word_Short_InconACCUnp_Word_Short_InconW
ITH
    ACCPlea_Col_Long_InconACCNeu_Col_Long_InconACCUnp_Col_Long_InconACCPlea
_Word_Long_Incon
    ACCNeu_Word_Long_InconACCUnp_Word_Long_Incon(PAIRED)
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  /MISSING=ANALYSIS.
```

T-Test

Notes

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	Split File	<none>
	N of Rows in Working Data File	37
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.

Notes

Syntax		T-TEST PAIRS=ACCPlea_Col_Short_Incon ACCNeu_Col_Short_Incon ACCUnp_Col_Short_Incon ACCPlea_Word_Short_Incon ACCNeu_Word_Short_Incon ACCUnp_Word_Short_Incon WITH ACCPlea_Col_Long_Incon ACCNeu_Col_Long_Incon ACCUnp_Col_Long_Incon ACCPlea_Word_Long_Incon ACCNeu_Word_Long_Incon ACCUnp_Word_Long_Incon (PAIRED) /CRITERIA=CI(.9500) /MISSING=ANALYSIS.
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Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	ACCPlea_Col_Short_Incon	.8150	37	.11771	.01935
	ACCPlea_Col_Long_Incon	.8598	37	.10664	.01753
Pair 2	ACCNeu_Col_Short_Incon	.8226	37	.11293	.01857
	ACCNeu_Col_Long_Incon	.8606	37	.11063	.01819
Pair 3	ACCUnp_Col_Short_Incon	.8539	37	.09745	.01602
	ACCUnp_Col_Long_Incon	.8640	37	.10628	.01747
Pair 4	ACCPlea_Word_Short_Incon	.9139	37	.05018	.00825
	ACCPlea_Word_Long_Incon	.9105	37	.06677	.01098
Pair 5	ACCNeu_Word_Short_Incon	.9020	37	.08532	.01403
	ACCNeu_Word_Long_Incon	.9088	37	.08789	.01445
Pair 6	ACCUnp_Word_Short_Incon	.9029	37	.07171	.01179
	ACCUnp_Word_Long_Incon	.9248	37	.06689	.01100

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	ACCPlea_Col_Short_Incon & ACCPlea_Col_Long_Incon	37	.695	.000
Pair 2	ACCNeu_Col_Short_Incon & ACCNeu_Col_Long_Incon	37	.568	.000
Pair 3	ACCUnp_Col_Short_Incon & ACCUnp_Col_Long_Incon	37	.713	.000
Pair 4	ACCPlea_Word_Short_Incon & ACCPlea_Word_Long_Incon	37	.476	.003
Pair 5	ACCNeu_Word_Short_Incon & ACCNeu_Word_Long_Incon	37	.588	.000
Pair 6	ACCUnp_Word_Short_Incon & ACCUnp_Word_Long_Incon	37	.505	.001

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	ACCPlea_Col_Short_Incon - ACCPlea_Col_Long_Incon	-.04476	.08825	.01451	-.07419	-.01534	-3.085	36	.004
Pair 2	ACCNeu_Col_Short_Incon - ACCNeu_Col_Long_Incon	-.03801	.10394	.01709	-.07266	-.00335	-2.224	36	.032
Pair 3	ACCUnp_Col_Short_Incon - ACCUnp_Col_Long_Incon	-.01014	.07762	.01276	-.03602	.01575	-.794	36	.432
Pair 4	ACCPlea_Word_Short_Incon - ACCPlea_Word_Long_Incon	.00338	.06153	.01012	-.01714	.02389	.334	36	.740
Pair 5	ACCNeu_Word_Short_Incon - ACCNeu_Word_Long_Incon	-.00676	.07869	.01294	-.03299	.01948	-.522	36	.605
Pair 6	ACCUnp_Word_Short_Incon - ACCUnp_Word_Long_Incon	-.02196	.06904	.01135	-.04498	.00106	-1.935	36	.061

Notes

Output Created		16-NOV-2016 14:55...
Comments		
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	N of Rows in Working Data File	37
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the model.

```
GLM RTPlea_Col_Short_InconRTPlea_Col_Long_InconRTPlea_Word_Short_InconRTPle
a_Word_Long_Incon
    RTNeu_Col_Short_InconRTNeu_Col_Long_InconRTNeu_Word_Short_InconRTNeu_Wo
rd_Long_Incon
    RTUnp_Col_Short_InconRTUnp_Col_Long_InconRTUnp_Word_Short_InconRTUnp_Wo
rd_Long_Incon
  /WSFACTOR=Valence 3 Polynomial Cue 2 Polynomial Delay 2 Polynomial
  /METHOD=SSTYPE(3)
  /EMMEANS=TABLES(OVERALL)
  /EMMEANS=TABLES(Valence) COMPARE ADJ(BONFERRONI)
  /EMMEANS=TABLES(Cue) COMPARE ADJ(BONFERRONI)
  /EMMEANS=TABLES(Delay) COMPARE ADJ(BONFERRONI)
  /EMMEANS=TABLES(Valence*Cue)
  /EMMEANS=TABLES(Valence*Delay)
  /EMMEANS=TABLES(Cue*Delay)
  /EMMEANS=TABLES(Valence*Cue*Delay)
  /PRINT=DESCRIPTIVE ETASQ
  /CRITERIA=ALPHA(.05)
  /WSDESIGN=Valence Cue Delay Valence*Cue Valence*Delay Cue*Delay Valence*Cue*
Delay.
```

General Linear Model

Notes

Output Created		16-NOV-2016 14:55...
Comments		
Input	Data	/Users/larsonresearch1/Desktop/Hilary/SPSS for Master's Thesis/PosAffect_Behav_Ratings_Rev.sav
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	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	37
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the model.

Notes

Syntax		GLM RTPlea_Col_Short_Incon RTPlea_Col_Long_Incon RTPlea_Word_Short_Incon RTPlea_Word_Long_Incon RTNeu_Col_Short_Incon RTNeu_Col_Long_Incon RTNeu_Word_Short_Incon RTNeu_Word_Long_Incon RTUnp_Col_Short_Incon RTUnp_Col_Long_Incon RTUnp_Word_Short_Incon RTUnp_Word_Long_Incon /WSFACTOR=Valence 3 Polynomial Cue 2 Polynomial Delay 2 Polynomial /METHOD=SSTYPE(3) /EMMEANS=TABLES(OVERALL) /EMMEANS=TABLES(Valence) COMPARE ADJ(BONFERRONI) /EMMEANS=TABLES(Cue) COMPARE ADJ(BONFERRONI) /EMMEANS=TABLES(Delay) COMPARE ADJ(BONFERRONI) /EMMEANS=TABLES(Valence*Cue) /EMMEANS=TABLES(Valence*Delay) /EMMEANS=TABLES(Cue*Delay) /EMMEANS=TABLES(Valence*Cue*Delay) /PRINT=DESCRIPTIVE ETASQ /CRITERIA=ALPHA(.05) /WSDESIGN=Valence Cue Delay Valence*Cue Valence*Delay Cue*Delay Valence*Cue*Delay.
Resources	Processor Time	00:00:00.04
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Within-Subjects Factors

Measure: MEASURE_1

Valence	Cue	Delay	Dependent Variable
1	1	1	RTPlea_Col_Short_Incon
		2	RTPlea_Col_Long_Incon
	2	1	RTPlea_Word_Short_Incon
		2	RTPlea_Word_Long_Incon
2	1	1	RTNeu_Col_Short_Incon
		2	RTNeu_Col_Long_Incon
	2	1	RTNeu_Word_Short_Incon
		2	RTNeu_Word_Long_Incon
3	1	1	RTUnp_Col_Short_Incon
		2	RTUnp_Col_Long_Incon
	2	1	RTUnp_Word_Short_Incon
		2	RTUnp_Word_Long_Incon

Descriptive Statistics

	Mean	Std. Deviation	N
RTPlea_Col_Short_Incon	945.1647	171.07931	37
RTPlea_Col_Long_Incon	938.0701	177.23463	37
RTPlea_Word_Short_Incon	898.4012	148.91731	37
RTPlea_Word_Long_Incon	908.7568	171.53184	37
RTNeu_Col_Short_Incon	940.1681	166.38418	37
RTNeu_Col_Long_Incon	941.6318	188.51226	37
RTNeu_Word_Short_Incon	911.6073	157.34220	37
RTNeu_Word_Long_Incon	889.1554	162.66936	37
RTUnp_Col_Short_Incon	944.7956	186.66624	37
RTUnp_Col_Long_Incon	933.7787	169.80602	37
RTUnp_Word_Short_Incon	923.7720	160.26164	37
RTUnp_Word_Long_Incon	905.4181	175.49767	37

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Valence	Pillai's Trace	.020	.362[b]	2.000	35.000	.699	.020
	Wilks' Lambda	.980	.362[b]	2.000	35.000	.699	.020
	Hotelling's Trace	.021	.362[b]	2.000	35.000	.699	.020
	Roy's Largest Root	.021	.362[b]	2.000	35.000	.699	.020
Cue	Pillai's Trace	.211	9.607[b]	1.000	36.000	.004	.211
	Wilks' Lambda	.789	9.607[b]	1.000	36.000	.004	.211
	Hotelling's Trace	.267	9.607[b]	1.000	36.000	.004	.211
	Roy's Largest Root	.267	9.607[b]	1.000	36.000	.004	.211
Delay	Pillai's Trace	.008	.281[b]	1.000	36.000	.600	.008
	Wilks' Lambda	.992	.281[b]	1.000	36.000	.600	.008
	Hotelling's Trace	.008	.281[b]	1.000	36.000	.600	.008
	Roy's Largest Root	.008	.281[b]	1.000	36.000	.600	.008
Valence * Cue	Pillai's Trace	.037	.665[b]	2.000	35.000	.521	.037
	Wilks' Lambda	.963	.665[b]	2.000	35.000	.521	.037
	Hotelling's Trace	.038	.665[b]	2.000	35.000	.521	.037
	Roy's Largest Root	.038	.665[b]	2.000	35.000	.521	.037
Valence * Delay	Pillai's Trace	.043	.786[b]	2.000	35.000	.463	.043
	Wilks' Lambda	.957	.786[b]	2.000	35.000	.463	.043
	Hotelling's Trace	.045	.786[b]	2.000	35.000	.463	.043
	Roy's Largest Root	.045	.786[b]	2.000	35.000	.463	.043
Cue * Delay	Pillai's Trace	.004	.133[b]	1.000	36.000	.717	.004
	Wilks' Lambda	.996	.133[b]	1.000	36.000	.717	.004
	Hotelling's Trace	.004	.133[b]	1.000	36.000	.717	.004
	Roy's Largest Root	.004	.133[b]	1.000	36.000	.717	.004
Valence * Cue * Delay	Pillai's Trace	.050	.931[b]	2.000	35.000	.404	.050
	Wilks' Lambda	.950	.931[b]	2.000	35.000	.404	.050
	Hotelling's Trace	.053	.931[b]	2.000	35.000	.404	.050
	Roy's Largest Root	.053	.931[b]	2.000	35.000	.404	.050

a. Design: Intercept
Within Subjects Design: Valence + Cue + Delay + Valence * Cue + Valence * Delay + Cue * Delay + Valence * Cue * Delay

b. Exact statistic

Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Valence	.900	3.691	2	.158	.909	.955	.500
Cue	1.000	.000	0	.	1.000	1.000	1.000
Delay	1.000	.000	0	.	1.000	1.000	1.000
Valence * Cue	.946	1.943	2	.378	.949	1.000	.500
Valence * Delay	.955	1.596	2	.450	.957	1.000	.500
Cue * Delay	1.000	.000	0	.	1.000	1.000	1.000
Valence * Cue * Delay	.977	.810	2	.667	.978	1.000	.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept
Within Subjects Design: Valence + Cue + Delay + Valence * Cue + Valence * Delay + Cue * Delay + Valence * Cue * Delay

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Valence	Sphericity Assumed	3077.843	2	1538.922	.410	.665	.011
	Greenhouse-Geisser	3077.843	1.818	1692.934	.410	.646	.011
	Huynh-Feldt	3077.843	1.909	1611.920	.410	.656	.011
	Lower-bound	3077.843	1.000	3077.843	.410	.526	.011
Error(Valence)	Sphericity Assumed	270241.572	72	3753.355			
	Greenhouse-Geisser	270241.572	65.450	4128.985			
	Huynh-Feldt	270241.572	68.739	3931.394			
	Lower-bound	270241.572	36.000	7506.710			
Cue	Sphericity Assumed	131478.120	1	131478.120	9.607	.004	.211
	Greenhouse-Geisser	131478.120	1.000	131478.120	9.607	.004	.211
	Huynh-Feldt	131478.120	1.000	131478.120	9.607	.004	.211
	Lower-bound	131478.120	1.000	131478.120	9.607	.004	.211
Error(Cue)	Sphericity Assumed	492705.582	36	13686.266			
	Greenhouse-Geisser	492705.582	36.000	13686.266			
	Huynh-Feldt	492705.582	36.000	13686.266			
	Lower-bound	492705.582	36.000	13686.266			
Delay	Sphericity Assumed	6839.509	1	6839.509	.281	.600	.008
	Greenhouse-Geisser	6839.509	1.000	6839.509	.281	.600	.008
	Huynh-Feldt	6839.509	1.000	6839.509	.281	.600	.008
	Lower-bound	6839.509	1.000	6839.509	.281	.600	.008

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Error(Delay)	Sphericity Assumed	877333.094	36	24370.364			
	Greenhouse-Geisser	877333.094	36.000	24370.364			
	Huynh-Feldt	877333.094	36.000	24370.364			
	Lower-bound	877333.094	36.000	24370.364			
Valence * Cue	Sphericity Assumed	5361.923	2	2680.962	.843	.435	.023
	Greenhouse-Geisser	5361.923	1.898	2825.752	.843	.429	.023
	Huynh-Feldt	5361.923	2.000	2680.962	.843	.435	.023
	Lower-bound	5361.923	1.000	5361.923	.843	.365	.023
Error(Valence*Cue)	Sphericity Assumed	228937.320	72	3179.685			
	Greenhouse-Geisser	228937.320	68.311	3351.410			
	Huynh-Feldt	228937.320	72.000	3179.685			
	Lower-bound	228937.320	36.000	6359.370			
Valence * Delay	Sphericity Assumed	5312.957	2	2656.478	.692	.504	.019
	Greenhouse-Geisser	5312.957	1.915	2774.884	.692	.498	.019
	Huynh-Feldt	5312.957	2.000	2656.478	.692	.504	.019
	Lower-bound	5312.957	1.000	5312.957	.692	.411	.019
Error (Valence*Delay)	Sphericity Assumed	276228.370	72	3836.505			
	Greenhouse-Geisser	276228.370	68.928	4007.508			
	Huynh-Feldt	276228.370	72.000	3836.505			
	Lower-bound	276228.370	36.000	7673.010			
Cue * Delay	Sphericity Assumed	587.391	1	587.391	.133	.717	.004
	Greenhouse-Geisser	587.391	1.000	587.391	.133	.717	.004
	Huynh-Feldt	587.391	1.000	587.391	.133	.717	.004
	Lower-bound	587.391	1.000	587.391	.133	.717	.004
Error(Cue*Delay)	Sphericity Assumed	158539.570	36	4403.877			
	Greenhouse-Geisser	158539.570	36.000	4403.877			
	Huynh-Feldt	158539.570	36.000	4403.877			
	Lower-bound	158539.570	36.000	4403.877			
Valence * Cue * Delay	Sphericity Assumed	8017.818	2	4008.909	1.060	.352	.029
	Greenhouse-Geisser	8017.818	1.955	4100.662	1.060	.351	.029
	Huynh-Feldt	8017.818	2.000	4008.909	1.060	.352	.029
	Lower-bound	8017.818	1.000	8017.818	1.060	.310	.029
Error (Valence*Cue*Delay)	Sphericity Assumed	272361.006	72	3782.792			
	Greenhouse-Geisser	272361.006	70.389	3869.369			
	Huynh-Feldt	272361.006	72.000	3782.792			
	Lower-bound	272361.006	36.000	7565.583			

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	Valence	Cue	Delay	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Valence	Linear			1395.701	1	1395.701	.512	.479	.014
	Quadratic			1682.142	1	1682.142	.352	.557	.010
Error(Valence)	Linear			98068.693	36	2724.130			
	Quadratic			172172.878	36	4782.580			
Cue		Linear		131478.120	1	131478.120	9.607	.004	.211
Error(Cue)		Linear		492705.582	36	13686.266			
Delay			Linear	6839.509	1	6839.509	.281	.600	.008
Error(Delay)			Linear	877333.094	36	24370.364			
Valence * Cue	Linear	Linear		3295.281	1	3295.281	.988	.327	.027
	Quadratic	Linear		2066.642	1	2066.642	.684	.414	.019
Error(Valence*Cue)	Linear	Linear		120089.789	36	3335.827			
	Quadratic	Linear		108847.530	36	3023.543			
Valence * Delay	Linear		Linear	4924.846	1	4924.846	1.586	.216	.042
	Quadratic		Linear	388.111	1	388.111	.085	.772	.002
Error (Valence*Delay)	Linear		Linear	111765.692	36	3104.603			
	Quadratic		Linear	164462.679	36	4568.408			
Cue * Delay		Linear	Linear	587.391	1	587.391	.133	.717	.004
Error(Cue*Delay)		Linear	Linear	158539.570	36	4403.877			
Valence * Cue * Delay	Linear	Linear	Linear	2841.616	1	2841.616	.859	.360	.023
	Quadratic	Linear	Linear	5176.203	1	5176.203	1.216	.277	.033
Error (Valence*Cue*Delay)	Linear	Linear	Linear	119111.168	36	3308.644			
	Quadratic	Linear	Linear	153249.838	36	4256.940			

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	378578902	1	378578902	1375.077	.000	.974
Error	9911327.46	36	275314.652			

Estimated Marginal Means

1. Grand Mean

Measure: MEASURE_1

Mean	Std. Error	95% Confidence Interval	
		Lower Bound	Upper Bound
923.393	24.901	872.891	973.896

2. Valence

Estimates

Measure: MEASURE_1

Valence	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
1	922.598	24.781	872.340	972.856
2	920.641	25.398	869.131	972.150
3	926.941	25.530	875.163	978.719

Pairwise Comparisons

Measure: MEASURE_1

(I) Valence	(J) Valence	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a] Lower Bound	Upper Bound
1	2	1.958	7.124	1.000	-15.930	19.845
	3	-4.343	6.067	1.000	-19.578	10.892
2	1	-1.958	7.124	1.000	-19.845	15.930
	3	-6.300	8.038	1.000	-26.483	13.882
3	1	4.343	6.067	1.000	-10.892	19.578
	2	6.300	8.038	1.000	-13.882	26.483

Based on estimated marginal means

a. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Pillai's trace	.020	.362[a]	2.000	35.000	.699	.020
Wilks' lambda	.980	.362[a]	2.000	35.000	.699	.020
Hotelling's trace	.021	.362[a]	2.000	35.000	.699	.020
Roy's largest root	.021	.362[a]	2.000	35.000	.699	.020

Each F tests the multivariate effect of Valence. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

3. Cue

Estimates

Measure: MEASURE_1

Cue	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
1	940.601	26.633	886.588	994.615
2	906.185	24.342	856.818	955.552

Pairwise Comparisons

Measure: MEASURE_1

(I) Cue	(J) Cue	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b] Lower Bound	Upper Bound
1	2	34.416*	11.104	.004	11.896	56.936
2	1	-34.416*	11.104	.004	-56.936	-11.896

Based on estimated marginal means

*. The mean difference is significant at the

b. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Pillai's trace	.211	9.607[a]	1.000	36.000	.004	.211
Wilks' lambda	.789	9.607[a]	1.000	36.000	.004	.211
Hotelling's trace	.267	9.607[a]	1.000	36.000	.004	.211
Roy's largest root	.267	9.607[a]	1.000	36.000	.004	.211

Each F tests the multivariate effect of Cue. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

4. Delay

Estimates

Measure: MEASURE_1

Delay	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
1	927.318	25.373	875.859	978.777
2	919.468	26.573	865.575	973.362

Pairwise Comparisons

Measure: MEASURE_1

(I) Delay	(J) Delay	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a] Lower Bound	Upper Bound
1	2	7.850	14.817	.600	-22.201	37.901
2	1	-7.850	14.817	.600	-37.901	22.201

Based on estimated marginal means

a. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Pillai's trace	.008	.281 [a]	1.000	36.000	.600	.008
Wilks' lambda	.992	.281 [a]	1.000	36.000	.600	.008
Hotelling's trace	.008	.281 [a]	1.000	36.000	.600	.008
Roy's largest root	.008	.281 [a]	1.000	36.000	.600	.008

Each F tests the multivariate effect of Delay. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

5. Valence * Cue

Measure: MEASURE_1

Valence	Cue	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
1	1	941.617	27.310	886.229	997.005
	2	903.579	24.334	854.228	952.930
2	1	940.900	27.317	885.499	996.301
	2	900.381	25.116	849.443	951.320
3	1	939.287	27.042	884.444	994.130
	2	914.595	25.427	863.027	966.163

6. Valence * Delay

Measure: MEASURE_1

Valence	Delay	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
1	1	921.783	24.982	871.117	972.449
	2	923.413	27.244	868.160	978.667
2	1	925.888	25.278	874.621	977.154
	2	915.394	27.652	859.313	971.475
3	1	934.284	27.285	878.948	989.620
	2	919.598	27.212	864.410	974.787

7. Cue * Delay

Measure: MEASURE_1

Cue	Delay	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
1	1	943.376	27.899	886.795	999.957
	2	937.827	28.065	880.909	994.745
2	1	911.260	24.509	861.554	960.966
	2	901.110	26.385	847.598	954.622

8. Valence * Cue * Delay

Measure: MEASURE_1

Valence	Cue	Delay	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
1	1	1	945.165	28.125	888.124	1002.205
		2	938.070	29.137	878.977	997.163
	2	1	898.401	24.482	848.750	948.053
		2	908.757	28.200	851.565	965.948
2	1	1	940.168	27.353	884.693	995.643
		2	941.632	30.991	878.779	1004.485
	2	1	911.607	25.867	859.147	964.068
		2	889.155	26.743	834.919	943.392
3	1	1	944.796	30.688	882.558	1007.033
		2	933.779	27.916	877.163	990.395
	2	1	923.772	26.347	870.338	977.206
		2	905.418	28.852	846.904	963.932

ERP Data: P300

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General Linear Model

Notes

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	Cases Used	Statistics are based on all cases with valid data for all variables in the model.
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Within-Subjects Factors

Measure: MEASURE_1

P300	Dependent Variable
1	P300_Pleasant
2	P300_Neutral
3	P300_Unpleasant

Descriptive Statistics

	Mean	Std. Deviation	N
P300_Pleasant	3.99934821	2.49952159	41
P300_Neutral	4.90093333	2.47273475	41
P300_Unpleasant	4.42664232	2.67649610	41

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
P300	Pillai's Trace	.391	12.531[b]	2.000	39.000	.000	.391	25.061	.994
	Wilks' Lambda	.609	12.531[b]	2.000	39.000	.000	.391	25.061	.994
	Hotelling's Trace	.643	12.531[b]	2.000	39.000	.000	.391	25.061	.994
	Roy's Largest Root	.643	12.531[b]	2.000	39.000	.000	.391	25.061	.994

a. Design: Intercept
Within Subjects Design: P300

b. Exact statistic

c. Computed using alpha =

Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b] Greenhouse-Geisser	Huynh-Feldt	Lower-bound
P300	.785	9.460	2	.009	.823	.853	.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept
Within Subjects Design: P300

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
P300	Sphericity Assumed	16.679	2	8.339	17.748	.000	.307	35.496	1.000
	Greenhouse-Geisser	16.679	1.646	10.135	17.748	.000	.307	29.205	.999
	Huynh-Feldt	16.679	1.707	9.771	17.748	.000	.307	30.294	.999
	Lower-bound	16.679	1.000	16.679	17.748	.000	.307	17.748	.984
Error(P300)	Sphericity Assumed	37.590	80	.470					
	Greenhouse-Geisser	37.590	65.823	.571					
	Huynh-Feldt	37.590	68.277	.551					
	Lower-bound	37.590	40.000	.940					

a. Computed using alpha =

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	P300	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
P300	Linear	3.743	1	3.743	8.813	.005	.181	8.813	.826
	Quadratic	12.936	1	12.936	25.115	.000	.386	25.115	.998
Error(P300)	Linear	16.988	40	.425					
	Quadratic	20.602	40	.515					

a. Computed using alpha =

Tests of Between-Subjects Effects

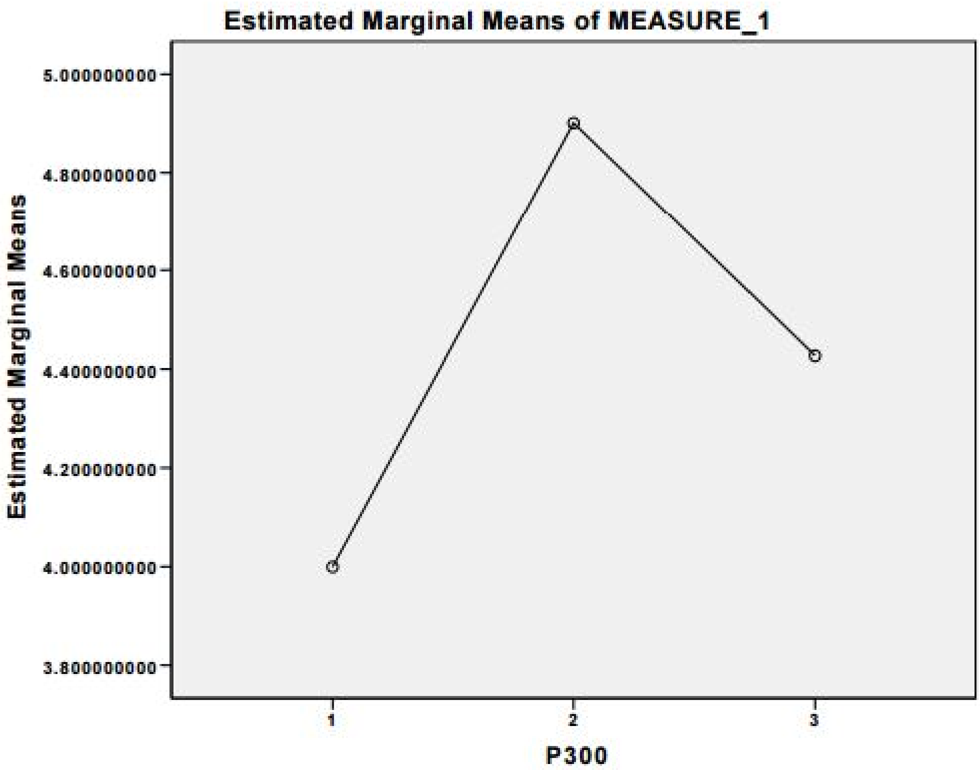
Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Intercept	2427.294	1	2427.294	130.599	.000	.766	130.599	1.000
Error	743.436	40	18.586					

a. Computed using alpha =

Profile Plots


Estimated Marginal Means of MEASURE_1
Estimated Marginal Means
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3.800000000
1
2
3
P300

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npleasant
    P300_Unpleasant (PAIRED)
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  /MISSING=ANALYSIS.
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T-Test

Notes

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	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
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ff_INS_8.11.16 (5).sav
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Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	P300_Pleasant	3.99934821	41	2.49952159	.390359690
	P300_Neutral	4.90093333	41	2.47273475	.386176289
Pair 2	P300_Neutral	4.90093333	41	2.47273475	.386176289
	P300_Unpleasant	4.42664232	41	2.67649610	.417998465
Pair 3	P300_Pleasant	3.99934821	41	2.49952159	.390359690
	P300_Unpleasant	4.42664232	41	2.67649610	.417998465

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	P300_Pleasant & P300_Neutral	41	.890	.000
Pair 2	P300_Neutral & P300_Unpleasant	41	.957	.000
Pair 3	P300_Pleasant & P300_Unpleasant	41	.939	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	P300_Pleasant - P300_Neutral	-.90158512	1.16380659	.181756053	-1.2689278	-.53424244	-4.960	40	.000
Pair 2	P300_Neutral - P300_Unpleasant	.474291011	.784484865	.122515952	.226677035	.721904987	3.871	40	.000
Pair 3	P300_Pleasant - P300_Unpleasant	-.42729411	.921639159	.143935855	-.71819933	-.13638890	-2.969	40	.005

ERP Data: Cue-Related Slow Wave

```
GLM Color_Pleasant_F3Word_Pleasant_F3Color_Neutral_F3Word_Neutral_F3Color_
Unpleasant_F3
    Word_Unpleasant_F3
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General Linear Model

Notes

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	Cases Used	Statistics are based on all cases with valid data for all variables in the model.

Notes

Syntax		GLM Color_Pleasant_F3 Word_Pleasant_F3 Color_Neutral_F3 Word_Neutral_F3 Color_Unpleasant_F3 Word_Unpleasant_F3 /WSFACTOR=CueSW_Pic 3 Polynomial CueSW_Cue 2 Polynomial /METHOD=SSTYPE(3) /PLOT=PROFILE (CueSW_Pic*CueSW_Cue) /EMMEANS=TABLES (OVERALL) /EMMEANS=TABLES (CueSW_Pic) /EMMEANS=TABLES (CueSW_Cue) /EMMEANS=TABLES (CueSW_Pic*CueSW_Cue) /PRINT=DESCRIPTIVE ETASQ /CRITERIA=ALPHA(.05) /WSDESIGN=CueSW_Pic CueSW_Cue CueSW_Pic*CueSW_Cue.
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Within-Subjects Factors

Measure: MEASURE_1

CueSW_Pic	CueSW_Cue	Dependent Variable
1	1	Color_Pleasant_F3
	2	Word_Pleasant_F3
2	1	Color_Neutral_F3
	2	Word_Neutral_F3
3	1	Color_Unpleasant_F3
	2	Word_Unpleasant_F3

Descriptive Statistics

	Mean	Std. Deviation	N
Color_Pleasant_F3	1.19572550	1.74497167	41
Word_Pleasant_F3	1.22802077	1.90791691	41
Color_Neutral_F3	1.33153396	1.37767522	41
Word_Neutral_F3	1.25822186	1.75597929	41
Color_Unpleasant_F3	1.59829105	1.68918706	41
Word_Unpleasant_F3	1.55100853	1.97083891	41

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
CueSW_Pic	Pillai's Trace	.132	2.963[b]	2.000	39.000	.063	.132
	Wilks' Lambda	.868	2.963[b]	2.000	39.000	.063	.132
	Hotelling's Trace	.152	2.963[b]	2.000	39.000	.063	.132
	Roy's Largest Root	.152	2.963[b]	2.000	39.000	.063	.132
CueSW_Cue	Pillai's Trace	.001	.047[b]	1.000	40.000	.830	.001
	Wilks' Lambda	.999	.047[b]	1.000	40.000	.830	.001
	Hotelling's Trace	.001	.047[b]	1.000	40.000	.830	.001
	Roy's Largest Root	.001	.047[b]	1.000	40.000	.830	.001
CueSW_Pic * CueSW_Cue	Pillai's Trace	.004	.076[b]	2.000	39.000	.927	.004
	Wilks' Lambda	.996	.076[b]	2.000	39.000	.927	.004
	Hotelling's Trace	.004	.076[b]	2.000	39.000	.927	.004
	Roy's Largest Root	.004	.076[b]	2.000	39.000	.927	.004

a. Design: Intercept
Within Subjects Design: CueSW_Pic + CueSW_Cue + CueSW_Pic * CueSW_Cue

b. Exact statistic

Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b] Greenhouse-Geisser	Huynh-Feldt	Lower-bound
CueSW_Pic	.993	.286	2	.867	.993	1.000	.500
CueSW_Cue	1.000	.000	0	.	1.000	1.000	1.000
CueSW_Pic * CueSW_Cue	.995	.207	2	.902	.995	1.000	.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept
Within Subjects Design: CueSW_Pic + CueSW_Cue + CueSW_Pic * CueSW_Cue

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
CueSW_Pic	Sphericity Assumed	5.925	2	2.963	3.291	.042	.076
	Greenhouse-Geisser	5.925	1.986	2.984	3.291	.043	.076
	Huynh-Feldt	5.925	2.000	2.963	3.291	.042	.076
	Lower-bound	5.925	1.000	5.925	3.291	.077	.076
Error(CueSW_Pic)	Sphericity Assumed	72.006	80	.900			
	Greenhouse-Geisser	72.006	79.420	.907			
	Huynh-Feldt	72.006	80.000	.900			
	Lower-bound	72.006	40.000	1.800			
CueSW_Cue	Sphericity Assumed	.053	1	.053	.047	.830	.001
	Greenhouse-Geisser	.053	1.000	.053	.047	.830	.001
	Huynh-Feldt	.053	1.000	.053	.047	.830	.001
	Lower-bound	.053	1.000	.053	.047	.830	.001
Error(CueSW_Cue)	Sphericity Assumed	45.654	40	1.141			
	Greenhouse-Geisser	45.654	40.000	1.141			
	Huynh-Feldt	45.654	40.000	1.141			
	Lower-bound	45.654	40.000	1.141			
CueSW_Pic * CueSW_Cue	Sphericity Assumed	.124	2	.062	.075	.928	.002
	Greenhouse-Geisser	.124	1.989	.062	.075	.927	.002
	Huynh-Feldt	.124	2.000	.062	.075	.928	.002
	Lower-bound	.124	1.000	.124	.075	.786	.002
Error (CueSW_Pic*CueSW_Cue)	Sphericity Assumed	66.391	80	.830			
	Greenhouse-Geisser	66.391	79.579	.834			
	Huynh-Feldt	66.391	80.000	.830			
	Lower-bound	66.391	40.000	1.660			

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	CueSW_Pic	CueSW_Cue	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
CueSW_Pic	Linear		5.396	1	5.396	5.667	.022	.124
	Quadratic		.529	1	.529	.624	.434	.015
Error(CueSW_Pic)	Linear		38.087	40	.952			
	Quadratic		33.919	40	.848			
CueSW_Cue		Linear	.053	1	.053	.047	.830	.001
Error(CueSW_Cue)		Linear	45.654	40	1.141			
CueSW_Pic * CueSW_Cue	Linear	Linear	.065	1	.065	.074	.787	.002
	Quadratic	Linear	.059	1	.059	.076	.784	.002
Error (CueSW_Pic*CueSW_Cue)	Linear	Linear	35.156	40	.879			
	Quadratic	Linear	31.235	40	.781			

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	455.314	1	455.314	32.987	.000	.452
Error	552.112	40	13.803			

Estimated Marginal Means

1. Grand Mean

Measure: MEASURE_1

Mean	Std. Error	95% Confidence Interval	
		Lower Bound	Upper Bound
1.360	.237	.882	1.839

2. CueSW_Pic

Measure: MEASURE_1

CueSW_Pic	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	1.212	.262	.683	1.741
2	1.295	.225	.841	1.749
3	1.575	.267	1.034	2.115

3. CueSW_Cue

Measure: MEASURE_1

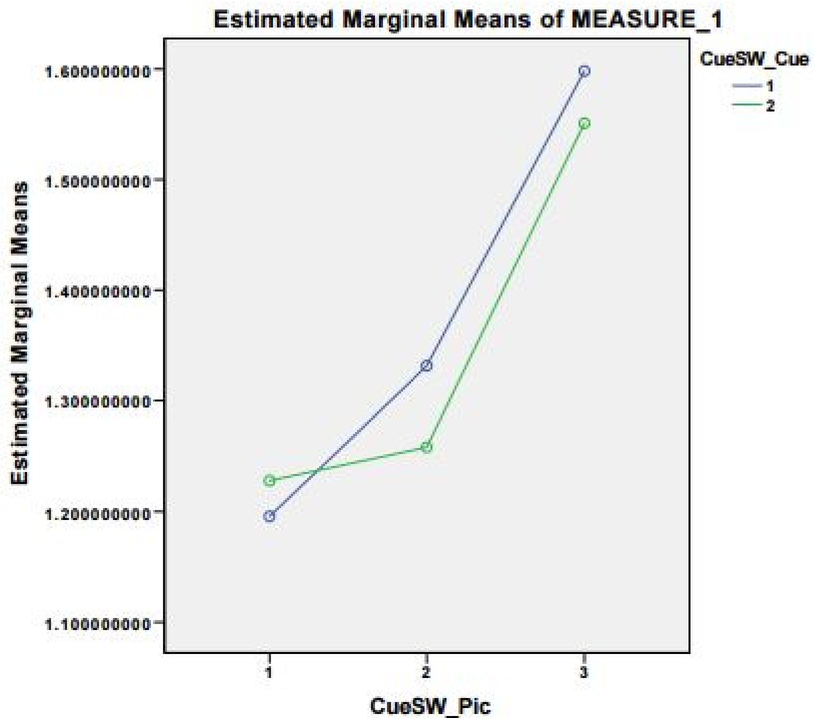
CueSW_Cue	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	1.375	.218	.934	1.816
2	1.346	.272	.796	1.895

4. CueSW_Pic * CueSW_Cue

Measure: MEASURE_1

CueSW_Pic	CueSW_Cue	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
1	1	1.196	.273	.645	1.747
	2	1.228	.298	.626	1.830
2	1	1.332	.215	.897	1.766
	2	1.258	.274	.704	1.812
3	1	1.598	.264	1.065	2.131
	2	1.551	.308	.929	2.173

Profile Plots




```
 COMPUTE CueSW_PleasantF3=MEAN(Color_Pleasant_F3,Word_Pleasant_F3).
EXECUTE.
COMPUTE CueSW_NeutF3=MEAN(Color_Neutral_F3,Word_Neutral_F3).
```

```
EXECUTE.
COMPUTE CueSW_UnpleasF3=MEAN(Color_Unpleasant_F3,Word_Unpleasant_F3).
EXECUTE.
T-TEST PAIRS=CueSW_PleasantF3 CueSW_PleasantF3 CueSW_NeutF3 WITH CueSW_NeutF3
CueSW_UnpleasF3
    CueSW_UnpleasF3 (PAIRED)
  /CRITERIA=CI(.9500)
  /MISSING=ANALYSIS.
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T-Test

Notes

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	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST PAIRS=CueSW_PleasantF3 CueSW_PleasantF3 CueSW_NeutF3 WITH CueSW_NeutF3 CueSW_UnpleasF3 CueSW_UnpleasF3 (PAIRED) /CRITERIA=CI(.9500) /MISSING=ANALYSIS.
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Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	CueSW_PleasantF3	1.2119	41	1.67495	.26158
	CueSW_NeutF3	1.2949	41	1.43755	.22451
Pair 2	CueSW_PleasantF3	1.2119	41	1.67495	.26158
	CueSW_UnpleasF3	1.5746	41	1.71157	.26730
Pair 3	CueSW_NeutF3	1.2949	41	1.43755	.22451
	CueSW_UnpleasF3	1.5746	41	1.71157	.26730

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	CueSW_PleasantF3 & CueSW_NeutF3	41	.840	.000
Pair 2	CueSW_PleasantF3 & CueSW_UnpleasF3	41	.834	.000
Pair 3	CueSW_NeutF3 & CueSW_UnpleasF3	41	.828	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	CueSW_PleasantF3 - CueSW_NeutF3	-.08300	.90831	.14185	-.36970	.20369	-.585	40	.562
Pair 2	CueSW_PleasantF3 - CueSW_UnpleasF3	-.36278	.97579	.15239	-.67077	-.05478	-2.381	40	.022
Pair 3	CueSW_NeutF3 - CueSW_UnpleasF3	-.27977	.96074	.15004	-.58302	.02348	-1.865	40	.070

```
 GLM PleasCol_Congruent_N450PleasCol_Incongruent_N450NuetCol_Congruent_N450
    NeutCol_Incongruent_N450UnpleasCol_Congruent_N450UnpleasCol_Incongruent_
N450
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  /METHOD=SSTYPE(3)
  /PLOT=PROFILE(N450_Pic*N450_Congruency)
  /EMMEANS=TABLES(OVERALL)
  /EMMEANS=TABLES(N450_Pic)
  /EMMEANS=TABLES(N450_Congruency)
  /EMMEANS=TABLES(N450_Pic*N450_Congruency)
  /PRINT=DESCRIPTIVE ETASQ
  /CRITERIA=ALPHA(.05)
  /WSDESIGN=N450_Pic N450_Congruency N450_Pic*N450_Congruency.
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General Linear Model

Notes

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Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the model.

ERP Data: N450

Notes

Syntax		GLM PleasCol_Congruent_N450 PleasCol_Incongruent_N450 NuetCol_Congruent_N450 NeutCol_Incongruent_N450 UnpleasCol_Congruent_N450 UnpleasCol_Incongruent_N450 /WSFACTOR=N450_Pic 3 Polynomial N450_Congruency 2 Polynomial /METHOD=SSTYPE(3) /PLOT=PROFILE (N450_Pic*N450_Congruency) /EMMEANS=TABLES (OVERALL) /EMMEANS=TABLES (N450_Pic) /EMMEANS=TABLES (N450_Congruency) /EMMEANS=TABLES (N450_Pic*N450_Congruency) /PRINT=DESCRIPTIVE ETASQ /CRITERIA=ALPHA(.05) /WSDESIGN=N450_Pic N450_Congruency N450_Pic*N450_Congruency.
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Within-Subjects Factors

Measure: MEASURE_1

N450_Pic	N450_Congruency	Dependent Variable
1	1	PleasCol_Congruent_N450
	2	PleasCol_Incongruent_N450
2	1	NuetCol_Congruent_N450
	2	NeutCol_Incongruent_N450
3	1	UnpleasCol_Congruent_N450
	2	UnpleasCol_Incongruent_N450

Descriptive Statistics

	Mean	Std. Deviation	N
PleasCol_Congruent_N450	-.33916975	2.43172401	41
PleasCol_Incongruent_N450	-.08145713	2.09143012	41
NuetCol_Congruent_N450	.122979553	2.17940904	41
NeutCol_Incongruent_N450	-.07825083	1.90509184	41
UnpleasCol_Congruent_N450	-.07708449	2.26552635	41
UnpleasCol_Incongruent_N450	-.31616828	2.61167873	41

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
N450_Pic	Pillai's Trace	.040	.813[b]	2.000	39.000	.451	.040
	Wilks' Lambda	.960	.813[b]	2.000	39.000	.451	.040
	Hotelling's Trace	.042	.813[b]	2.000	39.000	.451	.040
	Roy's Largest Root	.042	.813[b]	2.000	39.000	.451	.040
N450_Congruency	Pillai's Trace	.004	.161[b]	1.000	40.000	.691	.004
	Wilks' Lambda	.996	.161[b]	1.000	40.000	.691	.004
	Hotelling's Trace	.004	.161[b]	1.000	40.000	.691	.004
	Roy's Largest Root	.004	.161[b]	1.000	40.000	.691	.004
N450_Pic * N450_Congruency	Pillai's Trace	.059	1.214[b]	2.000	39.000	.308	.059
	Wilks' Lambda	.941	1.214[b]	2.000	39.000	.308	.059
	Hotelling's Trace	.062	1.214[b]	2.000	39.000	.308	.059
	Roy's Largest Root	.062	1.214[b]	2.000	39.000	.308	.059

a. Design: Intercept
Within Subjects Design: N450_Pic + N450_Congruency + N450_Pic * N450_Congruency

b. Exact statistic

Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b] Greenhouse-Geisser	Huynh-Feldt	Lower-bound
N450_Pic	.957	1.721	2	.423	.959	1.000	.500
N450_Congruency	1.000	.000	0	.	1.000	1.000	1.000
N450_Pic * N450_Congruency	.995	.208	2	.901	.995	1.000	.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept
Within Subjects Design: N450_Pic + N450_Congruency + N450_Pic * N450_Congruency

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
N450_Pic	Sphericity Assumed	2.796	2	1.398	.930	.399	.023
	Greenhouse-Geisser	2.796	1.917	1.458	.930	.395	.023
	Huynh-Feldt	2.796	2.000	1.398	.930	.399	.023
	Lower-bound	2.796	1.000	2.796	.930	.341	.023
Error(N450_Pic)	Sphericity Assumed	120.195	80	1.502			
	Greenhouse-Geisser	120.195	76.689	1.567			
	Huynh-Feldt	120.195	80.000	1.502			
	Lower-bound	120.195	40.000	3.005			
N450_Congruency	Sphericity Assumed	.228	1	.228	.161	.691	.004
	Greenhouse-Geisser	.228	1.000	.228	.161	.691	.004
	Huynh-Feldt	.228	1.000	.228	.161	.691	.004
	Lower-bound	.228	1.000	.228	.161	.691	.004
Error (N450_Congruency)	Sphericity Assumed	56.771	40	1.419			
	Greenhouse-Geisser	56.771	40.000	1.419			
	Huynh-Feldt	56.771	40.000	1.419			
	Lower-bound	56.771	40.000	1.419			
N450_Pic * N450_Congruency	Sphericity Assumed	3.136	2	1.568	1.307	.276	.032
	Greenhouse-Geisser	3.136	1.989	1.576	1.307	.276	.032
	Huynh-Feldt	3.136	2.000	1.568	1.307	.276	.032
	Lower-bound	3.136	1.000	3.136	1.307	.260	.032
Error (N450_Pic*N450_Congruency)	Sphericity Assumed	95.945	80	1.199			
	Greenhouse-Geisser	95.945	79.578	1.206			
	Huynh-Feldt	95.945	80.000	1.199			
	Lower-bound	95.945	40.000	2.399			

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	N450_Pic	N450_Congruency	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
N450_Pic	Linear		.008	1	.008	.006	.938	.000
	Quadratic		2.788	1	2.788	1.603	.213	.039
Error(N450_Pic)	Linear		50.636	40	1.266			
	Quadratic		69.560	40	1.739			
N450_Congruency		Linear	.228	1	.228	.161	.691	.004
Error (N450_Congruency)		Linear	56.771	40	1.419			
N450_Pic * N450_Congruency	Linear	Linear	2.530	1	2.530	1.968	.168	.047
	Quadratic	Linear	.606	1	.606	.544	.465	.013
Error (N450_Pic*N450_ Congruency)	Linear	Linear	51.429	40	1.286			
	Quadratic	Linear	44.516	40	1.113			

Tests of Between-Subjects Effects

Measure: MEASURE_1
Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	4.043	1	4.043	.170	.682	.004
Error	951.890	40	23.797			

Estimated Marginal Means

1. Grand Mean

Measure: MEASURE_1

Mean	Std. Error	95% Confidence Interval	
		Lower Bound	Upper Bound
-.128	.311	-.757	.500

2. N450_Pic

Measure: MEASURE_1

N450_Pic	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	-.210	.330	-.878	.457
2	.022	.297	-.579	.623
3	-.197	.360	-.924	.530

3. N450_Congruency

Measure: MEASURE_1

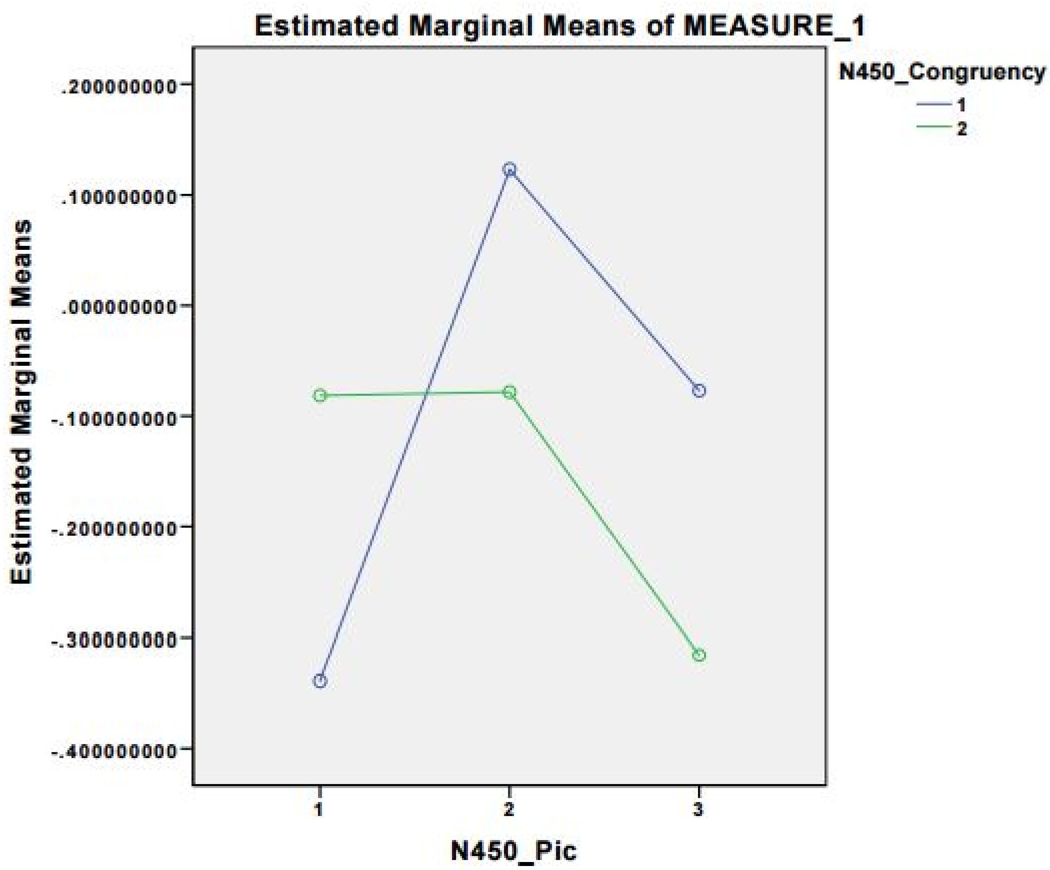
N450_Congruency	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	-.098	.322	-.749	.554
2	-.159	.318	-.801	.484

4. N450_Pic * N450_Congruency

Measure: MEASURE_1

N450_Pic	N450_Congruency	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
1	1	-.339	.380	-1.107	.428
	2	-.081	.327	-.742	.579
2	1	.123	.340	-.565	.811
	2	-.078	.298	-.680	.523
3	1	-.077	.354	-.792	.638
	2	-.316	.408	-1.141	.508

Profile Plots



ERP Data: Conflict SP

```
GLM PleasCol_Congruent_PostCSP PleasCol_Incongruent_PostCSP NeutCol_Congruent_
PostCSP
    NeutCol_Incongruent_PostCSP UnpleasCol_Congruent_PostCSP UnpleasCol_Incong
ruent_PostCSP
  /WSFACTOR=ConflictSP_Pic 3 Polynomial ConflictSP_Cong 2 Polynomial
  /METHOD=SSTYPE(3)
  /PLOT=PROFILE(ConflictSP_Pic*ConflictSP_Cong)
  /EMMEANS=TABLES(OVERALL)
  /EMMEANS=TABLES(ConflictSP_Pic) COMPARE ADJ(LSD)
  /EMMEANS=TABLES(ConflictSP_Cong) COMPARE ADJ(LSD)
  /EMMEANS=TABLES(ConflictSP_Pic*ConflictSP_Cong)
  /PRINT=DESCRIPTIVE ETASQ
  /CRITERIA=ALPHA(.05)
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General Linear Model

Notes

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Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the model.

Notes

Syntax		GLM PleasCol_Congruent_PostCSP PleasCol_Incongruent_PostCSP NuetCol_Congruent_PostCSP NeutCol_Incongruent_PostCSP UnpleasCol_Congruent_PostCSP UnpleasCol_Incongruent_PostCSP /WSFACTOR=ConflictSP_Pic 3 Polynomial ConflictSP_Cong 2 Polynomial /METHOD=SSTYPE(3) /PLOT=PROFILE (ConflictSP_Pic*ConflictSP_Cong) /EMMEANS=TABLES (OVERALL) /EMMEANS=TABLES (ConflictSP_Pic) COMPARE ADJ(LSD) /EMMEANS=TABLES (ConflictSP_Cong) COMPARE ADJ(LSD) /EMMEANS=TABLES (ConflictSP_Pic*ConflictSP_Cong) /PRINT=DESCRIPTIVE ETASQ /CRITERIA=ALPHA(.05) /WSDESIGN=ConflictSP_Pic ConflictSP_Cong ConflictSP_Pic*ConflictSP_Cong.
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Within-Subjects Factors

Measure: MEASURE_1

ConflictSP_Pic	ConflictSP_Cong	Dependent Variable
1	1	PleasCol_Congruent_PostCSP
	2	PleasCol_Incongruent_PostCSP
2	1	NuetCol_Congruent_PostCSP
	2	NeutCol_Incongruent_PostCSP
3	1	UnpleasCol_Congruent_PostCSP
	2	UnpleasCol_Incongruent_PostCSP

Descriptive Statistics

	Mean	Std. Deviation	N
PleasCol_Congruent_PostCSP	1.63630969	2.06162740	41
PleasCol_Incongruent_PostCSP	2.10648675	1.71230542	41
NuetCol_Congruent_PostCSP	1.07118969	2.30689307	41
NeutCol_Incongruent_PostCSP	1.75250623	1.81997107	41
UnpleasCol_Congruent_PostCSP	.799106788	2.00026836	41
UnpleasCol_Incongruent_PostCSP	2.30728691	1.96002498	41

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
ConflictSP_Pic	Pillai's Trace	.122	2.704[b]	2.000	39.000	.080	.122
	Wilks' Lambda	.878	2.704[b]	2.000	39.000	.080	.122
	Hotelling's Trace	.139	2.704[b]	2.000	39.000	.080	.122
	Roy's Largest Root	.139	2.704[b]	2.000	39.000	.080	.122
ConflictSP_Cong	Pillai's Trace	.349	21.397[b]	1.000	40.000	.000	.349
	Wilks' Lambda	.651	21.397[b]	1.000	40.000	.000	.349
	Hotelling's Trace	.535	21.397[b]	1.000	40.000	.000	.349
	Roy's Largest Root	.535	21.397[b]	1.000	40.000	.000	.349
ConflictSP_Pic * ConflictSP_Cong	Pillai's Trace	.183	4.376[b]	2.000	39.000	.019	.183
	Wilks' Lambda	.817	4.376[b]	2.000	39.000	.019	.183
	Hotelling's Trace	.224	4.376[b]	2.000	39.000	.019	.183
	Roy's Largest Root	.224	4.376[b]	2.000	39.000	.019	.183

a. Design: Intercept
Within Subjects Design: ConflictSP_Pic + ConflictSP_Cong + ConflictSP_Pic * ConflictSP_Cong

b. Exact statistic

Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

					Epsilon[b]		
Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Greenhouse-Geisser	Huynh-Feldt	Lower-bound
ConflictSP_Pic	.969	1.233	2	.540	.970	1.000	.500
ConflictSP_Cong	1.000	.000	0	.	1.000	1.000	1.000
ConflictSP_Pic * ConflictSP_Cong	.986	.566	2	.754	.986	1.000	.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept
Within Subjects Design: ConflictSP_Pic + ConflictSP_Cong + ConflictSP_Pic * ConflictSP_Cong

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
ConflictSP_Pic	Sphericity Assumed	9.086	2	4.543	3.046	.053	.071
	Greenhouse-Geisser	9.086	1.940	4.684	3.046	.055	.071
	Huynh-Feldt	9.086	2.000	4.543	3.046	.053	.071
	Lower-bound	9.086	1.000	9.086	3.046	.089	.071
Error (ConflictSP_Pic)	Sphericity Assumed	119.306	80	1.491			
	Greenhouse-Geisser	119.306	77.585	1.538			
	Huynh-Feldt	119.306	80.000	1.491			
	Lower-bound	119.306	40.000	2.983			
ConflictSP_Cong	Sphericity Assumed	48.338	1	48.338	21.397	.000	.349
	Greenhouse-Geisser	48.338	1.000	48.338	21.397	.000	.349
	Huynh-Feldt	48.338	1.000	48.338	21.397	.000	.349
	Lower-bound	48.338	1.000	48.338	21.397	.000	.349
Error (ConflictSP_Cong)	Sphericity Assumed	90.364	40	2.259			
	Greenhouse-Geisser	90.364	40.000	2.259			
	Huynh-Feldt	90.364	40.000	2.259			
	Lower-bound	90.364	40.000	2.259			
ConflictSP_Pic * ConflictSP_Cong	Sphericity Assumed	12.339	2	6.170	4.788	.011	.107
	Greenhouse-Geisser	12.339	1.972	6.258	4.788	.011	.107
	Huynh-Feldt	12.339	2.000	6.170	4.788	.011	.107
	Lower-bound	12.339	1.000	12.339	4.788	.035	.107
Error (ConflictSP_Pic*ConflictSP_Cong)	Sphericity Assumed	103.091	80	1.289			
	Greenhouse-Geisser	103.091	78.864	1.307			
	Huynh-Feldt	103.091	80.000	1.289			
	Lower-bound	103.091	40.000	2.577			

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	ConflictSP_Pic	ConflictSP_Cong	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
ConflictSP_Pic	Linear		4.151	1	4.151	2.484	.123	.058
	Quadratic		4.935	1	4.935	3.762	.060	.086
Error (ConflictSP_Pic)	Linear		66.836	40	1.671			
	Quadratic		52.469	40	1.312			
ConflictSP_Cong		Linear	48.338	1	48.338	21.397	.000	.349
Error (ConflictSP_Cong)		Linear	90.364	40	2.259			
ConflictSP_Pic * ConflictSP_Cong	Linear	Linear	11.044	1	11.044	8.543	.006	.176
	Quadratic	Linear	1.295	1	1.295	1.008	.321	.025
Error (ConflictSP_Pic*ConflictSP_Cong)	Linear	Linear	51.707	40	1.293			
	Quadratic	Linear	51.384	40	1.285			

Tests of Between-Subjects Effects

Measure: MEASURE_1
Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	639.359	1	639.359	40.363	.000	.502
Error	633.605	40	15.840			

Estimated Marginal Means

1. Grand Mean

Measure: MEASURE_1

Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
1.612	.254	1.099	2.125

2. ConflictSP_Pic

Estimates

Measure: MEASURE_1

ConflictSP_Pic	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
1	1.871	.263	1.340	2.403
2	1.412	.296	.814	2.010
3	1.553	.270	1.008	2.099

Pairwise Comparisons

Measure: MEASURE_1

(I) ConflictSP_Pic	(J) ConflictSP_Pic	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b] Lower Bound	Upper Bound
1	2	.460*	.196	.024	.064	.855
	3	.318	.202	.123	-.090	.726
2	1	-.460*	.196	.024	-.855	-.064
	3	-.141	.174	.420	-.492	.209
3	1	-.318	.202	.123	-.726	.090
	2	.141	.174	.420	-.209	.492

Based on estimated marginal means

*. The mean difference is significant at the

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Pillai's trace	.122	2.704[a]	2.000	39.000	.080	.122
Wilks' lambda	.878	2.704[a]	2.000	39.000	.080	.122
Hotelling's trace	.139	2.704[a]	2.000	39.000	.080	.122
Roy's largest root	.139	2.704[a]	2.000	39.000	.080	.122

Each F tests the multivariate effect of ConflictSP_Pic. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

3. ConflictSP_Cong

Estimates

Measure: MEASURE_1

ConflictSP_Cong	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
1	1.169	.284	.594	1.744
2	2.055	.257	1.535	2.576

Pairwise Comparisons

Measure: MEASURE_1

(I) ConflictSP_Cong	(J) ConflictSP_Cong	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-.887*	.192	.000	-1.274	-.499
2	1	.887*	.192	.000	.499	1.274

Based on estimated marginal means

*. The mean difference is significant at the

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Pillai's trace	.349	21.397[a]	1.000	40.000	.000	.349
Wilks' lambda	.651	21.397[a]	1.000	40.000	.000	.349
Hotelling's trace	.535	21.397[a]	1.000	40.000	.000	.349
Roy's largest root	.535	21.397[a]	1.000	40.000	.000	.349

Each F tests the multivariate effect of ConflictSP_Cong. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

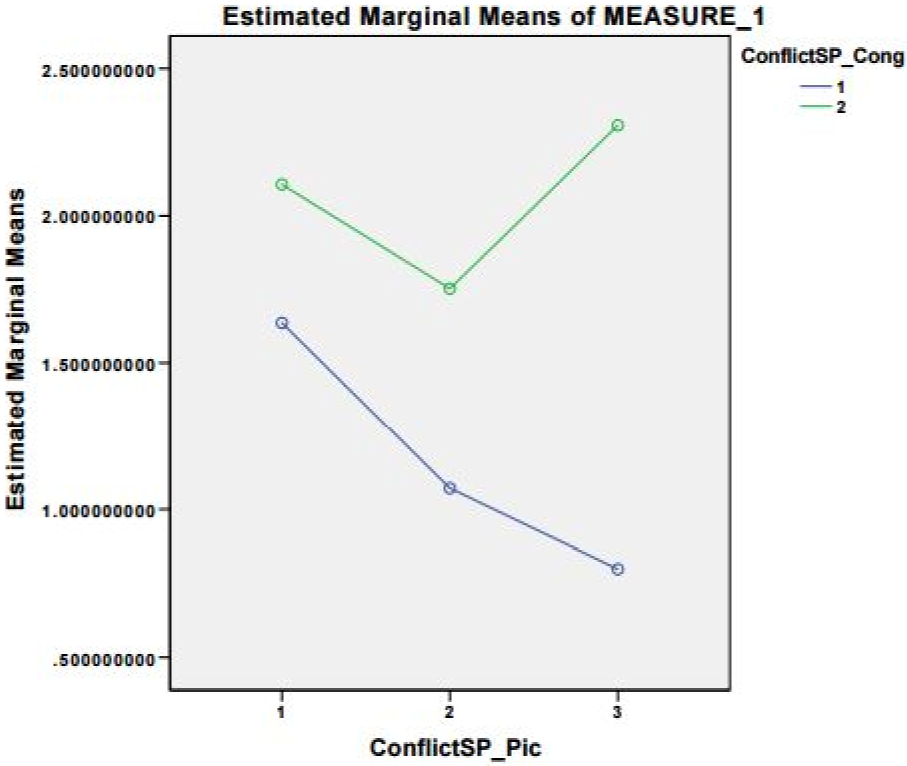
a. Exact statistic

4. ConflictSP_Pic * ConflictSP_Cong

Measure: MEASURE_1

ConflictSP_Pic	ConflictSP_Cong	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
1	1	1.636	.322	.986	2.287
	2	2.106	.267	1.566	2.647
2	1	1.071	.360	.343	1.799
	2	1.753	.284	1.178	2.327
3	1	.799	.312	.168	1.430
	2	2.307	.306	1.689	2.926

Profile Plots




```
T-TEST PAIRS=PleasCol_Congruent_PostCSP PleasCol_Congruent_PostCSP NuetCol_Con
gruent_PostCSP WITH
    UnpleasCol_Congruent_PostCSP NuetCol_Congruent_PostCSP UnpleasCol_Congruen
t_PostCSP (PAIRED)
  /CRITERIA=CI(.9500)
  /MISSING=ANALYSIS.
```

T-Test

Notes

Output Created		28-OCT-2016 23:59:...
Comments		
Input	Data	/Users/larsonresearch1/Desktop/PosAff_INS_8.11.16 (5).sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	41
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST PAIRS=PleasCol_Congruent_PostCSP PleasCol_Congruent_PostCSP NuetCol_Congruent_PostCSP WITH UnpleasCol_Congruent_PostCSP NuetCol_Congruent_PostCSP UnpleasCol_Congruent_PostCSP (PAIRED) /CRITERIA=CI(.9500) /MISSING=ANALYSIS.
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PleasCol_Congruent_PostCSP	1.63630969	41	2.06162740	.321972107
	UnpleasCol_Congruent_PostCSP	.799106788	41	2.00026836	.312389435
Pair 2	PleasCol_Congruent_PostCSP	1.63630969	41	2.06162740	.321972107
	NuetCol_Congruent_PostCSP	1.07118969	41	2.30689307	.360276169
Pair 3	NuetCol_Congruent_PostCSP	1.07118969	41	2.30689307	.360276169
	UnpleasCol_Congruent_PostCSP	.799106788	41	2.00026836	.312389435

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	PleasCol_Congruent_PostCSP & UnpleasCol_Congruent_PostCSP	41	.525	.000
Pair 2	PleasCol_Congruent_PostCSP & NuetCol_Congruent_PostCSP	41	.630	.000
Pair 3	NuetCol_Congruent_PostCSP & UnpleasCol_Congruent_PostCSP	41	.645	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	PleasCol_Congruent_PostCSP - UnpleasCol_Congruent_PostCSP	.837202902	1.98015418	.309248128	.212189122	1.46221668	2.707	40	.010
Pair 2	PleasCol_Congruent_PostCSP - NuetCol_Congruent_PostCSP	.565120003	1.89157191	.295413901	-.03193376	1.16217377	1.913	40	.063
Pair 3	NuetCol_Congruent_PostCSP - UnpleasCol_Congruent_PostCSP	.272082899	1.83460908	.286517802	-.30699118	.851156978	.950	40	.348

```
T-TEST PAIRS=PleasCol_Incongruent_PostCSP PleasCol_Incongruent_PostCSP NeutCol
_Incongruent_PostCSP
    WITH UnpleasCol_Incongruent_PostCSP NeutCol_Incongruent_PostCSP UnpleasCol
_Incongruent_PostCSP
```

```
    (PAIRED)
  /CRITERIA=CI(.9500)
  /MISSING=ANALYSIS.
```

T-Test

Notes

Output Created		29-OCT-2016 00:05:...
Comments		
Input	Data	/Users/larsonresearch1/Desktop/PosAff_INS_8.11.16 (5).sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	41
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST PAIRS=PleasCol_Incongruent_PostCSP PleasCol_Incongruent_PostCSP NeutCol_Incongruent_PostCSP WITH UnpleasCol_Incongruent_PostCSP NeutCol_Incongruent_PostCSP UnpleasCol_Incongruent_PostCSP (PAIRED) /CRITERIA=CI(.9500) /MISSING=ANALYSIS.
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PleasCol_Incongruent_PostCSP	2.10648675	41	1.71230542	.267417179
	UnpleasCol_Incongruent_PostCSP	2.30728691	41	1.96002498	.306104474
Pair 2	PleasCol_Incongruent_PostCSP	2.10648675	41	1.71230542	.267417179
	NeutCol_Incongruent_PostCSP	1.75250623	41	1.81997107	.284231728
Pair 3	NeutCol_Incongruent_PostCSP	1.75250623	41	1.81997107	.284231728
	UnpleasCol_Incongruent_PostCSP	2.30728691	41	1.96002498	.306104474

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	PleasCol_Incongruent_PostCSP & UnpleasCol_Incongruent_PostCSP	41	.710	.000
Pair 2	PleasCol_Incongruent_PostCSP & NeutCol_Incongruent_PostCSP	41	.703	.000
Pair 3	NeutCol_Incongruent_PostCSP & UnpleasCol_Incongruent_PostCSP	41	.730	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	PleasCol_Incongruent_PostCSP - UnpleasCol_Incongruent_PostCSP	-.20080016	1.41638852	.221202724	-.64786754	.246267226	-.908	40	.369
Pair 2	PleasCol_Incongruent_PostCSP - NeutCol_Incongruent_PostCSP	.353980520	1.36510156	.213193046	-.07689870	.784859739	1.660	40	.105
Pair 3	NeutCol_Incongruent_PostCSP - UnpleasCol_Incongruent_PostCSP	-.55478068	1.39471674	.217818161	-.99500760	-.11455375	-2.547	40	.015

Appendix B

Power Analysis: Small Effect

F tests - ANOVA: Repeated measures, within factors

Analysis:	A priori: Compute required sample size		
Input:	Effect size f	=	0.1
	α err prob	=	0.05
	Power (1-β err prob)	=	0.80
	Number of groups	=	1
	Number of measurements	=	6
	Corr among rep measures	=	0.5
	Nonsphericity correction ε	=	1
Output:	Noncentrality parameter λ	=	13.0800000
	Critical F	=	2.2307082
	Numerator df	=	5.0000000
	Denominator df	=	540
	Total sample size	=	109
	Actual power	=	0.8042303

Power Analysis: Medium Effect

F tests - ANOVA: Repeated measures, within factors

Analysis:	A priori: Compute required sample size		
Input:	Effect size f	=	0.25
	α err prob	=	0.05
	Power (1-β err prob)	=	0.80
	Number of groups	=	1
	Number of measurements	=	6
	Corr among rep measures	=	0.5
	Nonsphericity correction ε	=	1
Output:	Noncentrality parameter λ	=	14.2500000
	Critical F	=	2.3156892
	Numerator df	=	5.0000000
	Denominator df	=	90.0000000
	Total sample size	=	19
	Actual power	=	0.8198474

Power Analysis: Large Effect

```
F tests - ANOVA: Repeated measures, within factors

Analysis:     A priori: Compute required sample size
Input:        Effect size f                      =   0.4
              α err prob                             =
    0.05
              Power (1-β err prob)               =   0.80
              Number of groups                   =   1
              Number of measurements             =   6
              Corr among rep measures            =   0.5
              Nonsphericity correction ε         =   1
Output:       Noncentrality parameter λ          =   15.3600000
              Critical F                         =   2.4851432
              Numerator df                       =   5.0000000
              Denominator df                     =   35.0000000
              Total sample size                  =   8
              Actual power                       =   0.8111719
```

Footnotes

[1]While the method of examination for the valence conditions on cognitive control processes focused on participants with elevated anxiety and depressive scores as well, we did rerun analyses on the participants below the cut off scores. Analyses indicated differences between the P300 (main effect of valence in all participants; no main effects in below cut-off score participants), cue-related slow wave (main effect of valence in all participants; no significant differences in below cut-off score participants), conflict SP (main effect of congruency, valence, and interaction of valence with congruency in all participants; only main effect of congruency in below cut-off score participants), accuracy (main effect of cue and delay with an interaction of valence, cue, and delay among all participants; only main effect of valence in below cut-off score participants), and response times (main effect of cue and delay in all participants; no main effects or interactions in below-cut off score participants). These differences are likely some combination of decreased statistical power and potential neural differences between those with high negative affect and lower negative affect. Future studies comparing those with high and low negative affect are needed to address this possibility.