THE BENEFIT OF DISTRACTIONS: THE EFFECT OF SOCIAL AND NON-SOCIAL DISTRACTIONS ON BOREDOM AND PERFORMANCE

by

LYRA MICHELLE STEIN

A Dissertation Submitted to the

Graduate School-New Brunswick

Rutgers, The State University of New Jersey

In partial fulfillment of the requirements

For the degree of

Doctor of Philosophy

Graduate Program in Psychology

Written under the direction of

Dr. John R. Aiello

And approved by

_____

_____

_____

_____

New Brunswick, New Jersey

May, 2012

ABSTRACT OF THE DISSETATION

THE BENEFIT OF DISTRACTIONS: THE EFFECT OF SOCIAL AND NON-SOCIAL DISTRACTIONS ON BOREDOM AND PERFORMANCE

By LYRA MICHELLE STEIN

DISSERTATION DIRECTOR:

DR. JOHN R. AIELLO

The present study sought to test a cognitive capacity explanation of the distraction-conflict theory of social facilitation (Baron, 1986). Introverts and extraverts performed a sustained attention to response task and a word-pair task in the presence of social and non-social distractions of varying salience. These tasks were performed in the presence of social distractions (coactor and evaluator) and non-social distractions (low and high complexity music) to determine if performance in the different conditions was moderated by extraversion. In addition, this study proposed that the mediators of the moderated relationship between condition and extraversion would be boredom, mind-wandering and task-unrelated thoughts. Results show the moderation of extraversion such that extraverts were facilitated with different forms of distractions while introverts were impaired. This indicates that extraverts need more outside stimulation to achieve performance facilitation while introverts tend to become over-stimulated with too much outside stimulation. When performance was facilitated in the SART task, the amount of

task unrelated thoughts decreased, whereas when performance was impaired, task unrelated thoughts increased. For the word-pair task, when performance increased, levels of boredom decreased and when performance was impaired, the level of boredom increased. These results support a cognitive capacity explanation for the distraction-conflict theory of social facilitation given that performance impairment was seen with under and over stimulation.

ACKNOWLEDGEMENTS

I would like to thank my advisor, John R. Aiello, and my committee members, Richard Contrada, Jean Phillips and David Wilder for their guidance in this process. I would also like to thank Shoshannah Bauxbaum and Max Fishkind for contributions toward the musical compositions. And the tireless efforts of all of the research assistants in the social organization research lab.

I would also like to thank members of my family for their love and support through this journey. I would specially like to thank Dan, Brad, my parents, Diane and Steve and my children, Ethan and Brielle.

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

The term "social facilitation" originated from Allport (1924) to describe "an increase in response merely from sight or sound of others making the same movement" (p.262). He noticed that when individuals were performing in the presence of others, they tended to experience performance enhancement as compared to when they were performing alone. However, as additional studies were conducted, contradictory results began to surface as to whether performance was, in fact, facilitated or impaired when in the presence of other people (Aiello & Douthitt, 2001; Bond & Titus, 1983). Though several mediators have been proposed, there is still no unifying theory of what mechanisms lead to simple task enhancement and complex task impairment. The main goal of the current study is to test potential moderators and mediators of the facilitation/impairment effect with a focus on the distraction-conflict theory of social facilitation. This study seeks to determine if performance may be facilitated when an individual will seeks to relieve a state of inattention due to decreased cognitive load. In addition, it is hypothesized that the variability in social facilitation results may be explained by individual differences, namely a difference in cognitive capacity indexed by an individual's level of extraversion. Extraversion is a likely moderator of the social facilitation effect due to increased working memory capacity and an increased tendency to experience boredom.

A second aim of this study is to address the nature of "distraction". Baron (1986) proposed that a test of the distraction-conflict theory of social facilitation (the notion that a distraction focuses attention on the task when it is "simple" and will overload cognitive resources when the task is "complex") would be facilitation/impairment results in the presence of a non-social distraction. This study will examine performance with differing levels of social and non-social distraction.

This study employed 2 tasks which use executive capacity to determine if and whether introverts and extraverts differ in the amount of outside stimulation needed to focus attention on the task (as hypothesized by Baron, 1986). There were five conditions with an absence condition, 2 levels of social distraction and 2 levels of non-social distraction.

Theories of Social Facilitation

Employing the Hull (1943) and Spence (1956) theories of task performance, Zajonc's drive theory of social facilitation states that the presence of others will increase drive levels, which will then increase the probability of the dominant response. A response is dominant, or has the highest habit strength, when that response is elicited with the greatest frequency during performance. For example, during learning, the incorrect response is dominant, and after acquisition, the correct response becomes more probable and thus, dominant. Therefore the definition of a "simple task" refers to a task which is well-learned; where the habit strength for the correct answer is quite high given that the connection between the stimulus and the response is in place. In this case, facilitation

will be the dominant response. For a complex task, which is not well-learned, and where the connections between the stimulus and response have not been formed, the habit strength for the incorrect response is higher, which leads to performance impairment as the dominant response (Spence, Taylor & Ketchel, 1956; Zajonc, 1965). The drive theory is elegant and parsimonious; however "drive" is a vague concept which is hard to test empirically.

In addition to Zajonc's (1965) drive theory, several other researchers have proposed theories to explain why individuals are facilitated in some instances and impaired in others. Cottrell (1968) put forth the idea that the presence of another was not enough to cause the observed impairment or facilitation and it is, in fact, the knowledge that a social presence implies evaluation that drives the facilitation and impairment responses. This theory states that previous evaluation situations cause people to develop learned "drive" which is responsible, in turn, for the facilitation and impairment. Another theory, the self-awareness theory, introduced by Duval and Wicklund (1972), maintains that people focus on themselves in a manner that directs attention to others' evaluation of their performance. Performance differences were attributed to increased focus on individual performance ideals and an effort on goal attainment.

After the drive and goal-focused theories, Baron (1986) then redirected the explanation toward cognitive processes. He attempted to account for the performance differences with the proposal of the distraction-conflict theory. This theory maintains that distraction may cause performance impairment if the task requires attention whereas distraction could facilitate performance on less cognitively demanding tasks by focusing attention on the central cues, hence the task itself (Baron, 1986). In later years, Zajonc

(1980) addressed all of the proposed theories (distraction-conflict, self-awareness and evaluation apprehension) acknowledging that these theories may have validity, but all that is required for performance facilitation/impairment is the mere-presence of another (Zajonc, 1980). Recent progress has sought to ascribe the performance effects to physiologic arousal (Blascovich, Mendes, Hunter, and Salomon, 1999; Gendolla and Richter, 2006), personality variables (Grant & Dajee, 2003; Uziel, 2007) and effort (Harkins, 2006) however, there is no consensus as to one unified, widely accepted theory of social facilitation.

Past studies in social facilitation have often used a combination of tasks, somewhat arbitrarily classified as simple or complex, and interpreted findings under the umbrella of either “simple” or “complex” based on the results. Since the 1960s, research into social facilitation effects focused on performance when alone or under observation using cognitive and motor tasks. The theories developed to explain the effects have claimed to be valid for both cognitive and motor tasks with researchers reporting results in terms of performance on "simple" and "complex" tasks with an objective indication of simple and complex.

Strauss (2002) undertook the problem of defining facilitation and impairment with regard to motor tasks. He classified motor tasks into categories based on conditioning/coordination, with those requiring stamina, power and speed as conditional abilities and those requiring only speed and coordination as coordinating abilities. Tasks placing a high demand on conditioning abilities are those requiring a high level of energy and stamina where performance is dependent on energy level and can be classified as “simple” according to Zajonc (1965). Motor tasks placing demands on coordination and

requiring practice, such as driving and cycling, demand more attention to body movements when first performed. In this case, performance can be determined by the degree of automaticity and the amount of cognitive load needed to perform the task before it becomes automatic (Strauss, 2002).

Given that motor tasks can be classified as simple and complex or automatic and controlled based on the amount of attention needed for performance, perhaps cognitive tasks can be classified in the same manner. A hierarchical structure is theorized for information processing which includes a supervisory or "executive" mechanism involved in controlling the operation of information processing subsystems (Wagstaff, Wheatcroft, Cole, Brunas-Wagstaff, Blackmore & Pilkington, 2008). Cognitive tasks which are not well learned, contain novel sequences of action, require error correction, or consist of situations judged technically difficult are controlled by the executive system. Support for this executive system comes from evidence which demonstrates the overload of the central processor by the performance of 2 or more tasks that require central processor activity. In this case, when the central processor activity is burdened with 2 attention demanding tasks, the result is performance impairment (Baddeley, Emslie, Kolodny & Duncan, 1998). Wagstaff, et al. (2008) proposed that the presence of others can place high demands on the central processor, especially if others are perceived as potentially threatening, leaving less available capacity to work on the task at hand.

In Baron's (1986) distraction-conflict theory, attentional mechanisms are important for the facilitation/impairment effect. The key tenet of this theory is that social presence, which is distracting, threatens an organism with cognitive overload and produces performance impairment. When the task does not tax attentional mechanisms,

one only need attend to a few central cues whereas, when the task has more attentional demands, one must attend to both central and peripheral cues for the correct execution of the task. With a social presence, attention is focused on the central cues which then enhances simple task performance and impairs complex task performance. Baron (1986) suggested that it is not the increased activation of attentional conflict that results the performance impairment on attention demanding tasks, but *cognitive overload* that exhausts cognitive capacity.

It would seem that there is nothing more to be said about a phenomenon as old as social facilitation, nevertheless, recent publications on the topic reveal that the debate is live and well. One task that has been extensively employed to study the distraction-conflict theory, including attention, is the Stroop Task (MacLeod, 1991). In the Stroop task (Stroop, 1935), participants have to name the color of words that are either congruent (the word red appears in red ink) or incongruent (the word red appears in a color which is not red). Stroop interference describes the fact that response time is slowed down by color incompatible words. The interference is said to be due to the relative automaticity of word reading (Kahneman & Chajczyk, 1983; MacLeod, 1991). This task was brought to the fore front on social facilitation literature by Huguet, Galvaing, Monteil, & Duman (1999) to test attentional explanations of social facilitation. If the presence of others leads to attentional focusing (Baron, 1986), then attention to colors (the central cue) should be enhanced and thus reduce Stroop interference. Studies indicated that the mere presence of others led to a decrease in Stroop interference are contrary to drive theory which predicts an increase in interference due to the dominant response (reading) (Huguet, et al., 1999).

In 2006, Harkins proposed the "mere effort" theory of social facilitation which focuses on the evaluative components of a presence that will motivate an individual to try their hardest on both simple and complex tasks and attention and narrowing of cues make no difference given the proper motivation. In a series of studies, Harkins (2006) used the remote associations test to elucidate the role of effort in the mediation on social facilitation/impairment. He found that the potential for evaluation led to facilitation of responses when the words were closely related with, concluding that the participants wanted to do well, which potentiates whichever response is "prepotent". On the remote associations test, the prepotent response is to generate words closely related to a word triad and with greater effort on the part of the individual, the more associations produced. However, Harkins' empirical evidence does not rule out the distraction-conflict theory of facilitation, as there is no measure of attention.

Subsequently, a study by McFall, Jamison and Harkins (2009) pitted the mere effort theory against the distraction-conflict theory (Baron, 1986) concluding that it is mere effort and not distraction that explains that results in facilitation/impairment. The study focused on the Stroop task, where the "prepotent" response is defined as reading the word and explains that for enhancement to occur, the individual would have to put effort in to overcome the prepotent response and name the color of the word. The two conditions of the study differed in response time, either 1 sec or 750 msec, and results indicated that there was more interference from the automatic response of reading the word when the response time was shorter (performance was impaired). Thus they concluded that a presence in the room only reduced Stroop interference when the response deadline was late enough for cognitive inhibition to operate or effort to be put

forth by the individual. However, Sharma, Booth, Brown, and Huguet (2010) found evidence for performance facilitation with no response deadline, concluding that the facilitation results were due to attentional mechanisms. Thus, the state of research on the topic is now focused on attentional mechanisms that are consistent with the distraction-conflict theory (Muller, Atzeni, & Butera, 2004).

Mediators of social facilitation

Many mediators have been proposed that are thought to be responsible for the relationship between presence and performance. These mediators range from drive (Zajonc, 1965), threat of evaluation (Cottrell, 1968), the desire to meet a standard goal (Carver & Scheier, 1981), the effort one puts into a task (Harkins, 2006) and cognitive explanations, such as attention (Baron, 1986). One common theme is that all of these potential mediators present a "distraction". If one is experiencing increased drive (or arousal, as defined by Zajonc), fewer cognitive resources are left for attending to a task (Lieberman, 2000). Likewise, if one is concerned about evaluation or meeting a standard/goal or even how much effort should be exerted on a task, cognitive capacity in the central executive is consumed. Therefore, perhaps the mediating mechanism is an individual's cognitive capacity that interacts with the cognitive demands of the distraction.

Cognitive task engagement can be conceptualized as a continuum such that at the low end, the individual experiences a state of boredom and a desire for outside stimulation, while at the high end, the individual experiences task absorption and experiences high levels of task engagement (Phillips, 2008). When individual

experiences under-stimulation, insufficient activity in the executive processor, a state of discomfort is created that can be remedied with outside stimulation (Fisher, 1993). When the optimal level of stimulation is achieved by a sufficiently stimulating task, any outside distraction puts the individual in a state of conflict that divides attention. This relationship can be conceptualized as an inverted "U", where an optimal level of stimulation needs to be reached for cognitive task engagement and anything above or below that level will lead to performance impairment.

Boredom

Simple task facilitation may be explained by an individual's level of boredom, or excess cognitive capacity, when task stimulation is low. When a task is simplified and routine, it provides no variation and is not able to fill an individual's attentional capacity (executive processor). The consequences of this state can be dangerous and research indicates this "boredom is associated with decreased job performance (O'Hanlon, 1981; Smith 1981), increased accident rate (Branton, 1970), property damage (Drory, 1982) and job dissatisfaction (Gardell, 1982). According to Phillips (2008), cognitive task engagement is not only dependent on aspects of the task, but also the perceptions of the individual. She defines cognitive task engagement as "sustained involvement in a task accompanied by a positive emotional undertone, low feelings of boredom, and a low desire for change or variety" (Phillips, 2008, p. 12). Thus, boredom, or excess cognitive capacity, is an aversive state caused by the task and the capacity of the individual.

Many researchers have suggested that attentional difficulties are at the root of boredom (Fisher, 1993; Hamilton, 1981; Leary, Rogers, Canfield & Coe, 1986).

Hamilton (1981) suggested that training one's attention helps to increase one's ability to maintain an optimal level of information flow and therefore decreased boredom levels. A study by Hamilton, Haier and Bushbaum (1984) directly related poor attention to the experience of boredom. When people feel bored, they report not being able to keep their attention on the task at hand, or having to put forth substantial effort to keep their attention focused on the task. The association between attentiveness and poor attentional control has been the focus of various conceptualizations of boredom. Leary, Rogers, Canfield and Coe (1986) considered boredom to be "…an affective experience associated with cognitive attentional processes" (p. 968). Mikulas and Vodanovich (1993) define boredom as a subjective state characterized by a lack of attentional focus, while Damrad-Frye and Laird (1989, p.316) state that "the essential behavioral component of boredom is the struggle to maintain attention." From these definitions, it is apparent that boredom can be defined as a reaction to a difficulty in maintaining attention to task.

The opposite of a state of boredom is called "flow" and is defined, by Csikszentmihalyi (1975), as "the holistic sensation that people feel when they act with total involvement" (p. 36). During this state there is little distraction and it is as if a person has no sense of time and is only aware of the task at hand. He describes this state as a centering of attention to a limited stimulus field where all distracters are filtered out of consciousness. This definition is very similar to Baron's (1986) distraction-conflict theory of simple task facilitation which states that only when one pays attention to the central cues and ignores distracters, are they facilitated. It is in this state where attention is solely focused only on the task and even internal distracters cannot disrupt this state (Csikszentmihalyi, 1975). If attentional resources are left over as a task is being

performed, such as with a simple, repetitive task, it is very likely that this much sought after state of flow, will not be reached. It is these left over resources which create a need for individuals to seek additional stimulation to bring them to an optimal state and bring about the ability to focus. For instance, if the skills and capacity of the individual are greater than the opportunity of fully engaging attention, boredom will ensue (Phillips, 2008). This state of flow does not depend on objective task characteristics, but is believed to be dependent on one's perceptions of their skills and the challenge afforded by the task (Csikszentmihalyi, 1975). Thus, there is an optimal level of challenge that is required to engage attention. When the task itself provides little meaningful stimulation, individuals tend to look to their surrounding environment or their own internal thoughts for stimulation, which contributes to the perception of boredom (Fisher 1993).

Therefore, when an individual performs a task that leaves excess cognitive capacity, they will have difficulty attending to the task. However, when faced with a distraction of some sort (social presence in the case of social facilitation), the excess capacity is filled and attention can be now directed to the task and performance is facilitated. When a task leaves excess cognitive capacity, any distraction, either social or non-social will work to relieve the aversive state of boredom. This current study attempts to provide support for a mediating variable of boredom that leads to facilitation/impairment. When an individual focuses on the task, boredom, as defined by a composite factor analyzed by Fisher (1998), will simultaneously be reduced and lead to attentional focusing.

H1: Boredom will mediate the relationship between condition (absence/presence) and performance facilitation such that presence will facilitate performance through a decrease in boredom.

For a definitive test of attentional allocation, a task that is known to require attention, is needed. A task that is uniquely suited to test attention to task, executive control and boredom is the sustained attention to response task (SART; Chan, Shum, Toulopoulou, & Chen, 2008; Helton, 2008; Robertson, Manly, Andrade, Baddeley, & Yiend, 1997). When performing the SART, participants respond with a key press whenever frequent digits (non-targets) are presented on a computer screen while withholding responses to a particular infrequent digit (the target). The infrequent target is usually presented with 11% frequency and the respondent is required to withhold their response. Because of the monotony of frequent responding, individuals become under-stimulated and attention becomes decoupled from the task. When this decoupling of attention occurs, thought probes indicate that a state of boredom and mind-wandering occur. In terms of objective behavior, the inability to withhold a response to a target stimulus is taken as evidence of failing to adequately attend to the task and correct withholding of responses to target are indicators of attending to the task (Manly, Lewis, Robertson, Watson, & Datta, 2002; Manly, Robertson, Galloway, & Hawkins, 1999; Robertson et al., 1997).

Mind-Wandering

Mind-wandering is a hallmark of boredom and represents the inability of an individual to keep his or her focus on the task at hand (Smallwood, Baracaia, Lowe & Obonsawin, 2003; Smallwood, Davies, Heim, Finnigan, Sudberry, & O'Connor, 2004; Smallwood, Obonsawin, & Heim, 2003). Mind-wandering has been considered the "default" when there is not enough stimulation from a task to keep attention focused (Mason, Norton, Van Horn, Wegner, Grafton & McCrae, 2007). The shift in attention from the primary task towards one's internal goals and thoughts indicates that mind-wandering is a state where information processing is decoupled from the primary task and representations of the external environment are not processed (Smallwood & Schooler, 2006). The measurement of mind-wandering and the decoupling of attention from the primary task is accomplished by thought sampling however, there are limitations to directly asking about the nature of thoughts given that self-reports are not always reliable (Nisbett & Wilson, 1977). Nonetheless, there are several indicators that self-reports are valid, especially by assessing other signs of inattention and boredom such as physiological data and lack of attention to task (Schooler & Schreiber, 2004). Several lines of evidence indicate that mind wandering is the result of having excess cognitive capacity or trouble focusing on the primary task because of declining stimulation. Mind wandering decreases as the rate of stimulus presentation increases (Antrobus, 1968; Giambra, 1995; Grodsky & Giambra, 1990; Smallwood et al., 2004). This indicates that the default of mind-wandering or boredom decreases as stimulation from the external environment increases. Research also indicates that mind-wandering and boredom increase with practice on a given task (Antrobus, 1968; Giambra, 1995; Smallwood et al., 2003; Smallwood et al., 2004). When the mind wanders it can lead to measurable deficits

in task performance (Teasdale, Dritschell, Taylor, Proctor, Lloyd & Nimmo-Smith, 1995, Giambra, 1995, Smallwood et al. 2004). In a variety of tasks including go/no go (Smallwood et al., 2004) and simple signal detection tasks (Giambra, 1995), the experience of mind-wandering has been shown to lead to subtle deficits in task performance. Mind-wandering, therefore, is often accompanied by an involuntary switch to performing the task on automatic pilot and the subjective experience of boredom.

Empirical studies of mind-wandering indicate that it can be measured by self-caught reports (when the individual realizes that they are mind-wandering) or probe-caught (when asked to stop and reflect on whether they were mind-wandering) reports. In probe-caught mind-wandering reports, individuals are interrupted during a task and asked to report what they were thinking (Smallwood, et al., 2003; Smallwood, et al., 2004; Teasdale, et al., 1995). In self-caught reports, individuals are asked to monitor their awareness for off-task episodes. Studies find probe-caught reports of mind wandering to be more effective because the self-caught reports may actually induce task unrelated thoughts (Cunningham, Scerbo, & Freeman, 2000). There are two methods for selecting probe-caught episodes. The first is having individuals respond yes/no as to whether their thoughts belong to that category or having participants report what is going through their mind at a specific time and then having experimenters code the thoughts using published guidelines (Giambra,1995; Schooler, Reichle, & Halpern, 2005; Teasdale, et al., 1995). Research finds that having the participant indicate what is going through their mind does not bias the nature of the thought as which may occur when one has to fit their thoughts into a pre-selected category (Smallwood & Schooler, 2006).

These on-time ratings can be compared with a retrospective questionnaire given at the end of the study to validate the results (Smallwood et al., 2003; Smallwood, et al., 2004).

Frequently, subjective accounts of mind-wandering are recoded through thought probes which are presented at the end of a trial where the participant is asked to report their thoughts immediately prior to the beginning of the probe (Hester, Foxe, Molholm, Shapner, & Garavan, 2005; Schooler et al., 2005; Rabbit, 2002). This report of mind-wandering during a trial is significantly correlated with response to targets (the incorrect response) (Smallwood et al., 2004; Smallwood et al., 2006). In addition, Smallwood, Beach, Schooler and Handy (2008) found direct evidence that attention is decoupled from the task with the report of mind wandering through EEG studies. Thus with assessment of objective task measurement and subjective assessment of mind wandering, the SART can measure states of boredom and indicate when an individual is not attending to the task.

The SART task can also distinguish between the distraction-conflict theory and Zajonc's (1965) drive theory. If a social presence focuses attention on task, then performance would increase with more non-responses to the targets (correct response). If one is not attending to the task and responds to targets, reports of mind-wandering can indicate that the individual has reached a state of boredom. In addition, if a social presence increases the dominant response, then the individual will continue responding to the targets because the response has become dominant (has the highest habit strength after frequently responding to non-targets).

Individual Differences

In addition, this study seeks to determine if facilitation or impairment co-vary as a function of individual differences. If performance facilitation and enhancement are mediated by cognitive capacity (boredom/mind-wandering), individual differences in the amount of available cognitive resources should be taken into account. The best supported personality moderator of reaction to unstimulating tasks is introversion/extraversion (Gardner & Cummings, 1989). Extraverts need more outside stimulation to maintain an optimal level of arousal and tend to suffer most when they are under stimulated by the task or by their surroundings (Eysenck, 1967). In addition, the higher resting level of cortical activity found with introverts occupies more cognitive resources than the lower level activity found in extraverts (Lieberman, 2000). Eysenck (1967) proposed a theory which made use of the working memory notion advanced by Baddeley & Hitch (1974) which argues that those high in cortical activity (introverts) have smaller available resources for working memory capacity. The lower resting level of cortical activity in extraverts has been linked to an increased capacity for working memory and thus a higher threshold to reach optimum levels (Lieberman, 2000). Consequently, because extraverts have a great capacity to fill, they will need more outside stimulation to focus attention on the task when bored. In addition, extraverts show greater performance decrements on vigilance tasks, report being more bored on repetitive tasks, prefer jobs with more mental demands and faster pace, and introduce more variability in methods when working on routine tasks (Davies & Parasuraman, 1982; Gardner & Cummings, 1988; Hill, 1975; Sterns, Alexander, Barrett, & Dambrot, 1983). Thus, all other factors being equal, extraverts would be expected to report being more bored than introverts on the SART

task. In addition to personality differences, the nature of the distraction has to be taken into account.

Nature of the Distraction

Performance on repetitive tasks can be attributed to variables in 2 categories, endogenous and exogenous characteristics. Among the endogenous factors which emanate from within an organism are factors such as gender, age, amount of working memory capacity and personality (Davies & Parasuraman, 1982). Among the exogenous factors are the complexity of the task, changes in the outside environment and frequency of stimulation (Davies & Parasuraman, 1982). This study will examine the interaction of the exogenous and endogenous factors, both of which effect task performance.

It has been suggested that social presence can be viewed, not as a dichotomous variable, but as a continuous variable, varying by the salience of the presence (Aiello, 1998; Feinberg & Aiello, 2006). Salience refers to the amount of input from stimuli and the resultant attention drawn to the perceiver. Salience also reflects the behavioral significance of perceptual information and determines what information is prioritized (Kaldy, Blaser, & Leslie, 2006). Theoretically, the salience of a presence can determine how much attention is drawn to the perceiver by the presence. The idea of passive presence stems from Zajonc's concept of the "mere" presence of another (1965, 1980). He indicated that this is a sufficient condition for social facilitation effects and studies have reported impairment when audiences are merely present and non-evaluative (Markus, 1978; Rajecki, Ickes, Corcoran & Lenerz, 1977; Schmitt, Gilovich, Goore, & Joseph, 1986). In order for an individual to experience "passive" salience, he/she must

be working on a different task from the performer, as coactors who work on the same task have the opportunity to compare their own performance to how their peers appear to be performing, altering the potential for evaluation (Sanders, Baron, Moore, 1978; Szymanski, Garczynski, & Harkins, 2000). Why should the mere presence of another cause distraction when not performing the same task or not evaluating? The distraction-conflict theory indicates that the mere presence of a social being is distracting. Others of the same species may attract our attention because they are reinforcing and organisms may be biologically attuned to others of the same species. In addition, individuals have an innate curiosity as to what other's are thinking or perceiving when their presence is known (Baron, 1986).

Some researchers report that it is not the mere presence of another but the increasing salience of competitive pressure that heightens the social facilitation effect (Henchy & Glass, 1968; Martens & Landers, 1972). Although mere presence is capable of causing social facilitation effects, observers exposed to an evaluative presence often feel greater effects. Schmitt et al. (1986) found support for the effect of mere presence on an audience, but also found that evaluation apprehension intensifies the mere presence effect. Cottrell (1968) stated that it was not the simple presence of another that would produce the social facilitation effects, but the positive or negative outcomes that are anticipated when another is evaluating the individual. It has been suggested (Baron, 1986; Geen, 1981; Feinberg & Aiello, 2006) that the apprehension of evaluation itself can be considered a form of distraction. An evaluative other may be a source of attentional conflict that distracts individuals away from the task because one is thinking about how they appear. Thus, some may argue that the conceptual distinction between the

apprehension of evaluation and distraction may not be so clear-cut. If the increasing salience of another increases attention paid to the presence, this will increase the amount of distraction experienced (Kaldy et al., 2006).

Given the conflicting results of the nature of the presence needed to induce social facilitation effects, perhaps an interaction between the salience of the presence and the amount of cognitive load an individual can handle would better explain the pattern of results. Extraverts have high cognitive capacity and would need a more salient presence to reach optimal levels, whereas introverts require less salience. Surprisingly, few studies have investigated differences in the social facilitation effect between introverts and extraverts. Graydon and Murphy (1995) found that extraverts showed performance facilitation at a sporting event in the presence of an audience while introverts were impaired. Grant and Dajee (2003) found that in a "mere presence" situation with a coactor performing a different task, introverts were facilitated on a simple task while there was no change in the performance of extraverts. The authors claim that introverts are near their optimal level of cortical activity and the added stimulation of a passive coactor was enough to push introverts to their optimal level whereas extraverts still experienced excess cognitive capacity (Grant & Dajee, 2003). On a repetitive task with little stimulation (the SART task), it is proposed that facilitation will occur for introverts due to the coactor performing a different task. This facilitation will be accompanied by a concomitant decrease in boredom and mind-wandering. Likewise, with the increased salience of an evaluative presence, extraverted individuals will be brought closer to their optimum level of stimulation, experience less boredom and more mind-wandering which will result in performance enhancement.

H2: Introverts will show performance enhancement on the SART task with a coactor presence while extraverts will show performance enhancement with evaluator presence when compared with the absence condition.

Provided that a coactor presence will facilitate the performance of introverts and have no effect on extraverts (Grant & Dajee, 2003), the relationship of decreasing boredom and increasing performance will hold for introverts in the presence of a coactor. Given that an evaluative presence may facilitate the performance of extraverts and impair performance of introverts (Graydon & Murphy, 1995), the relationship of decreasing boredom and increasing performance will hold for extraverts when in the presence of an evaluator. Extraverts will experience less boredom with a coactor presence, but even less boredom with an evaluator presence which will result in increased performance facilitation. On the other hand, introverts will experience performance facilitation through a decrease in boredom with a coactor presence but will not experience additional performance facilitation with an evaluator presence due an overload of their attentional mechanisms.

H3: Extraversion will moderate the negative relationship between social presence and boredom such that an increase in social presence and an increase in extraversion will produce performance enhancement through a reduction in boredom

Social vs. Non-Social Distractions

Baron (1986) claimed that a definitive test of the distraction-conflict hypothesis is to test a condition with a non-social distraction. Studies have addressed whether an actual presence is needed for social facilitation effects and found that an implied presence, the implication of another observing the participant or the participant being monitored in some sense, was enough to produce the performance patterns (Aiello & Douthitt, 2001). Some examples include conditions with only an indication that someone is behind a one-way mirror (Criddle, 1971), the implication that one is being evaluated electronically (Aiello & Svec, 1993) or when told that performance data would be evaluated immediately after performance (Feinberg & Aiello, 2006). In addition, studies have found social facilitation patterns with non-social interruptions, such as diverting attention from a central task to a second task and then focusing back on the original task effects (Sanders et al., 1978). However, no study has implemented a continuous non-social distraction without indication of a person or of evaluation. If another is present during the entirety of task performance in social presence conditions, a real test of the distraction conflict theory would be the presence of a non-social distraction present during the entirety of performance. There is a distinct difference between switching attention to another task (as commonly used as an indication of distraction) and performing in an environment with a continuous distracter (Jett & George, 2003) For instance, one would get very different results on the SART if the individual had to purposely switch their attention to another task and the switch attention back to the task. Yet, very few studies have researched the effects of a social versus non-social continuous distraction that would lend evidence to the distraction-conflict theory. Pessin (1933)

demonstrated that mechanical noise and social presence produced the same social facilitation effects as a social presence and scant studies have found that noise facilitates performance on the Stroop task (Houston, 1969; Hartley & Adams, 1974; O'Malley & Poplawsky, 1971).

One non-social distraction that is known to cause performance facilitation and performance impairment is music. Since the turn of the century, researchers have been interested in the effects of music at work and the ability of music to facilitate performance on repetitive tasks (Newman, Hunt & Rhodes, 1966). Results indicate that the beneficial effects of music depend upon the type of music, the task performed, and personality differences of the perceiver. Playing music while carrying out a repetitive task can decrease boredom and raise performance levels (Fox & Embry, 1972) and just as is the case with social presence, there have been contradictory findings concerning the effects of performance. Konz (1962) found that on two repetitive simple tasks, performance was facilitated in the presence of music, however Freeburne & Fleischer (1952) found that music had no effect on a complex mental task. On the other hand, Dannenbaum (1945) found that people are less able to detect geometric faults when music is playing and Kirkpatrick (1943) found that music impairs work demanding mental concentration.

Research into the effects of music on performance has been met with conflicting results. Smith (1961) hypothesized that music reduces boredom induced from a highly repetitive task but acts as a distracter for complex mental work, but Perrewe and Mizerski (1987) found that music had no effect on performance of simple or complex tasks. The results of music and performance appear to be highly similar to that of social facilitation

and perhaps functions through the same mechanism, distraction. Furnham and Bradley (1997) found that the conflicting results may be due to an inconsistent definition of a simple or complex task. In addition, they suggest that the conflicting findings can also be the result of individual personality trait differences. In addition, Konecni (1982) argued that music fills cognitive capacity and the complexity of music can be a factor as to whether performance is facilitated or impaired.

When studying, introverts are more likely to choose a place away from any noise or distractions, while extraverts are more likely to choose a noisy area (Campbell & Hawley, 1982). Morganstern, Hodgson and Law (1974) found that when introverts and extraverts were able to control the noise and the amount of music played, extraverts always made larger changes trying to find a balance whereas introverts made smaller changes. This supports the notion that introverts and extraverts have different optimal levels concerning outside stimulation.

This study attempts to determine if a non-social distraction, music, can produce the same performance effects as a social distraction. If the distraction-conflict theory of social facilitation is correct, non-social distractions will have the same performance effects as social distractions, filling cognitive resources to reduce excess capacity and causing conflict at high levels of distraction. Just as this study will employ two levels of salience for social presence, the music distraction will also have two levels of salience. Research demonstrates that the complexity of different musical features can affect cognitive task performance. Mayfield and Moss (1989) discovered that music with a quick tempo improved cognitive performance on a decision making task and Milliman (1986) reported that a faster tempo was perceived to be more complex. One way of

classifying music is by the type of information load. Kiger (1989) reported that music with a low information load facilitated reading comprehension while high information load music impaired reading.

In addition, Geen, McCown, and Broyles (1985) found that at low intensity noise, introverts showed performance facilitation, while at higher intensity rates, showed a decrease in performance on a simple, repetitive task. Extraverts, on the other hand, showed increased performance only with high intensity noise. This indicates that introverts, who have low cognitive capacity resources, can be brought to an optimal state with low intensity music while extraverts need more stimulation. It appears that introverts and extraverts prefer different levels of complexity. Cohen, Hummel, Turner & Durer-Dobos (1966) found that the performance of introverts was facilitated with low intensity noise on repetitive tasks, while Rzepa (1984) found that extraverts preferred complex stimuli and tended to perform poorly on a simple monotonous task.

The current study attempted to assess performance for introverts and extraverts in the presence of high and low information load music. First, if the effects of social facilitation are mainly caused by distractions that can fill cognitive capacity, then no difference is expected in performance between the social presence conditions and the music conditions. Just as coactor presence is a low level of social salience, low complexity music is a low level of salience. When performing the SART, introverts should be relieved of boredom when listening to low complexity music and show facilitation while extraverts will show a decrease in boredom and performance facilitation with high complexity music.

H4: Introverts will show performance enhancement on the SART with low information load while extraverts will show performance enhancement with high information load when compared with the absence condition.

Extraverts will experience less boredom with low complexity music (LC), but even less boredom with high complexity (HC) music which will lead to an increase in performance facilitation as the complexity increases. On the other hand, introverts will experience performance facilitation through a decrease in boredom with low complexity music but will not experience additional performance facilitation with high complexity music due to attentional conflict.

H5: Extraversion will moderate the relationship the relationship between information load and boredom such that an increase in information load and an increase in extraversion will produce performance enhancement through a reduction in boredom.

Working Memory Tasks

According to the distraction-conflict theory of social facilitation, individuals will show performance impairment on a "complex task" because of attentional conflict (Baron, 1986). However, even the impairment on complex tasks only accounts for 1-3 % variance in performance. The effects on the complex task are not as variable as the simple task performance, but results indicate that sometimes facilitation occurs with a "complex" task (Aiello & Douthitt, 2001; Bond & Titus, 1983). Campbell (1988) proposed a framework in which "any objective task characteristic that implies an increase

in information load, information diversity, or the rate of information change can be considered a contributor to complexity," (pg. 41). In addition, Wood (1986) proposed that task complexity can be measured by analyzing the number of distinct, non-redundant acts and information cues required to complete a task, the amount of coordination between acts, and the degree of variability in cue validity over time. Wagstaff et al. (2008) defined a complex task as any task which uses the central executive, as such tasks are not well learned, contain novel sequences of action, require error correction, and situations judged to be dangerous. However, a task could be "complex" to one individual and not "complex" to another depending on several factors, including cognitive ability and cognitive capacity (Phillips, 2008). Melmed et al. (1995) defined a complex task as one which is varied and *less likely to induce feelings of boredom* because they engage an individual's attentional capacity. This definition would argue that the complexity of a task depends on the individual cognitive capacity and the how much attentional capacity is filled from the task.

If one assumes a cognitive capacity model of social facilitation, no clear cut dichotomy should exist between a "simple" or "complex" task, rather performance enhancement or facilitation should depend on the cognitive resources of the individual. However, there are extremes where almost all individuals will show facilitation and impairment. However, most studies of social facilitation attempt to define tasks which based on the nature of the individual performing the task. Only when an individual reaches a state of attention conflict, where attentional resources from the task are all encompassing, and any distraction will cause impairment. For example, attending to a memorization task will require more working memory resources than attending to a

simple repetitive task (McVay & Kane, 2009), however, extraverts, with increased working memory resources, may still show performance facilitation while introverts may become impaired.

The predominant measure of working memory capacity which includes a difference in introverts and extraverts is paired-associate list learning. Subjects in these studies learn lists of words with one member of each pair later being used as a retrieval cue for another. Howarth and Eysenck (1968) tested extraverts and introverts using seven pairs of associates with various retention intervals. The immediate recall condition was found to bear the relationship between extraversion and working memory with extraverts remembering twice as many associates as introverts indicating a higher capacity for extraverts. Some studies (Spence, 1956; Howarth, 1969) incorporated the notion of response competition. In this condition, participants were required to inhibit responding to preexisting associates or retrieval cue words. This condition, called the competitional condition uses more working memory resources because individuals are required to search for the correct response while inhibiting the tendency to respond to the intrusive "prepotent" associate. For example, Spence et al. (1956) employed 2 word-pair lists: a non-competitional list (simple task), and a competitional list (complex task). The stimulus and response words on the non-competitional list were highly associated, such as ''crazy-insane" and ''barren-fruitless" while the competitional list had associations within pairs such as ''crazy-fruitless" and ''barren–insane'' Howarth (1969) found that extraverts performed better on both word lists indicating a higher working-memory capacity than introverts.

The word-pair associates task is included in this study because it is a hallmark of a "simple" task used in social facilitation and has been defined as a dominant response model. Since the words on the non-competitional word list are semantically related, after learning the task, the individual's dominant response should be the correct associate. Results find that performance on the non-competitional list is impaired, but as always with social facilitation tasks, mixed results were found (Baron et al., 1978; Feinberg & Aiello, 2006; Guerin, 1986). By employing the SART task, the cognitive capacity model may be able to explain the differing results by the nature of the presence and the nature of the individual.

The paired associate task may be considered "more complex" than the repetitive SART task based on definitions on task complexity. However, the task will not be defined as more "difficult" and the participants may find the SART difficult because of the attentional requirement. As defined by Campbell (1988), this task will increase the information load and complexity over the simple task which will lead to an overall increase in task complexity. In addition, the task will increase the number of non-redundant acts and the variability of acts over time (Wood, 1986), but can not be classified as either "simple" or "complex".

In a meta-analysis of the effects of personality and social facilitation performance, extraverts were facilitated overall on complex tasks (Uziel, 2007), however it is difficult to differentiate the level of complexity of the tasks included in the analysis. Though this is indication that extraverts may be facilitated on seemingly complex tasks, which could account for some of the discrepancies in the social facilitation literature. In reference to the music literature, extraverts have shown performance facilitation on tasks of memory

with simple music and to a greater extent with complex music (Furnham & Allass, 1999; Furnham & Bradley, 1997). Given that Uziel (2007) found performance enhancement for extraverts on complex tasks, it is expected that extraverts will be facilitated on the working memory task with both coactor and evaluator presence while introverts will be impaired with both presence conditions.

H6: Performance on the word-pair task will be facilitated for extraverts with a coactor presence and to a greater extent with evaluator presence when compared with the absence condition. Introverts will not be facilitated in either presence condition when compared with the absence condition.

Given the prediction that introverts will not be facilitated with either level of presence, the relationship between decreased boredom and performance enhancement will not hold for lower levels of extraversion. However, the relationship between a decrease in boredom and performance facilitation will hold for higher levels of extraversion.

H7: Extraversion will moderate the negative relationship between social presence and boredom such that an increase in social presence and an increase in extraversion will produce performance enhancement through a reduction in boredom.

Given the prediction that extraverts will show facilitation on a simple memory tasks in the presence of simple and complex music and introverts show impairment on both (Furnham & Allass, 1999), it is proposed that extraverts will show a decrease in boredom and a concomitant increase in performance on the word-pair task in the presence of both low complexity and high complexity music.

H8: Performance on the word-pair task will be facilitated for extraverts with low complexity music and to a greater extent with high complexity music when compared with the absence condition. Introverts will not be facilitated in either music condition when compared with the absence condition.

Given the prediction that introverts will not be facilitated with either level of music, the relationship between decreased boredom and performance enhancement will not hold for lower levels of extraversion. However, the relationship between a decrease in boredom and performance facilitation will hold for higher levels of extraversion.

H9: Extraversion will moderate the negative relationship between music complexity and boredom such that an increase in complexity and an increase in extraversion will produce performance enhancement through a reduction in boredom.

CHAPTER II

METHODS

Participants

Participants were recruited from the undergraduate participant pool at Rutgers University and participated for course credit. Phase 1 included 165 participants (24 were excluded because of computer malfunction or failure to follow directions), 61.5% female and 38.5% male, with a mean age of 18.57 (*SD* = 1.17). Racial/Ethnic composition was 50.5% Caucasian, 7.5% African American, 6.5% Hispanic/Latino, 5.5% Middle Eastern, 14.1% South Asian, 11.6% East Asian, 2.5% Southeast Asian and 1.0% other. Phase 2 consisted of 177 participants (16 were excluded because of computer malfunction or failure to follow directions), 37.9% female and 62.1% male, with a mean age of 18.86 (*SD* = 1.18). Racial/Ethnic composition was 45.8% Caucasian, 5.6% African American, 7.3% Hispanic/Latino, 4.0% Middle Eastern, 18.1% South Asian, 13.0% East Asian, 3.4% Southeast Asian and 2.3% other.

Research Design

In phase 1 of the study, all participants were asked to report their thoughts and their level of boredom at various times during both the SART and word-pair tasks. Therefore, these participants were most likely aware of the purpose of the study (they were asked to rate their level of boredom during the task) and may have engaged in metacognitive trains of thought due to the thought probes. In phase 2, all participants completed the SART and word-pair tasks without interruptions.

For each phase, participants were assigned randomly to one of five conditions: absence, coactor presence, evaluator presence, low complexity music and high complexity music. The order of the tasks (the SART and word-pair task) was counterbalanced.

Materials and Procedures

After being welcomed by a supervisor and asked to fill out a consent form, all participants were informed that they would be completing two tasks designed to measure how undergraduates perform on workplace tasks. However, in the music conditions, participants were told that they were participating in a study of sensation and perception and would be presented with different stimuli that would affect some of their senses. When asked about the purpose of the study, participants in the music condition indicated that the study was, in fact, testing sensation and perception.

The participants were seated at a desk equipped with a PowerMac G4 computer and given 3 questionnaires: The Boredom Proneness Scale (Farmer & Sundberg, 1986) (measures an individual's propensity toward boredom) the Wonderlic Personnel Test (Wonderlic, Inc., 1999) (measures cognitive ability) and the NEO-PI-R (Costa & McCrae, 1992) (measures extraversion). The participants were then asked to read along on the screen as the supervisor read the instructions.

Each participant performed both tasks (counterbalanced) and at the end of each task, they were given 4 parts (arousal, nervousness, hedonic tone and thought content) of the Dundee Stress State Questionnaire (DSSQ; Matthews et al., 1999, 2002).

SART Task

The attention task was a variation of the sustained attention to response task (SART) used by Stawarczyk, Majerus, Maquet & D'Argembeau (2011). Stimuli (numbers between 1 and 9) were presented sequentially on the center of the screen. Participants were told to respond as fast and accurately as possible to the numbers and to press the space bar for every number they saw but to withhold their response when the number 3 appeared (the target stimulus). The interstimulus interval was 1000 msec, and the duration of each stimulus (target and non-target) was 300 msec. The participants first completed a practice trial which consisted of 2 blocks, each with 3 targets (in phase 1, participants were asked to assess their level of boredom on the task on a Likert scale from 1 (not boring) to 5 (very boring) asked to type what they were thinking at that moment). The participants then pressed a key to continue to the actual task. The study consisted of 4 blocks each, with 5-8 targets and with target and non-target probability randomized within the block. The average probability of target stimuli across blocks was about 11%. When asked to report thoughts, participants were presented with a screen that said "Stop". The next screen had the following appear, "I would like you to type what is passing through your mind as you saw the word stop" (Smallwood et al., 2003).

Word-Pair Task

A non-competitive word-pair association task was used which consisted of 18 word pair associations used by Spence (1956) (Appendix A). Participants were given a brief explanation by the experimenter of the word pair association task. More thorough details were presented to the participant via the computer monitor after the completion of

the experimenter's introduction. The participant then completed a practice trial with 6 word pairs not on the actual word list. They were given 25 seconds to study the word-pair list and then asked to type in the correct response (the second word in the pair) when the stimulus (the first word in the word-pair) was presented on the computer screen. The actual word-pair list was presented for 60 seconds and participant was asked to type in their response when the stimulus word was presented. For phase 1 of the study, participant were asked about their level of boredom and typed their thoughts at the beginning, after the practice trial and then after the actual trial.

Experimental Conditions

Absence Condition

Participants were told that once the trial began, the supervisor would leave the experimental room and close the door and the participants were instructed to ring a bell when the task was completed.

Evaluative Presence Condition

Participants were told that during the task the supervisor would be sitting behind them to evaluate their performance as they completed the task. Supervisors told participants that the company they work for wants their performance evaluated. The supervisor also told the participants that they were only present to observe and not to interact unless there was a problem and that all instructions would be presented via the computer monitor. Supervisors sat 1.2 meters behind participants (a setup similar to Baron et al., 1978) and made check marks on a check list every 30 seconds.

Coaction Condition

As the supervisor was finishing reading the directions for the first task, a confederate (lab assistant) knocked on the door and told the supervisor that the other experimenter, in a nearby room, ran out of space and they were instructed to knock on the door. The confederate brought a questionnaire with them and the supervisor told the confederate to have a seat behind the participant (the same chair that the evaluator used in the evaluation condition). The supervisor told the participant and the confederate not to interact with each other as it may affect the results of the study. The confederate stayed in the room during both of the tasks.

Music Conditions

After the instructor read the directions for the first task, he or she went into the other room and turned the music on. When the participant indicated that he or she had finished the first task, the experimenter turned off the music before entering the room to read the directions for the second task. After the supervisor read the directions for the second task, they turned the music back on. The volume was be set at 60 dB, the volume for normal conversation.

Questionnaires

Extraversion

Extraversion was measured with the NEO PI-R™ (Costa & McCrea, 1992). The NEO PI-R is a self-report personality test consisting of 5 broad domains and 30 sub

domains of personality and contains 120 items. The questionnaire was developed through rational and factor analytic methods to measure the five major factors or domains of personality: Neuroticism (alpha = .92), Extroversion (alpha = .90), Openness (alpha = .87), Agreeableness (alpha = .86) and Conscientiousness (alpha = .91). The test retest reliability reported in the manual of the NEO PR-I over 6 years was: N= .83, E= .82, O= .83, A= .63, C= .79. Costa and McCrae (1992) point out that this not only shows good reliability of the domains, but also that they are stable over a long periods of time (past the age of 30), as the scores over 6 years are only marginally more different then the scores as measured a few months apart (Costa and McCrae, 1992). Factor analyses performed on multiple samples determined the factorial validity of the instrument. Items were retained that loaded in the appropriate factor space and evidenced appropriate patterns of convergent and discriminant validity (Costa and McCrae, 1992). Participants indicate their degree of agreement with each item on a five-point Likert scale ranging from 1 = "strongly disagree" to 5 = "strongly agree".

Boredom Proneness

The boredom proneness scale was intended for use as a covariate to determine if performance could be accounted for by a stable personality trait of boredom. Constructed by Farmer and Sundberg (1986), the questionnaire measures the stable trait of boredom on the Boredom Proneness Scale (BPS). The scale was originally conceived as a 28 items with a true/false response scale. The current study used a variation of the response rating with a 7-point Likert scale (Somers & Vodanovich, 2000) for better discrimination. In previous research (e.g., Farmer & Sundberg, 1986; Vodanovich, 2003), internal-

consistency reliability coefficients ranged between .73 and .74 for the External Stimulation factor, .70 and .71 for the Internal Stimulation factor, and .79 and .84 for the boredom proneness scale total score (Appendix B).

Wonderlic Personnel Test

The Wonderlic Personnel Test, (Wonderlic, Inc., 1999) was measured as a covariate since it measures cognitive ability and is correlated with working memory capacity. It is a twelve-minute, fifty-question test used to assess the aptitude of prospective employees for learning and problem-solving in a wide range of occupations. The score was calculated as the number of correct answers given in the allotted time. A score of 20 is intended to indicate average intelligence (corresponding to an intelligence quotient of 100; a rough conversion is accomplished via the following formula: IQ = (2WPT + 60). The Wonderlic has test to retest reliability and the Wonderlic scored an *r* =.87 on the reliability scale compared along with the Pearson test score of *r* =.21, indicating its huge success in predicting a general level of intellect amongst students in an academic setting (Matthews & Lassiter, 2007).

Boredom and Mind-wandering

Boredom and mind-wandering were operationalized and tested by ratings of the degree of boredom experience on the task given after the completion of each task (adapted from Fisher, 1998) Aspects of boredom and mind-wandering were assessed by 22 items developed from the literature on boredom and previously piloted on student samples by Fisher (1998). Seventeen of the items were rated on a five point scale

ranging from “not at all” to “extremely” in terms of how well the statement characterized the feelings experienced by the respondents while working on the task. The other five items also used a five-point response format, with anchors specific to the questions being asked. Boredom' (versus interest) and had a reliability of 0.92. Items indicating interest and task enjoyment were reverse scored when added into the boredom scale. Mind-wandering consists of six items, with a coefficient alpha of 0.91. Most of these items indicate a passive, detached feeling in which thoughts unrelated to the present task occur. (Appendix C).

The Thinking Content and the Mood component (Arousal, Nervousness, Hedonic Tone) of the Dundee Stress State Questionnaire

Matthews et al. (1999) developed the Dundee State Stress Questionnaire (DSSQ) to assess various ways in which stress may be experienced as affect, motivation and cognition. The four measures of the ten factor-analytically determined scales which are appropriate for this study are the hedonic tone which measures the general pleasantness of mood (measured as a covariate), nervousness and energetic arousal and task irrelevant cognitive interference (to assess mind wandering) which measures ones worry about personal concerns over task concerns. These scales differentiate the broader factor of task engagement which assesses motivation, concentration and task engagement (Matthews et al, 2002). Studies employing these scales have revealed that when performing monotonous, repetitive tasks, individuals are usually in a state of task disengagement which is accompanied by an increase in distress and an increase in apathy concerning the task (Matthews et al, 1999, 2002). In contrast, tasks which engage

working memory elicit increased task engagement (Matthews, et al., 2002) (Appendix D).

Subjective reports of mind wandering were measured directly after completing the tasks using the Thinking Content component of the Dundee Stress State Questionnaire (Matthews et al., 1999). This scale is a 16-item questionnaire that assesses the content of thinking during a recently completed task, and it is divided into two 8-item factors: (a) TRI ("I thought about how I should work more carefully" or "I thought about my level of ability"), and (b) TUT ("I thought about personal worries" or "I thought about something that happened earlier today"). This measure has been successfully used in previous studies using thought probes (e.g., Smallwood et al., 2004) (Appendix E).

Music Post-task Questionnaire

Participants were given a questionnaire to asses their state during the music task. Participants were asked about how familiar they were with the music, if they were satisfied with the volume, the complexity of the music, etc. They were also asked about their mood state (Appendix F).

Salience scale

The salience scale was adapted from Glushakow (2011) and asks questions about the nature of the presence or the music). For phase 1, the scale was included in the post task questionnaire items after each task. To maintain the elusiveness of the purpose of the study, participants in phase 2 answered the salience scale after they had completed the two studies (Appendix G).

Music

The music for the high complexity and low complexity conditions was composed by Rutgers University music major. Two pieces of music, each 8 minutes long, were composed based on tempo, layers, melodic complexity, thematic variation, and repetitiveness as defined by Furnham & Allass (1999). The music was played and repeated throughout the study with participants either hearing the low complexity or the high complexity pieces. The music was played through speakers set up in the room behind books on a shelf connected by a wire to a computer in an adjacent room. Both the SART and word-pair task were counter balanced and the music continuously played on a loop until the study was completed.

Five music experts rated the musical compositions on tempo, musical layering, melodic complexity, variation and repetition (1 = low, 5 = high). Pair-wise comparisons revealed no significant difference in tempo for the low complexity (M = 2.40, SD = .55) and high complexity (M = 2.40, SD = .55) musical pieces. There was no significant difference for musical layering between the low complexity (M = 3.80, SD = .84) and high complexity (M = 3.40, SD = .89) conditions $t(4) = .590$, $p > .05$, no significant difference for melodic complexity between the low complexity (M = 3.00, SD = .71) and high complexity (M =2.60, SD = .89) conditions, $t(4) = 1.633$, $p > .05$, no significant differences for variation between the low complexity (M = 2.80, SD = 1.10) and high complexity (M = 3.00, SD = 1.22) conditions, $t(4) = -.343$, $p > .05$ and no significant differences for repetition in the low complexity (M = 3.20, SD = 1.10) and high complexity (M = 2.80, SD = 1.10) conditions, $t(4) = 1.00$, $p > .05$. These results were

surprising given that pretesting showed a significant difference in performance for introverts and extraverts based on the complexity of the musical pieces.

All participants indicated that they heard the music and that they were within the normal hearing range. Participants were unfamiliar with the musical compositions (M = 1.79, SD = 1.11) and significantly liked the low complexity music (M = 3.15, SD = 1.21) more than the high complexity music (M = 2.71, SD = 1.15), $t(113) = 1.98$, $p < .05$. There was no difference in how distracted participants were during the study between the low complexity (M = 2.74, SD = 1.19) and the high complexity (M = 2.63, SD = 1.10) conditions, $t(113) = .517$, $p > .05$. In terms of perceived complexity, there was no significant difference between the low complexity music condition (M = 2.56, SD = .98) and the high complexity music condition (M = 2.24, SD = 1.12), $t(112) = 1.60$, $p > .05$.

CHAPTER III

RESULTS

Covariates

The variables of boredom proneness and cognitive ability (measured by the Wonderlic) were tested as potential covariates of performance on the SART and word-pair tasks. For the SART task, boredom proneness was not correlated with performance $r(360) = .01$, $p > .05$ and scores on the Wonderlic were not correlated with performance $r(362) = -.06$, $p > .05$. For the word-pair task, boredom proneness was not correlated with performance, $r(347) = -.04$, $p > .05$, however the Wonderlic was correlated with performance, $r(360) = .34$, $p < .001$. For the regression analysis, Wonderlic scores were entered as a covariate (Table 1).

Mediators

Boredom

Subjective boredom was operationalized by a composite of the "boredom" component of the boredom questionnaire (Fisher, 1998). These items were "How bored are you?", "How fascinating was the task?", "How much did you enjoy the task?", "How interested were you in the task?.", "How boring was the task?" For the SART task, the reliability was $\alpha = .77$. For the word-pair task, the reliability was $\alpha = .79$.

In phase one of the SART task, participants were asked to rate how boring the task was (1 = very boring, 5 = very interesting) after each of the four blocks. Regression analysis was used to determine if the boredom assessments during the task predicted the

measure of composite boredom given at the end of the task. The mean for block 1 was 2.77 (*SD* = 1.17), for block 2 was 2.32 (*SD* = 1.18), block 3 was 2.21 (*SD* = 1.21) and block 4 was 2.03 (*SD* = 1.16). Regression analysis was used to determine if the ratings of boredom through out the task significantly predicted the measure of subjective boredom given at the end of the task. The results of the regression analysis for block one indicates that the boredom rating explained 33% of the variance in the composite boredom measure, $R^2 = .33$, $F(1, 134) = 67.12$, $p < .001$, $\beta = .-1.63$, $t(134) = -8.19$, $p < .001$. Block 2 indicates that the boredom rating explained 12% of the variance in the composite boredom measure, $R^2 = .12$, $F(1, 133) = 41.72$, $p < .001$, $\beta = -1.29$, $t(133) = -6.46$, $p < .001$. Block three indicates that the boredom rating explained 17% of the variance in the composite boredom measure, $R^2 = .17$, $F(1, 129) = 25.93$, $p < .001$, $\beta = -1.09$, $t(129) = -5.09$, $p < .001$. Block 4 indicates that the boredom rating explained 25% of the variance in the composite boredom measure $R^2 = .25$, $F(1, 133) = 44.32$, $p < .001$, $\beta = -1.33$, $t(133) = -6.66$, $p < .001$ (Table 2).

A repeated measures analysis of variance (ANOVA) was conducted to determine if participants were increasingly bored through out the task by assessing the boredom probes over time in each block. In order to test sphericity, Mauchleys test which tests for the hypothesized and observed variance/covariance patterns. The test was significant, $W = .89$, $\chi 2\ (5) = 15.28$, $p < .01$ suggesting that the matrix does not have equal variances and covariances. For this data, the corrective coefficient was the Huynh-Feldt $\varepsilon = .95$. The level of boredom across time relationship significant $F(3, 390) = 23.89$ $p < .01$, partial $\eta^2 = .16$. The repeated measures analysis indicates that participants were consistently more bored as the task progressed (Table 3).

For the word-pair task, boredom was assessed at three time periods during the task. For block 1, the means was 2.94 *(SD* = 1.11), for block 2, 2.85 (*SD* = 1.21) and for block 3, 2.86 (*SD* = 1.19). Regression analysis was used to determine if the ratings of boredom through out the word-pair task significantly predicted the measure of subjective boredom given at the end of the task. The results of the regression analysis for block 1 indicate that the boredom rating explained 4% of the variance in the composite boredom measure, $R^2 = .04$, $F(1, 106) = 4.32$, $p < .05$, $\beta = -.55$, $t(106) = -2.08$, $p < .05$. Block 2 indicates that the boredom rating did not explain any of the variance in the composite boredom measure, $R^2 = .03$, $F(1, 108) = 2.66$, $p > .05$. Block 3 indicates that the boredom rating explained 7 % of the variance in the composite boredom measure, $R^2 = .07$, $F(1, 108) = 7.55$, $p < .01$, $\beta = -.68$, $t(108) = -2.75$, $p < .01$ (Table 2).

A repeated measures analysis of variance (ANOVA) was conducted to determine if participants were increasingly bored through out the task by assessing the boredom probes over time. In order to test sphericity, Mauchleys test was run which tests for the hypothesized and observed variance/covariance patterns. The test was not significant, $W = .99$, $\chi 2\ (2) = .93$, $p > .05$ suggesting that the matrix does have equal variances and covariances. The level of boredom across time relationship was not significant $F(2, 216) = .745$ $p > .05$, partial $\eta^2 = .01$. The repeated measures analysis indicates that participants were not consistently more bored as the task progressed (Table 3).

Mind-Wandering

Mind-Wandering was operationalized by a composite of the "mind wandering" component of the boredom questionnaire (Fisher, 1998). These items were "How much was you mind wandering?", "How distracted were you?", "How much were you daydreaming?", "How much were you off in another world?", "To what extent did you mind wander?." For the SART task, the reliability was $\alpha = .88$. For the word-pair task, the reliability was $\alpha = .88$.

Mind-Wandering during the task was assessed by asking the participants what was going through their minds at certain points during the task. The thought probes were then coded by two independent raters who classified the thoughts in 4 different categories: (1) task-related and stimulus-dependent experience (i.e., on-task reports): the participant's attention and thoughts are fully focused on the task-related stimuli (i.e., the numbers); (2) task-related and stimulus-independent experience (i.e., task-related interferences reports): the participant experiences thoughts about the task that are not directly related to the numbers presented on the screen and, thus, that do not help him/her to have the best possible performance on the current ongoing trials (e.g., thoughts about task duration or about the participant's overall performance); (3) task-unrelated and stimulus-dependent experience (i.e., external distractions reports): the participant's attention is diverted by stimuli that are present in the current environment but unrelated to the task at hand (e.g., exteroceptive perceptions, such as noises, the luminance, the temperature or others features of the current environment or interoceptive sensations, such as feeling thirsty, tired or other physical sensations); (4) task-unrelated and stimulus-independent experience (i.e., mind-wandering reports): the participant has his/her attention decoupled from exteroceptive/interoceptive perceptions and is experiencing

thoughts unrelated to the task at hand (e.g., thoughts about what the participant did last evening, about what he/she needs to do this evening or about what significant others could be doing now) as adapted from Stawarczyk et al., 2011 (Figure 1).

Regarding thought probes for the SART task, participants reported being on task (task dependent, stimulus dependent) for 35.70% of probes, task related inferences (Task dependent, non-stimulus dependent) for 36.37% of probes, thinking about external distractions (task independent, stimulus dependent) for 14.39% of probes and mind wandering (task independent, stimulus independent) for 8.75% of probes. Introverts reported being on task for 35.17% of probes, having task related inferences for 42.11% of probes, external distractions for 13.25% of probes and mind wandering for 8.6% of probes. Extraverts reported being on task for 35.44% of probes, having task related inferences for 36.07% of probes, external distractions for 17.87% of probes and mind wandering for 9.04% of probes.

The coders rated the thought probes the scale (1 = on task, stimulus dependent thoughts, 4 = off task stimulus independent thoughts). The mean for block 1 was 1.93 (*SD* = .88), block 2 1.85 (*SD* = .95), for block 3 1.99 (*SD*= 1.94) and for block 4 2.20 (*SD* = .90). Regression analysis was run to determine if the mind-wandering assessments during the task predicted the measure of composite mind-wandering given at the end of the task. The results of the regression analysis for block 1 indicates that the mind-wandering rating explained 12% of the variance in the composite mind-wandering measure, $R^2 = .12$, $F(1, 130) = 16.86$, $p < .001$, $\beta = 2.23$, $t(130) = 4.11$, $p < .001$. Block two indicates that the mind-wandering rating explained 5% of the variance in the composite mind-wandering measure, $R^2 = .05$, $F(1, 134) = 7.13$, $p < .01$, $\beta = 1.32$, $t(134)$

= 2.67, $p < .01$. Block 3 indicates that the mind-wandering rating explained 13% of the variance in the composite mind-wandering measure, $R^2 = .13$, $F(1, 133) = 18.98$, $p < .001$, $\beta = 1.81$, $t(133) = 4.36$, $p < .001$. Block 4 indicates that the mind-wandering rating explained 14% of the variance in the composite mind-wandering measure $R^2 = .14$, $F(1, 133) = 22.18$, $p < .001$, $\beta = 1.82$, $t(133) = 4.71$, $p < .001$ (Table 2).

A repeated measures analysis of variance (ANOVA) was conducted to determine if participants were increasingly bored through out the task by assessing mind-wandering probes over time in each block. In order to test sphericity, Mauchleys test was run, which tests for the hypothesized and observed variance/covariance patterns. The test was not significant, $W = .94$, $\chi 2$ (5) = 7.41, $p > .05$ suggesting that the matrix does have equal variances and covariances. The level of mind-wandering across time relationship significant $F(3, 390) = 4.10$, $p < .01$, partial $\eta^2 = .03$. The repeated measures analysis indicates that participants consistently engaged in more mind-wandering as the task progressed (Table 3).

For the word-pair task, mind-wandering was assessed at three time periods during the task. For block 1, the means was 1.87 *(SD* = .80), for block 2, 1.60 (*SD* = .66) and for block 3, 1.53 (*SD* = .64). Regression analysis was used to determine if the ratings of mind-wandering through out the word-pair task significantly predicted the measure of mind-wandering given at the end of the task. The results of the regression analysis for block 1 indicates that the mind-wandering rating explained 10 % of the variance in the composite boredom measure, $R^2 = .10$, $F(1, 109) = 11.66$, $p < .01$, $\beta = 1.87$, $t(109) = 3.42$, $p < .01$. Block 2 indicates that the mind-wandering rating explained 5% of the variance in the composite mind-wandering measure, $R^2 = .05$, $F(1, 109) = 5.38$, $p < .05$, β

= 1.58, $t(109) = 2.32$, $p < .05$. Block 3 indicates that the mind-wandering rating did not explain any of the variance in the composite mind-wandering measure, $R^2 = .03$, $F(1, 109) = 2.80$, $p > .05$ (Table 2).

A repeated measures analysis of variance (ANOVA) was conducted to determine if participants increased their mind-wandering through out the task by assessing the mind-wandering probes over time. In order to test sphericity, Mauchleys test was run, which tests for the hypothesized and observed variance/covariance patterns. The test was significant, $W = .90$, $\chi 2\ (2) = 11.58$, $p < .01$ suggesting that the matrix does not have equal variances and covariances. For this data, the corrective coefficient was the Huynh-Feldt $\varepsilon = .93$. The level of mind-wandering across time was significant $F(2, 226) = 12.43$ $p < .01$, partial $\eta^2 = .10$. The repeated measures analysis indicates that participants engaged in more mind-wandering as the task progressed (Table 3).

Task Unrelated Thoughts (TUT)

In addition to the mind-wandering composite (Fisher, 1998), the contents of the thoughts were assessed. The Dundee Stress State Scale (DSSQ) consists of a section that deals with thought content. The second 8 items of the DSSQ on thoughts pertain to task unrelated thoughts (TUT). These included the following items, "thought about members of my family", "thought about something that made me feel guilty", "I thought about personal worries", "I thought about something that made me feel angry", "I thought about something that happened earlier", "I thought about something that happened in the recent past", "I thought about something that happened in the distant past", "I thought about something that was going to happen in the future." The reliability for the SART task was $\alpha = .90$ and $\alpha = .88$ for the word-pair task.

Regression analysis was used to determine if the mind-wandering assessments during the task predicted TUT for the SART task. The results of the regression analysis for block 1 indicates that the mind-wandering rating did not explain the variance in TUT, $R^2 = .03$, $F(1, 130) = 2.32$, $p > .05$. Block 2 indicates that the mind-wandering rating explained 5% of the variance in the TUT, $R^2 = .05$, $F(1, 130) = 7.14$, $p < .01$, $\beta = 1.18$, $t(130) = 2.67$, $p < .01$. Block 3 indicates that the mind-wandering did not explain any of the variance in TUT, $R^2 = .02$, $F(1, 133) = 2.43$, $p > .05$. Block 4 indicates that the mind-wandering rating explained 4% of the variance in the composite mind-wandering measure $R^2 = .04$, $F(1, 130) = 5.62$, $p < .05$, $\beta = 1.18$, $t(130) = 2.37$, $p < .05$ (Table 2). This indicates that the mind-wandering probes predicted the measure of TUT.

Regression analysis was used to determine if the ratings of mind-wandering through out the word-pair task significantly predicted TUT. The results of the regression analysis for block 1 indicates that the mind-wandering rating explained 16 % of the variance in TUT, $R^2 = .16$, $F(1, 111) = 20.65$, $p < .001$, $\beta = 2.55$, $t(111) = 4.54$, $p < .001$. Block 2 indicates that the mind-wandering rating explained 5% of the variance in the composite mind-wandering measure, $R^2 = .05$, $F(1, 111) = 5.69$, $p < .05$, $\beta = 1.71$, $t(111) = 2.38$, $p < .05$. Block 3 indicates that the mind-wandering rating did not explain any of the variance in TUT, $R^2 = .01$, $F(1, 111) = 1.01$, $p > .05$ (Table 3). Therefore, TUT is predicted from the mind-wandering probes given during the word-pair task. Additional related analyses are presented in the endnote. [1]

Performance compared to the absence condition

Traditional social facilitation research predicts a difference in performance when a person is present from the absence condition. Regression analysis compared all conditions separately to the absence condition for phase 1 and phase 2 (Table 4). The only significant difference in performance when compared to the absence condition (M = 13.40, SD = 4.58, n = 35) was the high complexity music condition (M = 11.18, SD = 3.23, n = 22) in phase 1. Levene's test for equality of variances was significant, therefore the t-value does not assume equal variances, $t(55) = 2.141$, $p < .05$.

Mediation Analysis

Hypothesis 1 proposed that boredom and mind-wandering would mediate the relationship between the salience of the presence depending on condition and performance. Therefore, the effect of condition on performance both directly and indirectly through boredom and mind-wandering will be determined. In this model X is the two conditions being compared, M = boredom or mind-wandering and Y = performance. This analysis was conducted using the PROCESS macro for SPSS (Hayes & Preacher, 2012). The potential mediators for this analysis were boredom and mind wandering because these could be significantly predicted from probes during the task. Recent recommendations (Hayes & Preacher, 2012) base inferences about the indirect effects not on the statistical significance of the paths that define it (from condition to mediator and then from mediator to performance, but rather on a quantification of the indirect effect itself and a statistical test of the sampling distributions of the indirect effects. The PROCESS macro evaluates the indirect effects by asymmetric bootstrap

confidence intervals which are significant if they do not include zero. This method takes into account the non-normality of the sampling distribution (Hayes, 2012).

Performance scores were regressed onto the condition (dummy-coded: absence = 0, high-complexity music = 1) with boredom entered as the proposed mediator. Five thousand bootstrap resamples were performed. The 95% confidence interval obtained for the indirect effects of the condition on performance through the mediator of boredom did include zero (−.36, 1.37). Therefore, the relationship between condition and performance was not mediated by boredom (Table 5).

Performance scores were regressed onto the condition (dummy-coded: absence = 0, high-complexity music = 1) with mind-wandering entered as the proposed mediator. Five thousand bootstrap resamples were performed. The 95% confidence interval obtained for the indirect effects of the condition on performance through the mediator of boredom did include zero (−.52, .36). Therefore, the relationship between condition and performance was not mediated by mind-wandering (Table 6).

Performance scores were regressed onto the condition (dummy-coded: absence = 0, high-complexity music = 1) with TUT entered as the proposed mediator. Five thousand bootstrap resamples were performed. The 95% confidence interval obtained for the indirect effects of the condition on performance through the mediator of boredom did include zero (−.72, .28). Therefore, the relationship between condition and performance was not mediated by TUT (Table 7).

SART Social Presence

Hypothesis 2 predicted that individuals with low extraversion in the coactor condition would be facilitated to a greater degree than individuals in the absence condition and individuals with high extraversion in the evaluation condition would be facilitated to a greater degree than those in the absence condition on the SART task. A step-wise regression was performed with two variables serving as predictors: condition dummy coded (absence = 0, coactor = 1), and the z-score for extraversion. The interaction between condition and the z-score for extraversion was entered in step 2. The results of the analysis are presented in Table 8. The overall relationship was significant $R^2 = .06$, $F(2, 65) = 2.613$, $p < .05$. The tolerance (.515) and variance inflation factor (1.944) indicate that the two predictor variables were not correlated. Cooke's distance (maximum .07) indicates that there were no overly influential points.

The interaction between condition and extraversion significantly predicted performance on SART task, $\beta = -.348$, $t(65) = -2.689$, $p < .05$. Simple slope analysis indicates that the simple slope for low extraversion was significant $t(65) = 1.973$, $p < .05$ and the simple slope for high extraversion was significant, $t(65) = -1.995$, $p < .05$. When plotted at 1 standard deviation above and below the mean, the interaction shows that introverts perform better in the absence condition when compared to the coactor condition and extraverts perform better in the coactor condition when compared to the absence condition (Figure 2). Additional regression analyses indicated that there was a marginally significant effect of extraversion in prediction of performance in the absence condition, $\beta = .037$, $t(33) = 2.007$, $p = .053$, where an increase in extraversion indicates an increase in errors. There was no difference for performance between introverts and extraverts in the coactor condition (Table 8).

The analysis was performed once again using on the participants from phase 2. The model was not significant $R^2 = .02$, $F(3, 56) = .438$, $p > .05$ indicating that extraversion did not moderation the relationship between condition and performance (Table 8).

For the evaluator presence in phase 1, a step-wise regression was performed with two variables serving as predictors: condition dummy coded (absence = 0 and evaluator = 1) and the z-score of extraversion. The interaction between condition and the z-score for extraversion was entered in step 2. The model was not significant $F(3, 51) = 1.868$, $p > .05$ for phase 1. The analysis was performed once again using on the participants from phase 2. The interaction component did not significantly contribute to the $F(3, 53) = 1.94$, $p > .05$ (Table 8).

To address the differences in performance between introverts and extraverts, the level of task unrelated thoughts was assessed. Task unrelated thoughts are the main reason why individuals have trouble paying attention on the SART task. An independent t-test revealed that for extraverts, there was a marginally significant difference between TUT between the absence condition ($M = 14.21$, $SD = 6.27$, $n = 17$) and the coactor condition ($M = 11.18$, $SD = 3.40$, $n = 22$), $t(37) = 1.884$, $p = .068$. In addition, introverts show a marginally significant difference in TUT between the absence ($M = 11.40$, $SD = 5.48$, $n = 20$) and the coactor condition ($M = 15.22$, $SD = 5.38$, $n = 9$), $t(27) = -1.747$, $p = .092$.

Though the composite factor for boredom was not significant, introverts reported that they were significantly more bored during the task in the coactor condition (1 = not bored at all, 5 = very bored) ($M = 4.33$, $SD = .70$, $n = 9$) than the absence condition ($M =$

3.20, SD = 1.01, n = 22), $t(27) = -3.046$, $p < .01$. This difference was not observed for the evaluator condition.

Hypothesis 2 was not supported since introverts performed significantly better in the absence condition when compared to the coactor condition and extraverts performed significantly better in the coactor condition when compared to the absence condition. The measures of TUT and boredom indicates that the participants were more bored and engaged in more TUT when they were not attending to the task.

Moderated Mediation

Hypothesis 3 predicted that boredom would mediate the moderated relationship between condition, extraversion and performance such that an increase in social presence and an increase in extraversion would produce performance enhancement through a reduction in boredom. Mediation and moderation analysis can be combined through the construction of what Hayes & Preacher (2012) calls a conditional process model. Such a model allows the indirect and direct effects of the independent variable *X* on a dependent variable *Y* through a mediator *M* to be moderated. When there is evidence of a moderation effect of *X* on *M*, the effect of *M* on *Y*, or both, estimation of and inference about, what Hayes & Preacher (2012) coined, the *conditional indirect effect* of X gives insight into the contingent nature of the independent variable's effect on the dependent variable through the mediator depending on the moderator. This process is called *moderated mediation* because the "indirect effect" or mechanism pathway through which *X* exerts its effect on *Y* is dependent on the value of a moderator (Hayes & Preacher, 2012).

The model for this analysis is called “first stage and direct effect moderation model” by Edwards & Lambert (2007). In this model both the effect of condition on boredom and the direct effect of condition on performance are estimated as moderated by extraversion. Because the effect of condition on boredom is modeled as contingent on extraversion, then so too is the indirect effect of condition on performance, because the indirect effect is the product of the conditional effect of condition on boredom and the unconditional effect of boredom on performance (Hayes & Preacher, 2012). This study proposes that the moderation of extraversion on condition in predicting performance will be mediated by either boredom, mind-wandering or TUT.

The mediation relationship of boredom on the interaction between condition and extraversion and performance was tested. The confidence interval for the conditional indirect effects of boredom as a mediator included zero (-.01, .01) which indicates that boredom is not a mediator (Table 9). For mind wandering, the confidence interval of the conditional indirect effects included zero (-.01, .01) indicating that mind wandering is not a mediator of the moderated relationship (Table 10). For TUT, the confidence interval of the conditional indirect effects included zero (-.03, .05) indicating that TUT are not a mediator of the moderated relationship (Table 11).

SART Non-Social

Another goal of this study was to determine if a social presence is needed for the social facilitation effect, or would any distraction that fills cognitive capacity have the same performance effects. However, the salience of the social distraction conditions and music conditions were not comparable. The music conditions were much more salient

than either of the social distraction conditions. Hypothesis 4 predicted that the low complexity music condition would show the same pattern as the coactor condition such that introverts would be facilitated and that the high complexity music condition would show the same pattern as the evaluation condition and extraverts would be facilitated.

A step-wise regression was performed for phase 1 with two variables serving as predictors: condition dummy coded (absence = 0 and low complexity = 1) and the z-score of extraversion. The interaction between condition and the z-score for extraversion was entered in step 2. The overall model was significant, $R^2 = .35$, $F(3, 56) = 2.61$, $p < .05$, however the interaction did not account for variance above the individual predictors alone, $\beta = -.01$, $t(56) = 0.01$, $p > .05$. The analysis was performed once again using on the participants from phase 2 and the model was not significant $R^2 = .00$, $F(3, 55) = .07$, $p > .05$ (Table 12).

For the second part of hypothesis 4 addressing high complexity music, a step-wise regression was performed for phase 1 with two variables serving as predictors: condition dummy coded (absence = 0 and high complexity music = 1) and the z-score of extraversion. The interaction between condition and the z-score for extraversion was entered in step 2. The overall model was significant, $R^2 = .16$, $F(3, 52) = 3.36$, $p < .05$ (Table 12). The tolerance (.663) and the variance inflation factor (1.51) indicate that the two predictors are not correlated. Cooke's distance (maximum .125) indicated there are no overly influential cases. The interaction of condition and extraversion significantly predicted performance, $\beta = -2.69$, $t(52) = -2.22$, $p < .05$. The simple slope for low extraversion was not significant $t(52) = 1.36$, $p < .05$, however the simple slope for high extraversion was significant, $t(52) = -2.86$, $p < .01$. When plotted at one standard

deviation above and below the mean, the interaction shows extraverts performed significantly better when in the high complexity condition than the absence condition (Figure 3). Additional regression analyses indicate that there was a marginally significant effect of extraversion in prediction of performance in the absence condition, $F(1, 33) = 3.98$, $p = .055$, $\beta = 1.50$, $t(32) = 2.00$, $p = .055$, where an increase in extraversion indicates an increase in errors. There was no difference for performance in the high complexity music condition between introverts and extraverts, $F(1, 20) = 2.21$, $p > .05$.

Again, given that the hall mark of not attending to the SART task is engaging in TUT (Smallwood, 2004), the amount of TUT in each condition was analyzed. There was a significant difference for the amount of TUTs between the absence ($M = 14.21$, $SD = 6.26$, $n = 14$) and the high complexity music condition ($M = 10.00$, $SD = 2.42$, $n = 14$), $t(26) = 2.35$, $p < .05$ for extraverts, however there was no significant difference for introverts $t(26) = -.621$, $p > .05$. The analysis was performed once again using on the participants from phase 2. The model was not significant $R^2 = .12$, $F(5, 46) = 1.21$, $p > .05$ (Table 12).

The hypothesis predicted that introverts would show performance facilitation in the low complexity music condition when compared to the absence condition and extraverts would show performance facilitation when compared to the absence condition. The results lend partial support to the hypothesis since extraverts were facilitated in the high-complexity music condition when compared to the absence condition.

Mediated Moderation

Given that extraversion moderated the relationship between condition and performance for the high complexity music condition, hypothesis 5 predicted that the moderation of extraversion on performance would be mediated by boredom, mind-wandering or TUT. For the high complexity music condition in phase 1, the confidence interval for the conditional indirect effects included zero (-.05, .01) which indicated that boredom is not a mediator (Table 13). For mind-wandering, the confidence interval for the conditional indirect effects included zero (-.02, .02) which indicates that mind wandering is not a mediator of the moderated relationship (Table 14). And the confidence interval for TUT for the conditional indirect effects included zero (-.03, .05) indicating that TUT is not a mediator (Table 15).

Salience SART

The hypotheses of this study predicted a relationship between the salience of the conditions and performance. For the SART task, it was hypothesized that for introverts, as the salience increased, performance would increase and then would subsequently decreases as the distraction became overwhelming. The univariate distribution was analyzed for any influential points using Cook's distance. The maximum distance for any point was .063, below the convention of 1, indicating that there were no influential points in the distribution. The relationship between the salience and the total errors was tested for a linear relationship and found not significant, $R^2 = .00$, $F(1, 134) = .14$, $p > .05$. For extraverts, it was predicted that as the salience increased, performance would increase. The univariate distribution was analyzed for influential points using Cook's distance. The maximum distance for points in the distribution was .05, indicating that

there were no influential points. The relationship between salience and the total errors was tested for a linear relationship and found not significant, $R^2 = .00$, $F(1, 141) = .02$, $p > .05$.

Word-pair Social Distraction

Hypothesis 6 addressed a moderated relationship between extraversion and condition for the word-pair task. The first part of hypothesis 6 predicted that performance would be facilitated for extraverts in the coactor condition when compared with the absence condition. A step-wise regression was performed for phase 1 with three variables serving as predictors: condition dummy coded (absence = 0 and coactor = 1), the z-score of extraversion and scores on the Wonderlic. The interaction between condition and the z-score for extraversion was entered in step 2. The results of the analysis are presented in table 19. The model was significant for phase 1, $R^2 = .23$, $F(4, 57) = 4.21$, $p < .01$, however the interaction term was not significant in predicting variance over and above the predictor variable alone, $\beta = 1.65$, $t(57) = 1.81$, $p > .05$.

For phase 2, the model was significant. $R^2 = .28$, $F(4, 51) = 4.74$, $p < .01$, and the interaction of condition and extraversion was significant, $\beta = .084$, $t(51) = 2.42$, $p < .05$. Tolerance (.32) and the variance inflation factor (3.08) indicated that the two predictor variables were not correlated. Cooke's distance (max .112) indicated that there were no overly influential points. Simple slope analysis for low extraversion was not significant $t(25) = -.16$, $p > .05$, however the simple slope for high extraversion was significant, $t(33) = 3.88$, $p < 01$. When plotted at one standard deviation above and below the mean, the interaction shows that extraverts show performance facilitation in the coactor

condition as compared to the absence condition (Figure 4). Additional regression analyses indicated that there was a significant effect of extraversion in prediction of performance in the absence condition, $\beta = .037$, $t(23) = -1.93$, $p < .01$, where a decrease in extraversion indicates an increase in errors. There was no difference for the performance in the coactor condition for introverts and extraverts (Table 16).

There was a significant difference in TUT for extraverts between the absence condition ($M = 14.00$, $SD = 5.88$, $n = 15$) and the coactor condition ($M = 10.70$, $SD = 3.10$, $n = 20$), $t(33) = 2.15$, $p < .05$. There was no significant difference in TUT for introverts, $t(22) = -1.02$, $p > .05$.

The second part of hypothesis 6 predicted an interaction between condition (absence/evaluation) and performance for the word-pair task. A step-wise regression was performed for phase 1 with three variables serving as predictors: condition dummy coded (absence = 0 and evaluation = 1), the z-score of extraversion and scores on the Wonderlic. The interaction between condition and the z-score for extraversion was entered in step 2. The results of the analysis are presented in Table 16. The model was significant for phase one, $R^2 = .24$, $F(4, 48) = 3.84$, $p < .01$, however the interaction did not significantly account for additional variance above the predictors, $\beta = 1.60$, $t(48) = 1.67$, $p > .05$ (Table 32). For phase 2, the model was significant $R^2 = .18$, $F(4, 50) = 2.76$, $p < .05$ and the interaction of condition and extraversion was significant, $\beta = 2.12$, $t(50) = 2.49$, $p < .05$. Tolerance (.448) and the variance inflation factor (2.23) indicate that the two predictor variables were not correlated. Cook's distance (max .134) indicates that there were no overly influential points. Simple slope analysis for low extraversion was significant $t(57) = -1.88$, $p < .05$, however the simple slope for high

extraversion was not significant, $t(57) = .470$, $p > .05$. When plotted at one standard deviation above and below the mean, the interaction shows that introverts show performance impairment in the evaluation condition when compared to the absence condition (Figure 5). Additional regression analyses indicate that there is a marginally significant effect of extraversion in the prediction of performance in the absence condition, $\beta = .037$, $t(33) = -1.394$, $p = .055$, where a decrease in extraversion indicates an increase in errors. There was no difference for the performance in the coactor condition for extraversion, $F(1, 29) = .19$, $p > .05$ (Table 16).

Again, extraverts had significantly more TUT in the absence condition ($M = 14.97$, $SD = 7.95$, $n = 21$) than in the evaluation condition ($M = 10.00$, $SD = 2.94$, $n = 14$), $t(27.26) = 2.402$, $p < .05$ (significance is for unequal variances). The variances were significantly different; therefore significance is reported for unequal variances. There was not a significant difference between TUTs for introverts between the absence and evaluation condition $t(24) = -.224$, $p > .05$.

Hypothesis 6 predicted an increase in performance for extraverts from the absence to coactor condition, which was supported. Hypothesis 6 also predicted an increase in performance from the absence condition to the evaluator condition. This part of the hypothesis was not supported as extraverts did not show a difference in performance. However introverts did show a decrease in performance from the absence condition to the evaluator condition.

Mediated Moderation

Given that extraversion moderated the relationship between condition and performance, hypothesis 7 predicted that the moderation of extraversion on performance would be mediated by boredom, mind wandering or TUT. For the coactor condition, the confidence interval for the conditional indirect effects included zero (-.01, .05) indicating that boredom is not a mediator (Table 17). For mind wandering, the confidence interval for the conditional indirect effects included zero (-.01, .04) indicating that mind wandering is not a mediator (Table 18). And for TUT, the confidence interval for the conditional indirect effects included zero (-.03, .01) indicating that TUT was not a mediator (Table 19).

For the evaluator condition in phase 2, the confidence interval for the conditional indirect effects included zero (-.02, .02) which indicates that boredom is not a mediator (Table 20). For mind-wandering, the confidence interval for the conditional indirect effects included zero (-.03, .01) and is therefore not a mediator (Table 21). And the confidence interval for the conditional indirect effects of TUT included (-.01, .02) which indicates that TUT is not a mediator (Table 22).

Word-Pair Non-Social Distraction

Hypothesis 8 predicted that extravert's performance would be facilitated in the low complexity music condition compared with the absence condition. A step-wise regression was performed for phase 1 with three variables serving as predictors: condition dummy coded (absence = 0 and low complexity music = 1), the z-score of extraversion and scores on the Wonderlic. The interaction between condition and the z-score for extraversion was entered in step 2. The results of the analysis are presented in

Table 24. The model was not significant for phase 1, $R^2 = .15$, $F(4, 57) = 2.24$, $p > .05$. The model was significant for phase 2, $R^2 = .20$, $F(4, 53) = 2.86$, $p < .05$, however the interaction did not significantly add additional variance, $\beta = .94$, $t(53) = .42$, $p > .05$ (Table 23).

The second part of hypothesis 8 addressed performance in the high complexity music condition such that extraverts would increase performance in the high complexity condition. A step-wise regression was performed for phase 1 with three variables serving as predictors: condition dummy coded (absence = 0 and high complexity music = 1), the z-score of extraversion and scores on the Wonderlic. The interaction between condition and the z-score for extraversion was entered in step 2. The results of the analysis are presented in Table 31. The model was significant, $R^2 = .28$, F (4, 47) = 4.44, p < .01, and the interaction did significantly add additional variance, $\beta = .57$, $t(47) = 2.23$, $p < .05$ (Table 24). The tolerance (.67) and variance inflation factor (1.49) indicate that the predictor variables are not correlated and Cooke's distance (max .144) indicated that there were no influential points. Simple slope analysis for low extraversion was significant $t(48) = -2.33$, $p < .05$ and the simple slope for high extraversion was not significant, $t(48) = .93$, $p > .05$. When plotted at one standard deviation above and below the mean, the interaction shows that introverts show performance impairment in the high complexity music condition as compared to the absence condition (Figure 6). Additional regression analyses indicate that there was a marginally significant effect of extraversion in the prediction of performance in the absence condition, $\beta = -1.54$, $t(30) = -2.40$, $p < .05$, where a decrease in extraversion indicates an increase in errors. There was no difference for the performance for the high complexity music condition between

introverts and extraverts (Table 23). For phase 2, the model was significant, $F(4, 51) = 6.58$, $p < .01$, however the interaction term was not significant, $\beta = .28$, $t(51) = 1.50$, $p > .05$.

Hypothesis 8 was not supported since extraverts did not show performance facilitation in the high-complexity music condition. However, the results do support the cognitive capacity explanation since introverts showed performance impairment in the high complexity music condition.

Mediated Moderation

Given that extraversion moderated the relationship between condition and performance in the high complexity music condition, hypothesis 9 predicted that the moderation of extraversion on performance would be mediated by boredom or mind wandering. For boredom, the confidence interval for the conditional indirect effects included zero (-.02, .01) indicating that boredom is not a mediator of the moderated relationship (Table 24). For mind wandering, the confidence interval for the conditional indirect effects included zero (-.04, .01) indicating that mind wandering is not a mediator of the moderated relationship (Table 25). For TUT, the confidence interval for the conditional indirect effects included zero (-.01, .05), which indicates that TUT is not a mediator (Table 26).

Salience Word-Pair

The hypotheses of this study predicted a relationship between the salience of the conditions and performance. For the word-pair task, it was hypothesized that for

introverts, as the salience increased, performance would decreases as the distraction became overwhelming. The univariate distribution was analyzed for any influential points using Cook's distance. The maximum distance for any point was .24, below the convention of 1, indicating that there are no influential points in the distribution. The relationship between the salience and the total correct was tested for a linear relationship and found the relationship was significant, $R^2 = .05$, $F(1, 127) = 7.28$, $p < .05$. For extraverts, it was predicted that as the salience increased, performance would initially increased and then subsequently decrease. The univariate distribution was analyzed for influential points using Cook's distance. The maximum distance for points in the distribution was .07, indicating that there were no influential points. The relationship between salience and the total correct was tested for a linear relationship and not significant, $R^2 = .00$, $F(1, 132) = .02$, $p > .05$ (Figure 7).

CHAPTER IV

DISCUSSION AND CONCLUSIONS

The current study demonstrates the importance of extraversion as a moderator in predicting performance during distractions and lends evidence to the cognitive capacity explanation of the distraction-conflict theory of social facilitation (Baron, 1986). A sustained attention to response (SART) task and the measurement of task unrelated thoughts (TUT) was important for determining if attention was focused on a task with distractions in the room, as hypothesized by Baron (1986). To perform the SART task and refrain from responding when the target appears, one has to be attending to the task. TUT is a measure of resource capacity and found to inhabit executive control resources when there is excess capacity (Smallwood & Schooler, 2006). In addition, working memory related brain areas are active during TUT (Christoff, Gordon, Smallwood, Smith, & Schooler, 2009; Stawarczyk et al., 2011). There is evidence that TUT become more frequent when working memory resources become available (Teasdale, Lloyd, Proctor, & Baddeley, 1993). In addition, TUT decrease when working memory resources are scarce, such as when performing tasks that place a high demand on working memory resources (Teasdale et al., 1995). In addition, TUT increase when individuals are not attending to the task and boredom increases, which can happen when stimulation is too high (Fisher, 1998; de Rijk, Schreurs & Bensing, 1999). When TUT occur during tasks that require working memory resources, performance tends to decline (Cheyne, Solman, Carriere, & Smilek, 2009; Smallwood et al., 2004). This evidence suggests that TUTs

are the default mode when working memory resources are needed, especially when an individual experiences under-stimulation or over-stimulation (Smallwood et al., 2008; Teasdale et al., 1995; de Rijk, et al., 1999).

The SART task encourages the use of working memory resources to ensure that the individual does not press the space bar when the infrequently occurring (11% of the time) target appears on the screen (Levinson, Smallwood & Davidson, 2012). For the SART task, the inability to withhold a response can be taken as evidence of failing to adequately attend to a task (Manly et al., 2002; Manly et al., 1999). Manual responses to these infrequent targets are a behavioral marker of mind-wandering, whereas correctly withheld responses are an indication that an individual is attending to the task. In addition, the assessment of task unrelated thoughts can support evidence that an individual is not attending to the task (Smallwood et al., 2008). Given these measurements of attention to task, the SART is an ideal task to test Baron's (1986) distraction-conflict theory with a cognitive capacity explanation. It may seem counter-intuitive that a social presence would result in focusing attention to the task, however if one considers that mind-wandering occurs when working memory is under-utilized or over-utilized, then a presence in the room can work to reduce mind-wandering and focus attention to the task or impair performance.

Traditional Social Facilitation

Hypothesis 1 tested the traditional social facilitation effects in terms of performance facilitation and impairment. According to theories proposed after Zajonc (1965) talked about dominant and non-dominant responses, performance facilitation

should occur with a presence in the room on a simple task. The only condition in this study that showed traditional performance facilitation when compared with the absence condition was the high complexity music condition on the SART task. Traditional social facilitation effects predict that a person presence or implied presence causes performance facilitation on a simple task. If interpreted as a typical social facilitation study, this study would have produced null results adding to decade's worth of conflicting results (Aiello & Douthitt, 2001; Bond & Titus, 1983). After Zajonc mentioned the dominant and non-dominant responses, subsequent research interpreted this as simple and complex tasks and focused on mechanisms for simple compared to complex tasks.

However, to interpret these results in the frame work of simple task facilitation and complex task impairment would be short sighted. One cannot conclude that all individuals would consider a task to be either simple or complex to the same degree. This study investigated performance differences based on the cognitive capacity of the individual instead of the dichotomy between simple and complex tasks. Recent studies on task performance focus on the distraction-conflict theory because of recent research on the nature of attention and how an overload of stimulation can distract from the task at hand (Huguet et al., 1999; Sharma et al., 2010). These modern studies address the distraction-conflict theory as originally conceptualized by Baron (1986), where a social presence during a simple task will facilitate performance because attention becomes focused on the central task and distracters are filtered out. However, this emphasis in the recent literature on distracters and the "central" task still does not address the issue of why a presence focuses attention on a task when it is "simple", or when the task possesses few cues (Baron, 1986).

SART Social Presence

To address the "why" of attentional focusing when there is a presence in the room, this study employed a task which was designed to measure attention to the task and the nature of thoughts. Hypothesis 2 predicted that introverts would be facilitated with a coactor presence and extraverts would be facilitated with an evaluator presence. The hypothesis was partially supported. With a coactor presence, introverts performance was impaired and extravert's performance was facilitated. These results support a cognitive capacity explanation for the distraction-conflict theory. Introverts in the absence condition engaged in minimal mind-wandering and were able to focus on the task more so than in the coactor condition. Extraverts, on the other hand, engaged in more mind-wandering in the absence condition because the under stimulation from the task left excess cognitive capacity which was filled with TUT. Once there was a coactor in the room, this decreased the amount of TUT and allowed extraverts to focus on the task.

In the coactor condition, introverts were impaired compared to the absence condition because they engaged in more TUT. This indicates that they disengaged from the task because the presence of the coactor over-stimulated their working memory resources and they entered a state of mind-wandering. Fisher (1998) and de Rijk et al. (1999) indicated that when cognitive resources are overloaded, individuals experience boredom and disengage focus from the task. In the evaluation condition, there was no difference in TUT when compared to the absence condition for either introverts or extroverts indicating that an evaluator presence was not enough to either decrease TUT for extraverts or increase TUT for introverts. Even though there was a reported

difference in salience between the coactor and evaluation condition, the coactor clearly had an effect on mind-wandering. This could possibly be from the uncertainty of the nature of the coactor and thoughts of why the coactor was in the room. The evaluator had a clearly defined role of watching the performance of the individual, but it was uncertain to the participant why the coactor was brought into the room and whether they were paying attention to the participant's performance.

These results also speak to the mere-effort theory of social facilitation which states that individuals perform better on a task with a person in the room because the presence increases their effort on the task (Harkins, 2006). If this were the case, then participants should have been facilitated in both the coactor and evaluation conditions because the participant would want to exert effort on the task if they knew they were being watched or evaluated. These results also address the notion of dominant versus non-dominant response. The non-response to target was the non-dominant response, which, by Zajonc's (1965) definition, should result in performance impairment with a presence in the room. However, extraverts were facilitated even when the correct response was the non-dominant response. This converging evidence is support for a cognitive capacity explanation for the distraction-conflict theory of social facilitation.

Hypothesis 3 predicted that this moderated effect would be mediated by either boredom, mind-wandering or TUT, which was not the case. It is interesting that there was a concomitant reduction in TUT's with performance facilitation, but the moderated relationship was not mediated by increased boredom, mind-wandering or TUTs. It appears that instead of boredom, the SART task was associated with TUT. Possibly the composite of boredom did not pick up on the increase of TUT.

SART Non-Social Distraction

To test the cognitive capacity explanation of the distraction-conflict model, Baron (1986) indicated that a definitive test would be to find social facilitation effects with a non-social distraction. The aim of this study was to have two levels of social distraction and two levels of non-social distraction that were comparable. However, both of the music conditions, low complexity and high complexity, were significantly higher than both of the social conditions in salience. Therefore, it is not possible to make a direct comparison, however this study uses the music conditions as another level of salience.

Hypothesis 4 predicted that introverts would be facilitated with the low complexity music and extraverts would be facilitated with the high complexity music when compared to the absence condition. The moderation analysis found that there was significant performance facilitation from the absence condition to the high complexity music condition for extraverts. This pattern was accompanied by a significant decrease in TUT from the absence to high complexity music condition. There was not a significant difference in performance for extraverts between the coactor and music conditions indicating that the coactor may have the same effect as the music; to decrease TUT and to facilitate performance for extraverts. It is interesting that, for extraverts, there was a significant difference between performance in the low and high complexity music conditions with extraverts performing significantly better in the high complexity music condition when compared to the low complexity condition. In addition, there were also significantly more TUT in the low complexity music condition. This may have been

because they liked the music more in the low complexity condition than the high complexity condition.

On the other hand, introverts did not show a difference in performance from the absence condition to the high complexity music condition. They found the high complexity music condition to be significantly more salient than the coactor condition, but performance was not impaired and there was no change in the amount of TUT. It is interesting that performance was not impaired for introverts in the music conditions as it was in the coactor condition. This could be because of the nature of the coactor affects introverts differently than a non-social distraction. Graydon and Murphy (1995) found that introverts were impaired on a cognitive task when in the presence of a noisy audience. The authors explained this using a working memory model where introverts have less functional working memory resources (Eysenck & Keane, 1990). However, it appears that introverts reported that they were less influenced by the coactor than the music, however the salience scale is based on self-report. According to Baron and colleagues (Baron, et al., 1978; Sanders, et al., 1978), coactors are often sources of social comparison information as people tend to evaluate their own performance. Muller and Butera (2007) show that a coactor is a threat to self-evaluation and concerns about performance in the presence of another is known to consume attentional resources in the form of ruminative thoughts (Koole, Smeets, van Knippenberg, & Dijksterhuis, 1999).

It is interesting that for the SART task, the only differences in performance by extraversion are for phase 1 of the study where the participants were periodically interrupted by assessments of their level of boredom and the nature of their thoughts. For phase 2, there were no differences between introverts and extraverts for any of the

salience questions, or for TUT. This could be because of the self-referential nature of the thought probes asking participants to report the nature of their thoughts. Sometimes the nature of the thought probes, asking people to report what they are thinking, stimulates non-related thoughts about the task (Schooler & Smallwood, 2006). Muller and Butera (2007) found that when attention is focused on the self, this tends to occupy cognitive capacity. For extraverts, they performed significantly better in the absence condition of phase 2 than in phase 1. This is most likely because the thought probes may have acted to distract attention from the task. Eysenck and Keane (1990) indicate that extroverts are more distractible and this is apparent since they engaged in more TUT in the absence condition in phase 1 than in phase 2. Therefore, the main effects seem to stem from the fact that extraverts engage in more TUT when there is not enough stimulation from the task or when distracted from the task.

Word-Pair Task

The word-pair task differs from the SART task in that it is correlated with scores on the Wonderlic Personnel Test (1992). Working memory and intelligence "g" have traditionally been considered the same construct. However, a recent meta-analysis indicates that working memory and "g" are actually separate constructs. Whereas working memory includes aspects of executive control and attention, "g", as measured by the Wonderlic appears to be a separate construct (Ackerman, Beier & Boyle, 2005). There was no correlation between the Wonderlic and the SART task even though the SART task requires working memory executive control to withhold a response to target (Smallwood et al., 2006). The word-pair task seems to require working memory and "g"

for performance. There was no correlation between extraversion and the Wonderlic even though extraverts are known to have higher working memory capacity (Eysenck & Eysenck, 1985). Therefore, the word-pair task requires working memory, but also seems to tap in to factors of "g", general intelligence, since "g" is involved when the cognitive load of the task is increased (Ackerman et al., 2005).

Hypothesis 6 predicted a difference in performance on the word-pair task based on an individual's level of extraversion. Extraverts were predicted to show performance facilitation in both the coactor and evaluation conditions because both of these conditions, with the higher cognitive load of the word-pair task, would put them at their optimal functioning level. This interaction between condition and extraversion was analyzed while controlling for Wonderlic scores, therefore performance was based on working memory capacity only. Hypothesis 6 was partially supported in that extraverts were facilitated in the coactor condition when compared to the absence condition. This indicates that extraverts were under stimulated in the absence condition and were able to focus on the task with a coactor in the room. However, there was not a decrease in TUT as performance increased, but a decrease in boredom as performance was facilitated. Introverts did not show this decrease in boredom and their performance was not different in the absence and coactor conditions.

For the evaluation condition, it was introverts who experienced performance impairment. However, extraverts did not experience a significant decrease in boredom from the absence to evaluation condition but introverts experienced more boredom in the evaluation condition than in the absence condition. This is most likely from overstimulation of the evaluator and the higher cognitive load of the task leading to

decoupling of attention from the task and increasing boredom (Fisher, 1998). Introverts seemed to be bothered by the presence of a coactor for the SART task, but did not show the same performance impairment for the word-pair task. This could be because the significant interaction occurred in phase 2 when individuals were not asked self-referential questions and there was no focus on self-evaluation. However, in phase 1 of the word-pair task, introverts did perform better in the absence condition than in the coactor condition whereas extraverts did not.

These interactions were significant for phase 2, which indicates that the interruptions in phase 1 most likely impaired performance for the word-pair task. There were no differences between phase 1 and phase 2 for introverts in the absence condition, but there was a difference for extraverts in the coactor condition. Extraverts in the coactor condition in phase 2 performed significantly better than in phase 1. This could have been because the questions about the thoughts decoupled their attention from the task, which then lead to more boredom. However, there was no difference in performance for introverts and extraverts for the evaluator condition between phase 1 and phase 2, however introverts did experience more TUT in the evaluator condition between phase 1 and phase 2.

For hypothesis 8, the interaction between condition and extraversion was not significant for the low-complexity music condition, but it was significant for the high complexity music condition in phase 1. The significant performance difference was based on introverts performing better in the absence condition than in the high complexity music condition. This seems to be significant for phase 1 and not phase 2 because introverts performed significantly better in phase 2 in the high-complexity music

condition. This is most likely due to the interruptions and the music being too much for introverts to deal with. And there was no significant difference for extraverts between phases 1 and 2.

It appears that TUT are associated with the SART task and boredom is associated with the word-pair task. The literature on the SART task shows a strong correlation between performance on the task and TUT (Smallwood et al., 2008). The word-pair task, which required a higher cognitive load, did not result in TUT, but in boredom. Because the cognitive load increased, individuals may have not thought they could not perform the word-pair task and reverted to a level of boredom. On the other hand, the participants had a chance to perform well even if their attention wandered for a while. This could have lead to less thoughts of boredom, but more task unrelated thoughts when they disengaged from the task.

Cognitive Capacity Explanation

Based on these results there is evidence for a cognitive capacity explanation for the distraction-conflict theory of social facilitation. Extraverts, when faced with a low stimulation task and with little outside stimulation showed performance facilitation with the increase in cognitive load and outside stimulation. Introverts showed performance impairment when overcome with too much outside stimulation and too much cognitive load. Ever since Zajonc (1965) introduced his dominant/non-dominant theory of social facilitation, researchers have interpreted this to mean “simple” and “complex” tasks. This study provides evidence for performance facilitation and impairment on the same task, under the same conditions depending on the cognitive capacity of the individual. In

addition, participants exhibited dominant and non-dominant responses on the same task under the same conditions. This study is the first to show social facilitation effects that are not based on the dominant response or not to be defined by "simple" or "complex" tasks. The results also lend evidence to the distraction-conflict theory of social facilitation.

Modern research on the distraction conflict theory of social facilitation focuses on attentional focusing on the "central cues" and blocking out distracters when performance is facilitated (Huguet et al., 1999; Muller et al., 2005; Sharma et al., 2010). Instead of focusing on Baron's initial conception of "central cues" and "distracters" (Baron et al., 1978), this study provides evidence for a cognitive capacity explanation of the distraction conflict theory. However, this study did not support the notion that it is "any" distraction that can cause social facilitation effects. Introverts seem to be sensitive to the presence of a coactor when asked self-referential information, such as what they were thinking, especially on the SART task. Asking the nature of their thoughts most likely activated self-evaluative thoughts because of the uncertain nature of the coactor (Muller et al., 2007). Surprisingly, this had a greater effect on performance than having an evaluator in the room when asked about thoughts. There was a trend toward more TUT in the coactor condition than in the absence condition. This pattern of performance impairment and increase in TUT was not observed for the music condition, indicating that there is something about a person presence that filled more cognitive capacity than a non-social distraction. When the cognitive load was increased, introverts showed a decreased in performance on the music condition and the coactor condition when compared with the absence condition.

Limitations

For phase 1 of the study, participants were interrupted and asked questions about their levels of boredom and the nature of their thoughts. During the word-pair task, they were asked about their boredom levels and the nature of their thoughts after they finished one round of the task. In the process of interrupting the participant's performance, the nature of the task changed. In addition, the questions asked their level of boredom which could have resulted in demand characteristics that may have lead to reports of more boredom and mind-wandering. The questions about the presence in the room were given when the coactor was still in the room which could have indicated that the coactor was part of the study. Therefore, the task was not the same in phase 1 and phase 2 for either of the tasks.

In addition, participants were not given a measure of working memory, therefore their working memory capacity was inferred from their level of extraversion. The literature supports the notion that extraverts have larger working memory capacity than introverts and they differ fundamentally as too much outside stimulation that can handle (Eysenck, 1967; Eysenck & Eysenck, 1985; Eysenck & Graydon, 1989).

Conclusions

This study supports the notion that social facilitation effects cannot be accounted for by task (simple or complex) or by the dominant or non-dominant response on a task, however it can be accounted for by the cognitive capacity of the individual, the amount of outside stimulation and the cognitive load of the individual. Introverts and Extraverts

performed differently on two distinctively different working-memory tasks with the same amount of outside stimulation. The effects of social facilitation seem to be sensitive to a person presence for some individuals when the cognitive load is not large (the SART involved the executive control aspect of working memory whereas the word-pair task involved elements of intelligence). This supports a model of task disengagement when either under-stimulated or over-stimulated and task engagement with the optimum stimulation (a relief from boredom).

REFERENCES

Ackerman, Beier, M. E. & Boyle, M. O. (2005). Working memory and intelligence: The same or different constructs? *Psychological Bulletin, 131*, 30-60.

Aiello, J.R. (October, 1998). *Social Facilitation: From coactions to electronic performance monitoring.* Paper presented at the Meetings of the Society of Experimental Social Psychology in Lexington, Kentucky.

Aiello, J. R. & Douthitt, E. A. (2001). Social Facilitation theory from Triplett to electronic performance monitoring. *Group Dynamics: Theory, Research & Practice, 5(3),* 163-180.

Aiello, J.R. & Kolb, K.J. (1995). Electronic performance monitoring and social context: Impact on productivity and stress. *Journal of Applied Psychology, 80* (3), 339-353.

Aiello, J. R., & Svec, C. M. (1993). Computer monitoring of work performance: Social facilitation and electronic presence. *Journal of Applied Social Psychology*, *23*(7), 537-548.

Allport, F. H. (1924). Response to social stimulation in the group. In F.H. Allport (Ed.), *Social Psychology* (pp.260-291). Hillsdale, NJ: Erlbaum.

Antrobus, J. S. (1968). Information theory and stimulus-independent thought. *British Journal of Psychology, 59,* 423–430.

Baddeley, A. D. (1996). Exploring the central executive. *Quarterly Journal of Experimental Psychology, 49*(A), 5–28.

Baddeley, A. D., Hitch, G. J. L. (1974). Working Memory, In G.A. Bower (Ed.), *The psychology of learning and motivation: advances in research and theory* (Vol. 8, pp. 47–89), New York: Academic Press.

Baddeley, A., Emslie, H., Kolodny, J., & Duncan, J. (1998). Random generation and the executive control of working memory. *Quarterly Journal of Experimental Psychology, 51A,* 819-852.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173-1182.

Baron, R. S. (1986). Distraction – conflict theory: progress and problems. In L. Berkowitz (Ed.), *Advances in experimental social psychology, 19,* pp.1-40.

Baron, R. S., Moore, D. & Sanders, G. S. (1978). Distraction as a source of drive in social facilitation research. *Journal of Personality and Social Psychology, 36,* 816-824.

Beauducel, A., Brocke, B., & Leue, A. (2006). Energetical bases of extraversion: Effort, arousal, EEG, and performance. International Journal of Psychophysiology, 62, 212–223.

Branton, P. (1970). A field study of repetitive manual work in relation to accidents at the workplace. *International Journal of Production Research, 8,* 93–107.

Blascovich, J., Mendes, W. B., Hunter, S. B. & Salomon, K. (1999). Social "facilitation" as challenge and threat. *Journal of Personality and Social Psychology, 77*, 68-77.

Bond, C. F. & Titus, L. J. (1983). Social facilitation: A meta-analysis of 241 studies. *Psychological Bulletin, 94(2),* 265-292.

Campbell, D. J. (1988). Task complexity: A review and analysis. *Academy of Management Review, 13,* 40-52.

Campbell, J. B. and Hawley, C. W. (1982). Study habits and Eysenck's Theory of Extraversion-Introversion. *Journal of Research in Personality, 16*, 139-146.

Carver, C. S. & Scheier, M. F. (1981). The self attention induced feedback loop and social facilitation. *Journal of Experimental Social Psychology, 17,* 545-568.

Chan, R. C. K., Shum, D., Toulopoulou, T. ,& Chen, E. Y. H. (2008). Assessment of executive functions: Review of instruments and identification of critical issues. *Archives of Clinical Neuropsychology, 23*, 201–216.

Cheyne, J., Solman, G. J., Carriere, J. S. & Smilek, D. (2009). Anatomy of an error: A bidirectional state model of task engagement/disengagement and attention-related errors. *Cognition 111(1),* 98-113.

Christoff, K., Gordon, A. M., Smallwood, J., Smith, R., & Schooler, J. W. (2009). Experience sampling during fMRI reveals default network and executive system contributions to mind wandering. *Proceedings of the National Academy of Sciences, 106 (21),* 8719-8724.

Cohen A, Hummel W. F., Turner J. N., Durer-Dobos F. N. (1966). Effects of noise on task performance. Rept. RR-4. US Department of health, education and welfare. *Occupational Health Research and Training Facility, Cincinnati, Ohio, USA*.

Cohen, J.L. & Davis, J. H. (1973). Effects of audience status, evaluation and time of action on performance with hidden word problems. *Journal of Personality and Social Psychology, 27*, 74-85.

Costa P. T., Jr. & McCrae, R. R. (1992). *NEO-PI-R and NEO-FFI professional manual.* Odessa, FL: Psychological Assessment Resources, Inc.

Cooper, R., & Shallice, T. (2001). Contention scheduling and the control of routine activities. *Cognitive Neuropsychology, 17*, 297-338.

Cottrell, N. B. (1968). Performance in the presence of other human's beings: mere presence and affiliations effects. In E.C. Simmel, R.A, Hoppe, & G. A. Milton (Eds.), *Social facilitation and imitative behavior* (pp. 91-110). Boston: Allyn and Bacon.

Criddle, W. D. (1971). The physical presence of other individuals as a factor in social facilitation. *Psychonomic Science, 22*, 229-230.

Cunningham, S., Scerbo, W., & Freeman, F. (2000). The electrocortical correlates of daydreaming during vigilance tasks. *The Journal of Mental Imagery, 24,* 61–72.

Csikszentmihalyi, M. (1975). *Beyond boredom and anxiety.* San Fransisco, CA: Jossey-Bass.

Damrad-Frye, R. & Laird, J. D. (1989). The experience of boredom: The role of self-perception of attention. *Journal of Personality and Social Psychology, 57,* 315-320.

Dannenbaum, A. (1945). The effect of music on visual acuity. *Sarah Lawrence Stud., 4,* 18-26.

Davies, D. R. & Parasuraman, R. (1982). *The Psychology of Vigilance*, London, Academic Press.

Dannenbaum, A. (1945). The effect of music on visual acuity. *Sarah Lawrence Studies, 4,* 18-26.

Duval, S. & Wicklund, R. A. (1972). *A theory of objective self-awareness*. New York: Academic Press

Edwards, J. R., & Lambert, L. S. (2007). Methods for integrating moderation and mediation: A general analytical framework using moderated path analysis. *Psychological Methods, 12*, 1-22.

Fisher, C. D. (1993). Boredom at work: A neglected concept. *Human Relations, 46,* 395-417.

Fisher, C. D. (1998). Effects of external and internal interruptions on boredom at work: two studies. *Journal of Organizational Behavior, 19,* 503-522.

Furnham, A., Gunter, B. and Peterson, E. (1994). Television distraction and the performance of introverts and extraverts. *Applied Cognitive Psychology, 8,* 705-711.

De Rijk, A. E., Schreurs, K. M. G., & Bensing, J. M. (1999). Complaints of fatigue related to too much as well as too little external stimulation*? Journal of Behavioral Medicine, 22(6),* 549-573.

Drory, A. (1982). Individual differences in boredom proneness and task effectiveness at work. *Personnel Psychology, 35,* 141-151.

Duval, S. & Wicklund, R. A. (1972). *A theory of objective self-awareness.* New York: Academic Press.

Eyesenck, H.J. (1967). *The biological basis of personality.* Springfield, IL: Charles C. Thomas.

Eyesenck, H. J. & Eyesenck, M. W. (1985). *Personality and Individual Differences: A Natural Science Approach.* New York: Plenum.

Eyesenck, M. W. & Graydon, J. (1989). Susceptibility to distraction as part of personality. *Personality and Individual Differences, 10,* 681-687.

Eysenck, M. W. & Keane, M. T. (1990). *Cognitive psychology: a student's handbook*, Lawrence Erlbaum Associates Ltd., Hove, UK.

Farmer, R. & Sundberg, N. D. (1986). Boredom proneness: The development and correlates of a new scale. *Journal of Personality Assessment, 50,* 4-17.

Feinberg, J. M., & Aiello, J. R. (2006). Social facilitation: A test of competing theories. *Journal of Applied Social Psychology*, *36*(5), 1087-1109.

Fisher, C. D. (1993). Boredom at work: A neglected concept. *Human Relations, 46,* 395-417.

Fisher, C. D. (1998). Effects of external and internal interruptions on boredom at work: Two studies. *Journal of Organizational Behavior, 19*, 503-522.

Fox, J. G. & Embrey, E. (1982). Music- an aid to productivity, *Applied Ergonomics, 3,* 202-205.

Freebune, C. M. and Fleischer, M. S. (1952). The effect of music distraction upon reading rate and comprehension. *Journal of Educational Psychology, 43*, 101-110.

Furnham, A. and Bradley, A. (1997). Music while you work: the differential distraction of background music on the cognitive test performance of introverts and extroverts. *Applied Cognitive Psychology, 11*, 445-455.

Furnham, A. & Allass, K. (1999). The influence of music distraction of varying complexity on the cognitive performance of extraverts and introverts. *European Journal of Personality, 13,* 27-38.

Gardell, B. (1982). Scandinavian research on stress in working life. *International Journal of Health Services, 12,* 31-41.

Gardner, D. G. & Cummings, L. L. (1988). Activation theory and job design: Review and reconceptualization. *Research in Organizational Behavior, 10,* 81-122.

Gendolla, G. H. E. & Richter (2006). Ego-involvement and the difficulty law of motivation: Effects on performance related to cardiovascular response. *Personality and Social Psychology Bulletin, 32(9),* 1188-1203.

Geen, R. G. (1981). Evaluation apprehension and social facilitation: A reply to Sanders. *Journal of Experimental Social Psychology, 17*, 252-256.

Geen, R. G., McCown, E. J., & Broyles, J. W. (1985). Effects of noise on sensitivity of introverts and extraverts to signals in a vigilance task. *Personality and Individual Differences, 6,* 237-241.

Geiwitz, P. (1966). Structure of boredom. *Journal of Personality and Social Psychology, 3,* 592-600.

Guerin, B. (1986). The effects of mere presence on a motor task. *Journal of Social Psychology, 126,* 399-401.

Giambra, L. M. (1995). A laboratory based method for investigating influences on switching attention to task unrelated imagery and thought. *Consciousness and Cognition, 4,* 1–21.

Glushakow, J. M. (2011). Social facilitation: Salience and mediated, anticipatory and residual presence. (Unpublished Doctoral Dissertation). Rutgers University, New Brunswick, NJ.

Grant, T. & Dagee, K. (2003). Type of task, types of audience, types of actor: interactions between mere presence and personality type in a simple mathematical task. *Personality and Individual Differences, 35,* 633-639.

Graydon, J., & Murphy, T. (1995). The effect of personality on social facilitation while performing a sports related task. *Personality and Individual Differences, 19(2),* 265–267.

Grodsky, A., & Giambra, L. (1989). Task unrelated images and thoughts whilst reading. In J. Shorr, P. Robin, J. A. Connek, & M. Wolpin (Eds.), *Imagery: Current perspectives.* New York: Plenum Press.

Guerin, B. (1993). *Social Facilitation.* Cambridge: University Press.

Hamilton, J. A. (1981). Attention, personality, and the self-regulation of mood: Absorbing interest and boredom. *Progress in Experimental Personality Research, 10,* 281-315.

Hamilton, J. A., Haier, R. J., Buchsbaum, M. S. (1984). Intrinsic enjoyment and boredom coping: Validation with personality, evoked potential and attention measures. *Personality and Individual Differences, 5,* 183-193.

Harkins, S. (2006). Mere effort as the mediator of the evaluation–performance relationship. *Journal of Personality and Social Psychology, 91,* 436–455.

Hartley, L. R., & Adams, R. G. (1974). The effect of noise on the Stroop test. *Journal of Experimental Psychology, 102,* 62-66.

Hayes, A. F. (2012). An analytical primer and computational tool for observed variable mediation, moderation, and conditional process modeling. Manuscript submitted for publication.

Hayes, A. F., & Preacher, K. J. (2012). Direct and indirect effects of a multicategorical causal agent in statistical mediation analysis. Manuscript submitted for publication.

Helton, W. S. (2008). Expertise acquisition as sustained learning in humans and other animals: commonalities across species. *Animal Cognition, 11,* 99-107.

Hester, R., Murphy, K., Foxe, J. J., Javitt, D. C., Foxe, D. M., and Garavan, H. (2004) Predicting Success: Patterns of pre-target cortical activation and deactivation. *Journal of Cognitive Neuroscience, 16(5),* 776-778.

Henchy, T., & Glass, D. C. (1968). Evaluation apprehension and the social facilitation of dominant responses. *Journal of Experimental Social Psychology, 10,* 446–454.

Hill, A. B. (1975). Extraversion and variety seeking in monotonous tasks. *British Journal of Psychology, 66(1),* 9-13.

Houston, B. K. (1969). Noise, task difficulty, and Stroop color-word performance. *Journal of Experimental Psychology, 82,* 403-404.

Howarth, E. (1969). Extraversion and increased interference in paired-associate learning. *Perceptual and Motor Skills, 29,* 203-206.

Huguet, P., Galvaing, M.P., Monteil, J.M. and Dumas, F. (1999). Social presence effects in the Stroop task: Further evidence for an attentional view of social facilitation. *Journal of Personality and Social Psychology*, *77,* 1011–1025.

Hull, C.L. (1943). *Principles of behavior.* New York: Appleton, Century-Crofts.

Humphreys, M. S., & Revelle, W. (1984). Personality, motivation, and performance: a theory of the relationship between individual differences and information processing. *Psychological Review, 91*, 153-184.

Jett, Q. R., & George, J. (2003). Work interrupted: A closer look at the role of interruptions in organizational life. *Academy of Management Review, 28(3),* 494–507.

Kahneman, D. & Chajczyk, D. (1983). Tests of the automaticity of reading: Dilution of Stroop effects by color-irrelevant stimuli. *Journal of Experimental Psychology: Human Perception and Performance, 9,* 497-509.

Kaldy, Z., Blaser, E. & Leslie, A. M. (2006). A new method for calibrating perceptual salience across dimensions in infants: The case of color vs. luminance. *Developmental Science, 9,* 482-489.

Kiger, D. (1989). Effects of music information load on a reading-comprehension task. *Perceptual and Motor Skills, 69*, 531-534.

Killingsworth, M. A. & Gilbert, D.T. (2010) A Wandering mind is an unhappy mind. *Science*, *330*, 6006.

Kirkpatrick, F. H. (1943). Music takes the mind away. *Personnel Journal, 22*, 225-228.

Koelega, H. S. (1992). Extraversion and vigilance performance: 30 years of inconsistencies. *Psychological Bulletin, 112,* 239–258.

Konecni, V. (1982). Social interaction and musical preference. In D. Deutsch (Ed.), *The Psychology of Music*. New York: Academic Press.

Konz, S. A. (1962). The effect of background music on productivity of two different monotonous tasks. *Paper to Human Factors Society,* New York.

Koole, S., Smeets, K., van Knippenberg, A., & Dijksterhuis, A. (1999). The cessation of rumination through self-affirmation. *Journal of Personality and Social Psychology, 77,* 111-125.

Leary, M. R., Rogers, P. A., Canfield, R. W. & Coe, C. (1986). Boredom in interpersonal encounters: Antecedents and social implications. *Journal of Personality and Social Psychology, 51,* 968-975.

Levinson, D. B., Smallwood, J. & Davidson, R. J. (2012). The persistence of thought: Evidence for a role of working memory in the maintenance of task-unrelated thinking. *Psychological Science,* doi. 10.1177/0956797611431465.

Lieberman, M. D. (2000). Introversion and working memory: Central executive differences. *Personality and Individual Differences*, *28(3),* 479-486.

Little, T. D., Card, N. A., Bovaird, J. A., Preacher, K., & Crandall, C. S. (2007) Structural equation modeling of mediation and moderation with contextual factors. In T.D. Little, J.A. Bovaird, & N.A. Card (Eds.). *Modeling contextual effects in longitudinal studies*. Mahwah, NJ: Erlbaum.

MacLeod, C. M. (1991). Half a century of research on the Stroop effect: An Integrative review. *Psychological Bulletin, 109,* 163–203.

Markus, H. (1978). The effect of mere presence on social facilitation: An unobtrusive test. *Journal of Experimental Social Psychology, 14,* 389–397.

Manly, T., Lewis, G. H., Robertson, I. H., Watson, P. C., & Datta, A. K. (2002). Coffee in the cornflakes: Time-of-day, routine response control and subjective sleepiness. *Neuropsychologia, 40*, 1–6.

Manly, T., Robertson, I.H., Galloway, M., & Hawkins, K. (1999). The absent mind: Further investigations of sustained attention to response. *Neuropsychologia, 37*, 661–670.

Manstead, A. S. R., & Semin, G. R. (1980). Social facilitation effects: Mere enhancement of dominant responses? *British Journal of Social and Clinical Psychology, 19*,119-136.

Markus, H. (1978). The effect of mere presence on social facilitation: An unobtrusive test. *Journal of Experimental Social Psychology, 14,* 389-397.

Martens, R. & Landers, D.M. (1972). Evaluation potential as a determinant of coaction effects. *Journal of Experimental Social Psychology, 8*, 347-359.

Matthews, T. & Lassiter, K. (2007). What does the Wonderlic Personnel test measure? Psychological Reports, 100, 707-712.

Mayfield, C. and Moss, S. (1989). Effect of music tempo on task performance. *Psychological Reports, 65,* 1283-1290.

Mason, M. F., Norton, M. I., Van Horn, J. D., Wegner, D. M., Grafton, S. T. & Macrae, C. N. (2007) Wandering Minds: The Default Network and Stimulus-Independent Thought. *Science, 315,* 393-395

McFall, S. R., Jamison, J. P. & Harkins, S. G. (2009). Testing the mere effort account of the evaluation performance relationship. *Journal of Personality and Social Psychology, 96(1),* 135-154.

McVay, J. C. & Kane, M. J. (2009). Conducting the train of thought: Working memory capacity, goal neglect, and mind wandering in an executive-control task. *Journal of Experimental Psychology, 35(1),* 196-204.

Melamed, S., Ben-Avi, I., Luz, J., & Green. M. S. (1995). Objective and subjective work monotony: Effects on job satisfaction, psychological distress, and absenteeism in blue-collar workers. *Journal of Applied Psychology, 80,* 29-42.

Mikulas, W. L., & Vodanovich, S. J. (1993). The essence of boredom. *The Psychological Record, 43*, 3–12.

Milliman, R. E. (1986). The Influence of Background Music on the Behavior of Restaurant Patrons. *Journal of Consumer Research*, *13*, 286-289.

Morgenstern, F. S, Hodgson, R. J. & Law, J. (1974). Work efficiency and personality: A comparison of introverted and extroverted subjects exposed to conditions and distraction and distortion of stimulus in a learning task. *Ergonomics, Vol. 17(2),* 211-220.

Muller, D. & Butera F., (2007). The focusing effect of self-evaluation threat on coactions and social comparison. *Journal of Personality and Social Psychology*, *93,* 194-211.

Muller, D., Atzeni, T. & Butera, F. (2004). Coaction and upward social comparison reduce the illusory conjunction effect: Support for the distraction-conflict theory. *Journal of Experimental Social Psychology, 40,* 659-665.

Newman, R., Hunt, D. and Rhodes, F. (1966). Effect of music on employee attitude and productivity in a skateboard factory. *Journal of Applied Psychology, 50,* 493-496.

Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological Review, 84*, 231-259.

Norman, D.A., & Shallice, T. (1985). Attention to action: Willed and automatic control of behavior. In R.J. Davidson, G.E. Schwartz and D. Shapiro (Eds.). *Consciousness and Self- Regulation: Advances in Research* (Vol 4.). New York: Plenum Press.

O'Hanlon, J.F. (1981). Boredom: Practical consequences and a theory. *Acta Psychologica, 49*, 53-82.

O'Malley, J. J., & Poplawsky, A. (1971). Noise induced arousal and breadth of attention. *Perceptual & Motor Skills, 33,* 887-890.

Oldham, G., Cummings, A., Mischel, L., Schmidthe, J. and Zhan, J. (1995). Listen while you work? Quasi-experimental relations between personal-stereo headset use and employee work responses. *Journal of Applied Psychology, 80:* 547-564.

Perrewe, P. & Mizerski, R. (1987). Effect of music on perceptions of task characteristics. *Perceptual and Motor Skills, 65,* 165-166.

Pessin, J. (1933). The comparative effects of social and mechanical stimulation on memorizing. *American Journal of Psychology, 45*, 263-270.

Phillips, J. M. (2008). The role of excess cognitive capacity in the relationship between job characteristics and cognitive task engagement. *Journal of Business and Psychology, 23,* 11-24.

Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers, 36,* 717–731.

Preacher, K. J., Rucker, D. D., & Hayes, A. F. (2007). Addressing moderated mediation hypotheses: Theory, methods, and prescriptions. *Multivariate Behavioral Research, 42*, 185-227.

Rabbit, P. (2002). Consciousness is slower than you think. *Quarterly Journal of Experimental Psychology, 55A,* 1081-1092.

Rajecki, D. W., Ickes, W., Corcoran, C., & Lenerz, K. (1977). Social facilitation of human performance: Mere presence effects. *Journal of Social Psychology, 102,* 297–310.

Roberts, J. W. (1959). Sound approach to efficiency. *Personnel Journal, 38,* 6-8.

Robertson, I. H., Manly, T., Andrade, J., Baddeley, B. T., & Yiend, J. (1997). "Oops!": Performance correlates of everyday attentional failures in traumatic brain injured and normal subjects. *Neuropsychologia, 35,* 747–758.

Rzepa T. (1984). Typological determinants in operator functioning in monotonous work conditions. *Polish Psychological Bulletin, 15,* 135-141.

Salame, P. & Baddeley, A. D. (1989). Effects of background music on phonological short term memory. *Quarterly Journal of Experimental Psychology, 41,* 107-122.

Sanders, G. S., & Baron, R. S. (1975). The motivating effects of distraction on task performance. *Journal of Personality & Social Psychology, 32*, 956-963.

Sanders, G. S., Baron, R. S., Moore, D. L. (1978). Distraction and social comparison as mediators of the social facilitation effect. *Journal of Experimental Social Psychology, 14,* 291-303.

Shiffman, S. (2000). Real time self report of momentary states in the natural environment: Computerized ecological momentary assessment. In A. A. Stone, J. S. Turkkan, C. A. Cachrach, J. B. Hope, H. S. Kurtzman, & V. S. Cain (Eds.), *The science of self report: Implications for research and practice* (pp. 277–296). Mahwah, NJ: Erlbaum.

Schooler, J. W., Reichle, E. D., & Halpern, D. V. (2005). Zoning-out during reading: Evidence for dissociations between experience and meta-consciousness. In D. T. Levin (Ed.), *Thinking and seeing: Visual metacognition in adults and children* (pp. 204–226). Cambridge, MA: MIT Press.

Schooler, J. W. & Schreiber, C. A. (2004) Consciousness, meta-consciousness, and the paradox of introspection. *Journal of Consciousness Studies, 11,* 17-39.

Schmitt, B. H., Gilovich, T., Goore, N., & Joseph, L. (1986). Mere presence and social facilitation: One more time. *Journal of Experimental Social Psychology, 22,* 242-248.

Schneider, W. & Shiffrin, R. M. (1977). Controlled and automatic human information processing: 1. Detection, search, and attention. *Psychological Review, 84,1-66.*

Sharma, D., Booth R., Brown, R. & Huguet, P. (2010). Exploring the temporal dynamics of social facilitation in the Stroop task. *Psychonomic Bulletin & Review, 17(1),* 52-58.

Smallwood, J., Baraciaia, S. F., Lowe, M., & Obonsawin, M. C. (2003). Task unrelated thought whilst encoding Information. *Consciousness and Cognition, 12,* 452–484.

Smallwood J., Beach E., Schooler J. W., Handy T. C. (2008). Going AWOL in the brain: mind-wandering reduces cortical analysis of external events. *Journal of Cognitive Neuroscience., 20(3),* 458-69.

Smallwood, J., Davies, J. B., Heim, D., Finnigan, F., Sudberry, M. V., O'Connor, R. C. (2004). Subjective experience and the attentional lapse. Task engagement and disengagement during sustained attention. *Consciousness and Cognition, 4,* 657–690.

Smallwood, J., Obonsawin, M. C., & Heim, S. D. (2003). Task unrelated thought: The role of distributed processing. *Consciousness and Cognition, 11*, 169–189.

Smallwood, J., & Schooler, J. W. (2006). The restless mind. *Psychological Bulletin, 132,* 946–958.

Smith, B., Wilson, R. and Davidson, R. (1984). Extrodermal activity and extraversion. *Personality and Individual Differences, 5,* 59-65.

Smith, R. P. (1981). Boredom: Practical consequences and a theory. *Acta Psychologica, 49,* 53-82.

Smith, W. A. (1961). Effects of industrial music in a work situation requiring complex mental activity. *Psychological Reports, 8,* 159-162.

Spence, K. W. (1956). *Behavior theory and conditioning.* New Haven, CT: Yale University Press.

Spence, J. T. & Spence, K. W. (1966). The motivational components of manifest anxiety: Drive and drive stimuli. In C.D. Spielberger (Ed.), *Anxiety and Behavior*. London: Academic Press.

Spence, K. W., Taylor, J. & Ketchel, R. (1956). Anxiety (drive) level and degree of competition in paired-associates learning. *Journal of Experimental Psychology, 52(5),* 306-310.

Sterns, L., Alexander, R. A., Barrett, G. V., & Dambrot, F. H. (1983). 'The relationship of extraversion and neuroticism with job preferences and job satisfaction for clerical employees. *Journal of Occupational Psychology, 56,* 145-153.

Strauss, B. (2002). Social facilitation in motor tasks: A review of research and theory. *Psychology of Sport and Exercise, 3(3),* 237-256.

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology, 18,* 643–662.

Szymanski, K., Garczynski, J. & Harkins, S. (2000). The contribution of the potential for evaluation to coactions effects. *Group Processes and Intergroup Relations*, *3*(3), 269- 283.

Teasdale, J. D., Lloyd, C. A., Proctor, L., Baddeley, A. (1993). Working memory and stimulus independent thought: Effects of memory load and presentation rate. *European Journal of Psychology, 5,* 413-433.

Teasdale, J. D., Dritschell, B. H., Taylor, M. J., Proctor, L., Lloyd, C. A., Nimmo-Smith, I. (1995). Stimulus-independent-thought depends upon central executive resources. *Memory and Cognition, 28,* 551–559.

Triplett, N. (1898). The dynamogenic factors in peacemaking and competition. *American Journal of Psychology, 9,* 507-533.

Uziel, L. (2007). Individual differences in the social facilitation effect: A review and meta-analysis. *Journal of Research in Personality, 41*, 579-601.

Wagstaff, G. F., Wheatcroft, J., Cole, J., Brunas-Wagstaff, J., Blackmore, V. & Pilkington, A. (2008). Some cognitive and neuropsychological aspects of social inhibition and facilitation. *European Journal of Cognitive Psychology, 20, 828-846.*

Wonderlic, Inc. (1999). *Wonderlic User's Manual for the WPT and SLE*. Libertyville, IL: Wonderlic, Inc.

Wood, R. E. (1986). Task complexity: Definition of the construct. *Organizational Behavior and Human Decision Processes, 37,* 60-82.

Zajonc, R. B. (1965). Social facilitation, *Science, 149*, 269-274.

Zajonc, R. B. (1980). Co presence. In P.B. Paulus (Ed.), *Psychology of Group Influence,* (pp. 35-60). Hillsadale, NJ: Erlbaum.

Table 1

Means and Standard Deviations and Correlation Matrix For performance and Covariates of Boredom Proneness and Cognitive Ability

Item	Item				
	Mean	SD	1	2	3
1.Total response to Target for SART (errors)	11.72	5.78			
2.Total correct on word pair task	10.32	2.79	-.12*		
3. scores on Wonderlic	24.23	4.16	-.09	.32**	
4. Boredom proneness	108.85	12.66	.00	-.05	.02

* $p < .05$, ** $p < .01$

Table 2

Regression Analysis Predicting the End of Task Measure of Boredom and Mind-Wandering from Probes During the SART and Word-Pair Tasks.

Boredom SART	R^2	*F*	*t*	*β*
Block 1	.33	67.12	-8.19	-1.63***
Block 2	.23	41.72	-6.46	-1.29***
Block 3	.17	25.93	-5.09	-1.09***
Block 4	.25	44.32	-6.66	-1.33***
Boredom Word-Pair	R^2	*F*	*t*	*β*
Block 1	.04	4.32	-2.08	-.55*
Block 2	.03	2.66	-1.63	-.41
Block 3	.07	7.44	-2.75	-.68**
Mind-wandering SART	R^2	*F*	*t*	*β*
Block 1	.12	16.86	4.11	2.23***
Block 2	.05	7.13	2.67	1.32**
Block 3	.13	18.98	4.36	1.82***
Block 4	.14	22.18	4.71	1.82***
Mind-Wandering Word-pair	R^2	*F*	*t*	*β*
Block 1	.10	11.66	3.42	1.87**
Block 2	.05	5.38	2.32	1.58*
Block 3	.03	2.80	1.67	1.19
TUT SART	R^2	*F*	*t*	*β*
Block 1	.02	2.32	1.52	.89
Block 2	.05	7.14	2.67	1.18**
Block 3	.02	2.43	1.56	.66
Block 4	.04	5.62	2.37	1.18*
TUT Word-Pair	R^2	*F*	*t*	*β*
Block 1	.16	20.56	4.54	2.54***
Block 2	.05	5.69	2.38	1.71*
Block 3	.01	1.01	1.01	.76

Note.* = $p < .05$, .** = $p < .01$, .*** = $p < .001$.

Table 3

Repeated Measures Analysis of Variance for Boredom and Mind-Wandering Probes on the SART and Word-Pair Tasks.

Boredom	Block 1	Block 2	Block 3	Block 4	*F*	*p*	Partial η
SART Task[a]	2.76 (1.13)	2.32 (1.18)	2.21 (1.21)	2.03 (1.16)	23.81**	.000	.16
Word-Pair Task[a]	2.94 (1.11)	2.85 (1.21)	2.86 (1.19)		.754	.472	.01
Mind-wandering	**Block 1**	**Block 2**	**Block 3**	**Block 4**	***F***	***p***	**Partial η**
SART Task[b]	1.93 (.88)	1.85 (.95)	1.99 (1.14)	2.20 (.90)	4.10**	.007	.03
Word-Pair Task[b]	1.87 (.80)	1.60 (.66)	1.52 (.64)		12.43***	.000	.10

[a] Participants responded on a 5 point scale ranging from (1) very boring to (5) very interesting

[b] Responses were coded into 4 categories based on attention to task (lower responses) and non-attention to task (higher responses).

Note.* = $p < .05$, .** = $p < .01$, .*** = $p < .001$.

Table 4

Regression Equations for the Effects of Condition on Performance for the SART and Word-Pair Tasks

	R^2	F	β	t
SART Phase 1				
Absence/Passive	.01	.75	-1.08	-.86
Absence/Evaluator	.01	.50	-.92	-.71
Absence/LC Music	.01	.79	-1.09	-.89
Absence/HC music	.07	3.92*	-2.22	-1.98*
SART Phase 2				
Absence/Passive	.02	1.03	1.18	1.01
Absence/Evaluator	.01	.31	.55	.55
Absence/LC Music	.01	.08	-.30	-.37
Absence/HC music	.00	.02	.15	.12

	R^2	F	β	t
Word-Pair Phase 1				
Absence/Passive	.04	2.69	-1.41	-1.64
Absence/Evaluator	.01	.26	-.51	-.51
Absence/LC Music	.00	.00	-.02	-.02
Absence/HC music	.04	2.09	-1.38	-1.45
Word-Pair Phase 2				
Absence/Passive	.05	2.79	2.21	1.87
Absence/Evaluator	.01	.50	.56	.71
Absence/LC Music	.00	.22	-.51	-.47
Absence/HC music	.06	3.04	1.56	1.87

*p< .05

Table 5

Standardized Regression Coefficients β and Conditional Indirect Effects of the Mediation Model of Boredom on Condition (Absence/High Complexity Music) and the SART Task Performance.

	Mediator variable model	
Predictor	*β*	*p*
Boredom		
Constant	17.97***	.00
Condition	-2.02*	.01
Outcome		
Total	*β*	*p*
Constant	16.38***	.00
Boredom	-.16	.43
Condition	-2.65*	.03

	Direct Effect	
	β	*p*
	-2.65*	.03

	Indirect Effect of Highest Order Interaction	
Mediator		
	Lower Level CI	Upper Level CI
Boredom	-.36	1.37

**p< .05, ***p< .001*

Table 6

Standardized Regression Coefficients β and Conditional Indirect Effects of the Mediation Model of Mind-Wandering on Condition (Absence/High Complexity Music) and the SART Task Performance.

	Mediator variable model	
Predictor Mind-Wandering	*β*	*p*
Constant	15.27***	.00
Condition	1.18	.40
Outcome Total	*β*	*p*
Constant	13.62***	.00
Mind-Wandering	-.01	.95
Condition	-2.32	.05

	Direct Effect	
	β	*p*
	-2.32	.05

	Indirect Effect	
Mediator		
	Lower Level CI	Upper Level CI
Mind-Wandering	-.46	.37

****p< .001*

Table 7

Standardized Regression Coefficients β and Conditional Indirect Effects of the Mediation Model of TUT on Condition (Absence/High Complexity Music) and the SART Task Performance.

	Mediator variable model	
Predictor TUT	*β*	*p*
Constant	12.24***	.00
Condition	-1.24	.34
Outcome Total	*β*	*p*
Constant	13.14***	.00
TUT	.03	.80
Condition	-2.29	.05

	Direct Effect	
	β	*p*
	-2.29	.05

	Indirect Effect	
Mediator		
	Lower Level CI	Upper Level CI
TUT	-.72	.37

****p< .001*

Table 8

Regression Equations for the Coactor and Evaluation Conditions for the SART for Phases 1 and 2

		R^2	F	β	t
Phase 1					
Step 1			.278		
	Extraversion			-.014	-.724
	Absence/Coactor			-.968	-.021
Step 2		.11*	2.613*		
	Ext*Con			-.3477	-2.689**
Phase 2					
Step 1			.590		
	Extraversion			-.014	.750
	Absence/Coactor			1.303	.127
Step 2		.00	.438		
	Ext*Con			.480	.391

		R^2	F	β	t
Step 1			2.87		
	Extraversion			1.393	2.295
	Absence/Evaluation			-.621	-.491
Step 2		.00	1.868		
	Ext*Con			-.284	-.228
Phase 2					
Step 1			.00		
	Extraversion			.132	.805
	Absence/Evaluation			.496	.544
Step 2		.01	.192		
	Ext*Con			.645	.600

Note.* = $p < .05$, .** = $p < .01$,

Table 9

Standardized Regression Coefficients β and Conditional Indirect Effects of the Mediated Moderation Model of the Total Incorrect Response to Target on the SART Moderated by Extraversion through Boredom

	Mediator Variable Model	
Predictor	*β*	*p*
Constant	17.18**	.00
Condition	-.09	.19
Extraversion	.00	.97
Condition x Extraversion	-.01	.19

	Dependent Variable Model	
	β	*p*
Intercept	8.77***	.00
Boredom	.17*	.03
Condition	-.03	.82
Extraversion	.01	.19
Condition x Extraversion	.01	.41

	Conditional Direct Effects of Condition on Total at Values of Extraversion	
Extraversion Level	*β*	*p*
-33.847	-.14	.40
-19.842	-.10	.47
-.8427	-.03	.78
18.857	.04	.78
34.157	.10	.62

	Indirect Effect of Highest Order Interaction	
Mediator		
	Lower Level CI	Upper Level CI
Boredom	-.01	.01

*Note. *p< .05, ***p< .001*

Table 10

Standardized Regression Coefficients β and Conditional Indirect Effects of the Mediated Moderation Model of the Condition (Absence/Coactor) Total Incorrect Response to Target on the SART Moderated by Extraversion through Mind-Wandering

	Mediator Variable Model	
Predictor	*β*	*p*
Constant	16.12***	.00
Condition	.06	.58
Extraversion	.01	.63
Condition x Extraversion	.00	.83
	Dependent Variable Model	
	β	*p*
Intercept	9.91***	.00
Mind-Wandering	.12*	.04
Condition	-.06	.61
Extraversion	.01	.24
Condition x Extraversion	.01	.48
	Conditional Direct Effects of Condition on Total at Values of Extraversion	
Extraversion	*β*	*p*
-33.771	-.16	.36
-19.771	-.12	.38
-.771	-.06	.60
18.229	.01	.99
32.229	.05	.80
	Indirect Effect of Highest Order Interaction	
Mediator		
	Lower Level CI	Upper Level CI
Mind-Wandering	-.01	.01

*Note. *p< .05, ***p< .001*

Table 11

Standardized Regression Coefficients β and Conditional Indirect Effects of the Mediated Moderation Model of the Condition (Absence/Coactor) Total Incorrect Response to Target on the SART Moderated by Extraversion through TUT

	Mediator Variable Model	
Predictor	*β*	*p*
Constant	12.71***	.00
Condition	.24	.85
Extraversion	-.01	.83
Condition x Extraversion	-.11*	.03
	Dependent Variable Model	
	β	*p*
Intercept	12.31***	.00
TUT	.08	.56
Condition	-.95	.48
Extraversion	-.01	.77
Condition x Extraversion	-.13*	.02
	Conditional Direct Effects of Condition on Total at Values of Extraversion	
Extraversion	*β*	*p*
-35.73	3.60	.14
-16.72	1.18	.48
-.27	-.98	.46
20.27	-3.53*	.04
33.27	-5.18*	.02
	Indirect Effect of Highest Order Interaction	
Mediator		
	Lower Level CI	Upper Level CI
TUT	-.05	.02

**p< .05, **p< .01, ***p< .001*

Table 12

Regression Equations for the Low Complexity Music and High Complexity Music Conditions Compared to the Absence Condition for the SART for Phases 1 and 2.

Phase		R^2	F	β	t
Phase 1					
Step 1			3.379*		
	Extraversion			-1.174	-.998
	Absence/LC Music			-1.505	2.701**
Step 2		.00	2.606*		
	Ext*Con			-.005	-.004
Phase 2					
Step 1			.012		
	Extraversion			.056	.090
	Absence/LC Music			-.109	-.092
Step 2		.00	.066		
	Ext*Con			.528	.418

Phase		R^2	F	β	t
Step 1			2.358		
	Extraversion			.656	1.123
	Absence/HC Music			-2.338	-2.035*
Step 2		.08*	3.335*		
	Ext*Con			-2.694	-2.222*
Phase 2					
Step 1			.150		
	Extraversion			.334	.513
	Absence/HC Music			.457	.344
Step 2		.01	.157		
	Ext*Con			.919	.688

* = $p < .05$, .** = $p < .01$,

Table 13

Standardized Regression Coefficients β and Conditional Indirect Effects of the Mediated Moderation Model of the Condition (Absence/High Complexity Music) and Total Incorrect Response to Target on the SART Moderated by Extraversion through Boredom

	Mediator variable model	
Predictor	*β*	*p*
Constant	17.01***	.00
Condition	-2.21**	.01
Extraversion	.02	.18
Condition x Extraversion	.05	.17

	Dependent variable model	
	β	*p*
Intercept	15.14***	.00
Boredom	-.14	.47
Condition	-2.47*	.04
Extraversion	.02	.45
Condition x Extraversion	-.10	.06

	Conditional Direct Effects of Condition on Total at Values of Extraversion	
Extraversion Level	*β*	*p*
-32.24	.66	.76
-15.25	-.99	.52
-1.26	-2.35	.06
14.74	-3.19**	.00
31.74	-3.02**	.00

	Indirect Effect of Highest Order Interaction	
Mediator		
	Lower Level CI	Upper Level CI
Boredom	-.05	.01

p< .05, **p< .01,*p< .001*

Table 14

Standardized Regression Coefficients β and Conditional Indirect Effects of the Mediated Moderation Model of the Condition (Absence/High Complexity Music) and Total Incorrect Response to Target on the SART Moderated by Extraversion through Mind-Wandering

	Mediator Variable Model	
Predictor	*β*	*p*
Constant	15.70***	.00
Condition	.76	.59
Extraversion	.06*	.04
Condition x Extraversion	.00	.96

	Dependent variable model	
	β	*p*
Intercept	13.54***	.00
Mind-Wandering	-.05	.64
Condition	-2.12	.07
Extraversion	.02	.45
Condition x Extraversion	-.02*	.04

	Conditional Direct Effects of Condition on Total at Values of Extraversion	
Extraversion	*β*	*p*
-32.25	1.25	.54
-15.25	-.523	.71
-1.26	-1.98	.09
14.74	-3.66**	.01
31.74	-3.54**	.01

	Indirect Effect of Highest Order Interaction	
Mediator		
	Lower Level CI	Upper Level CI
Mind-Wandering	-.02	.02

**p< .05, **p< .01, ***p< .001*

Table 15

Standardized Regression Coefficients β and Conditional Indirect Effects of the Mediated Moderation Model of the Condition (Absence/High Complexity Music) and Total Incorrect Response to Target on the SART Moderated by Extraversion through TUT

	Mediator Variable Model	
Predictor	*β*	*p*
Constant	11.98***	.00
Condition	-1.06	.42
Extraversion	.00	.99
Condition x Extraversion	-.12*	.03

	Dependent variable model	
	β	*p*
Intercept	13.33***	.00
TUT	-.05	.67
Condition	-2.12	.06
Extraversion	.02	.52
Condition x Extraversion	-.11*	.04

	Conditional Direct Effects of Condition on Total at Values of Extraversion	
Extraversion	*β*	*p*
-32.25	1.36	.51
-15.25	-.52	.72
-1.26	-2.07	.08
14.74	-3.85**	.01
31.74	-5.74**	.00

	Indirect Effect of Highest Order Interaction	
Mediator		
	Lower Level CI	Upper Level CI
TUT	-.03	.05

**p< .05, **p< .01, ***p< .001*

Table 16

Regression Equations for the Coactor and Evaluation Conditions Compared to the Absence Condition for the Word-Pair for Phases 1 and 2

Phase		R^2	F	β	t
Phase 1					
Step 1			4.84**		
	Extraversion			-.033	-1.912
	Absence/Coactor			-.776	-.921
Step 2		.23	4.21**		
	Ext*Con			.030	1.434
Phase 2					
Step 1			4.00**		
	Extraversion			-.024	-1.442
	Absence/Coactor			2.136	2.447*
Step 2		.28	4.74**		
	Ext*Con			.084	2.418*

Phase		R^2	F	β	t
Step 1			4.04*		
	Extraversion			-.034	-1.800
	Absence/Evaluation			-.499	.524
Step 2		.24	3.840**		
	Ext*Con			1.608	1.674
Phase 2					
Step 1			1.464		
	Extraversion			-.031	-1.762
	Absence/Evaluation			.389	.460
Step 2		.18	2.762*		
	Ext*Con			2.122[a]	2.491

* $p < .05$, ** $p < .01$

Table 17

Standardized Regression Coefficients β and Conditional Indirect Effects of the Mediated Moderation Model of the Condition (Absence/Coactor) and Correct Responses on the Word-Pair Task Moderated by Extraversion through Boredom

	Mediator Variable Model	
Predictor	*β*	*p*
Constant	14.84***	.00
Condition	-.73	.44
Extraversion	-.01	.44
Condition x Extraversion	-.04	.33

	Dependent variable model	
	β	*p*
Intercept	15.51***	.00
Boredom	-.30*	.01
Condition	1.89*	.02
Extraversion	-.03*	.03
Condition x Extraversion	.08*	.02

	Conditional Direct Effects of Condition on Total at Values of Extraversion	
Extraversion	*β*	*p*
-39.87	1.25	.43
-24.87	-.52	.95
-.87	1.81*	.03
20.13	3.85**	.00
35.13	4.63**	.00

	Indirect Effect of Highest Order Interaction	
Mediator		
	Lower Level CI	Upper Level CI
Boredom	-.01	.05

**p< .05, **p< .01, ***p< .001*

Table 18

Standardized Regression Coefficients β and Conditional Indirect Effects of the Mediated Moderation Model of the Condition (Absence/Coactor) and Correct Responses on the Word-Pair Task Moderated by Extraversion through Mind-Wandering

	Mediator Variable Model	
Predictor	*β*	*p*
Constant	16.22***	.00
Condition	2.34*	.02
Extraversion	.03	.15
Condition x Extraversion	-.03	.50

	Dependent variable model	
	β	*p*
Intercept	13.76***	.00
Mind-Wandering	-.17	.17
Condition	2.40*	.00
Extraversion	-.02	.18
Condition x Extraversion	.08*	.02

	Conditional Direct Effects of Condition on Total at Values of Extraversion	
Extraversion	*β*	*p*
-39.22	-.83	.63
-24.22	.40	.75
-.22	2.38**	.00
17.79	3.86**	.00
31.79	4.63**	.00

	Indirect Effect of Highest Order Interaction	
Mediator		
	Lower Level CI	Upper Level CI
Mind-Wandering	-.01	.04

**p< .05, **p< .01, ***p< .001*

Table 19

Standardized Regression Coefficients β and Conditional Indirect Effects of the Mediated Moderation Model of the Condition (Absence/Coactor) and Correct Responses on the Word-Pair Task Moderated by Extraversion through TUT

	Mediator Variable Model	
Predictor	*β*	*p*
Constant	14.61***	.00
Condition	-1.82	.40
Extraversion	-.01	.82
Condition x Extraversion	.03	.74

	Dependent variable model	
	β	*p*
Intercept	12.23***	.00
TUT	-.08	.13
Condition	1.95	.02
Extraversion	-.03	.06
Condition x Extraversion	.09**	.00

	Conditional Direct Effects of Condition on Total at Values of Extraversion	
Extraversion	*β*	*p*
-39.87	-1.73	.30
-24.87	-.34	.79
-.87	1.87*	.03
20.13	3.81**	.00
35.13	5.19**	.00

	Indirect Effect of Highest Order Interaction	
Mediator		
	Lower Level CI	Upper Level CI
TUT	-.03	.01

**p< .05, **p< .01, ***p< .001*

Table 20

Standardized Regression Coefficients β and Conditional Indirect Effects of the Mediated Moderation Model of the Condition (Absence/Evaluator) and Correct Responses on the Word-Pair Task Moderated by Extraversion through Boredom

	Mediator Variable Model	
Predictor	*β*	*p*
Constant	15.07***	.00
Condition	-.28	.77
Extraversion	.01	.73
Condition x Extraversion	.00	.99

	Dependent variable model	
	β	*p*
Intercept	13.51***	.00
Boredom	-.22	.06
Condition	.12	.88
Extraversion	-.03*	.04
Condition x Extraversion	.08*	.01

	Conditional Direct Effects of Condition on Total at Values of Extraversion	
Extraversion	*β*	*p*
-39.29	-3.15*	.04
-17.29	-1.32	.20
2.71	.34	.66
16.71	1.51	.10
32.71	2.84*	.03

	Indirect Effect of Highest Order Interaction	
Mediator		
	Lower Level CI	Upper Level CI
Boredom	-.02	.02

**p< .05, **p< .01, ***p< .001*

Table 21

Standardized Regression Coefficients β and Conditional Indirect Effects of the Mediated Moderation Model of the Condition (Absence/Evaluator) and Correct Responses on the Word-Pair Task Moderated by Extraversion through Mind-Wandering

	Mediator Variable Model	
Predictor	*β*	*p*
Constant	14.31***	.00
Condition	1.05	.33
Extraversion	.02	.31
Condition x Extraversion	.04	.37

	Dependent variable model	
	β	*p*
Intercept	9,64***	.00
Mind-Wandering	-.04	.75
Condition	-.08	.92
Extraversion	-.03*	.04
Condition x Extraversion	.07*	.02

	Conditional Direct Effects of Condition on Total at Values of Extraversion	
Extraversion	*β*	*p*
-38.49	-3.14	.06
-16.49	-1.39	.20
.51	-.04	.96
14.51	1.07	.25
31.51	2.42	.07

	Indirect Effect of Highest Order Interaction	
Mediator		
	Lower Level CI	Upper Level CI
Mind-Wandering	-.03	.01

**p< .05, ***p< .001*

Table 22

Standardized Regression Coefficients β and Conditional Indirect Effects of the Mediated Moderation Model of the Condition (Absence/Evaluator) and Correct Responses on the Word-Pair Task Moderated by Extraversion through TUT

	Mediator Variable Model	
Predictor	*β*	*p*
Constant	13.32***	.00
Condition	-4.27*	.04
Extraversion	-.03	.42
Condition x Extraversion	-.02	.86

	Dependent variable model	
	β	*p*
Intercept	10.60***	.00
TUT	-.03	.61
Condition	.06	.94
Extraversion	-.03*	.04
Condition x Extraversion	.08*	.02

	Conditional Direct Effects of Condition on Total at Values of Extraversion	
Extraversion	*β*	*p*
-39.29	-3.19	.05
-17.29	-1.37	.20
2.70	.28	.73
16.71	1.44	.15
32.71	2.76*	.04

	Indirect Effect of Highest Order Interaction	
Mediator	Lower Level CI	Upper Level CI
TUT	-.01	.02

**p< .05,, ***p< .001*

Table 23

Regression Equations for the Low-Complexity and High-Complexity Music Conditions Compared to the Absence Condition for the Word-Pair for Phases 1 and 2

Phase		R^2	F	β	t
Phase 1					
Step 1			1.56		
	Extraversion			-.025	-1.551
	Absence/LC Music			-.108	-.121
Step 2		.15	2.24		
	Ext*Con			1.708	2.005
Phase 2					
Step 1			3.62*		
	Extraversion			-.056	-2.520*
	Absence/LC Music			.231	.271
Step 2		.20	2.86*		
	Ext*Con			.943	.419

Phase		R^2	F	β	t
Step 1			3.80*		
	Extraversion			-.032	-1.651
	Absence/HC Music			-1.081	-1.185
Step 2		.28	4.44**		
	Ext*Con			.576	2.302*
Phase 2					
Step 1			7.83**		
	Extraversion			-.050	-3.510**
	Absence/HC Music			.876	1.166
Step 2		.35	6.58**		
	Ext*Con			.280	1.503

* $p < .05$, ** $p < .01$

Table 24

Standardized Regression Coefficients β and Conditional Indirect Effects of the Mediated Moderation Model of the Condition (Absence/HC Music) and Correct Responses on the Word-Pair Task Moderated by Extraversion through Boredom

	Mediator Variable Model	
Predictor	*β*	*p*
Constant	15.35***	.00
Condition	-.66	.48
Extraversion	.03	.10
Condition x Extraversion	.02	.69

	Dependent variable model	
	β	*p*
Intercept	12.24***	.00
Boredom	-.10	.50
Condition	-1.44	.53
Extraversion	-.02	.33
Condition x Extraversion	.10*	.03

	Conditional Direct Effects of Condition on Total at Values of Extraversion	
Extraversion	*β*	*p*
-31.69	-4.46*	.01
-17.68	-1.32*	.02
-2.69	-1.69	.08
15.31	.03	.98
30.31	1.46	.34

	Indirect Effect of Highest Order Interaction	
Mediator		
	Lower Level CI	Upper Level CI
Boredom	-.02	.01

**p< .05, ***p< .001*

Table 25

Standardized Regression Coefficients β and Conditional Indirect Effects of the Mediated Moderation Model of the Condition (Absence/HC Music) and Correct Responses on the Word-Pair Task Moderated by Extraversion through Mind-Wandering

	Mediator Variable Model	
Predictor	*β*	*p*
Constant	16.31***	.00
Condition	.77	.50
Extraversion	.02	.39
Condition x Extraversion	-.05	.37

	Dependent variable model	
	β	*p*
Intercept	8.76***	.00
Mind-Wandering	.12	.34
Condition	-1.42	.13
Extraversion	-.03	.22
Condition x Extraversion	.10*	.02

	Conditional Direct Effects of Condition on Total at Values of Extraversion	
Extraversion	*β*	*p*
-32.90	-4.74**	.00
-15.90	-3.02*	.01
-1.89	-1.61	.09
14.10	.01	.99
31.10	1.73	.28

	Indirect Effect of Highest Order Interaction	
Mediator		
	Lower Level CI	Upper Level CI
Mind-Wandering	-.04	.01

**p< .05, **p< .01, ***p< .001*

Table 26

Standardized Regression Coefficients β and Conditional Indirect Effects of the Mediated Moderation Model of the Condition (Absence/HC Music) and Correct Responses on the Word-Pair Task Moderated by Extraversion through TUT

	Mediator Variable Model	
Predictor	*β*	*p*
Constant	10.96***	.00
Condition	-2.15	.09
Extraversion	.08**	.00
Condition x Extraversion	-.06	.32

	Dependent variable model	
	β	*p*
Intercept	12.42***	.00
TUT	-.16	.15
Condition	-1.70	.08
Extraversion	-.01	.59
Condition x Extraversion	.08*	.024

	Conditional Direct Effects of Condition on Total at Values of Extraversion	
Extraversion	*β*	*p*
-31.69	-4.40*	.01
-17.69	-3.21*	.01
-2.69	-1.93*	.04
15.31	-.40	.72
30.31	.87	.58

	Indirect Effect of Highest Order Interaction	
Mediator		
	Lower Level CI	Upper Level CI
TUT	-.01	.05

**p< .05, **p< .01, ***p< .001*

Table 27

Means and Standard Deviations for Performance between Phase and Extraversion on the SART Task

Condition	Phase 1		Phase 2		
	Introverts	Extraverts	Introverts	Extraverts	*F*
Absence	12.54	15.11[ab]	10.11[a]	10.63[b]	
	(4.61)	(4.69)	(2.61)	(5.33)	3.845*
Coactor	13.56	11.81	11.92	11.40	
	(4.98)	(5.81)	(3.96)	(5.15)	.278
Evaluator	10.71	14.25	10.17	11.21	
	(5.28)	(5.01)	(3.81)	(3.38)	.316
LC Music	11.15	13.46	9.12	11.21	
	(5.27)	(4.54)	(4.85)	(4.28)	1.996
HC Music	12.22	10.46	10.35	10.69	
	(4.20)	(2.25)	(5.75)	(5.76)	.329

Numbers represent the mean (standard deviation) of the number of responses to target (error). *Note*.* = $p < .05$, Standard deviations appear in parentheses below means. Means within rows with the same superscripts are significantly different at least at the $p < .05$ level, using Tukey's HSD post hoc test.

Table 28

Means and Standard Deviations for Salience between Phase and Extraversion on the SART Task

Condition	Phase 1		Phase 2	
	Introverts	Extraverts	Introverts	Extraverts
Absence	5.00[a]	6.07[a]	5.00[ab]	6.33[ab]
	(0.00)	(2.62)	(0.00)	(3.73)
Coactor	6.44[a]	7.52[a]	8.37[ab]	7.33[ab]
	(2.51)	(2.84)	(4.56)	(2.61)
Evaluator	10.86[b]	8.50[a]	10.17[bc]	9.71[ab]
	(3.23)	(3.25)	(4.50)	(3.34)
LC Music	13.61[bc]	13.64[b]	13.38[c]	14.86[c]
	(4.15)	(5.21)	(3.91)	(4.93)
HC Music	15.80[c]	14.00[b]	12.94[c]	12.46[bc]
	(5.07)	(5.55)	(4.09)	(5.11)
F	25.504***	11.462***	8.422***	12.316***

Numbers represent the mean (standard deviation) of the number of responses to target (error). *Note*.* = $p < .05$, Standard deviations appear in parentheses below means. Means within columns with the same superscripts are significantly different at least at the $p < .05$ level, using Tukey's HSD post hoc test.

Table 29

Means and Standard Deviations for Performance by Phase and Extraversion on the Word-Pair Task

Condition	Phase 1		Phase 2		
	Introverts	Extraverts	Introverts	Extraverts	F
Absence	15.18	13.78	15.89	14.09	
	(3.52)	(4.11)	(3.89)	(3.77)	.986
Coactor	14.00	14.65	15.00	16.40	
	(3.64)	(3.75)	(2.94)	(3.35)	1.204
Evaluator	14.35	15.87	14.61	14.92	
	(3.97)	(4.13)	(2.99)	(2.81)	.316
LC Music	14.83	15.84	14.87	12.71	
	(3.84)	(3.43)	(4.15)	(5.10)	.643
HC Music	14.33	12.92[a]	16.35[a]	14.14	
	(3.52)	(4.25)	(1.63)	(6.03)	2.344*

Numbers represent the means (standard deviations) number of correct responses.
Note.* = $p < .05$, Standard deviations appear in parentheses below means. Means within rows with the same superscripts are significantly different at least at the $p < .05$ level, using Tukey's HSD post hoc test.

Table 30

Means and Standard Deviations for Salience between Phase and Extraversion on the SART Task

Condition	Phase 1	Phase 2
Absence	5.34[ab]	6.00[a]
	(1.72)	(3.12)
Coactor	7.20[ab]	7.87[ab]
	(2.74)	(3.72)
Evaluator	10.00[b]	9.97[b]
	(3.37)	(3.98)
LC Music	13.63[c]	14.03[c]
	(4.64)	(4.33)
HC Music	14.65[c]	12.74[c]
	(5.50)	(4.47)
F	31.813***	21.579***

Numbers represent the means (standard deviations) of the composite scores of the salience items. *Note*.*** = $p < .001$, Standard deviations appear in parentheses below means. Means within columns with differing subscripts are significantly different at least at the $p < .05$ level, using Tukey's HSD post hoc test.

Table 31

Means and Standard Deviations for Salience between Phase and Extraversion on the SART Task

Condition	Introverts	Extraverts
Absence	5.00[ab]	6.07[a]
	(0.00)	(2.62)
Coactor	6.44[ab]	7.52[b]
	(2.50)	(2.84)
Evaluator	10.85[b]	8.50[b]
	(3.23)	(3.25)
LC Music	13.61[c]	13.64[c]
	(4.15)	(5.21)
HC Music	15.80[c]	14.00[c]
	(5.07)	(5.55)
F	27.22***	24.17***

Numbers represent the means (standard deviations) of the composite scores of the salience items. *Note*.*** = $p < .001$, Standard deviations appear in parentheses below means. Means within columns with differing subscripts are significantly different at least at the $p < .05$ level, using Tukey's HSD post hoc test.

Table 32

Means and Standard Deviations for Salience between Phase on the Word-pair Task

Condition	Phase 1	Phase 2
Absence	5.14[ab]	6.00[a]
	(.452)	(3.12)
Coactor	7.16[ab]	7.87[ab]
	(3.10)	(3.72)
Evaluator	8.96[b]	9.97[b]
	(3.37)	(3.98)
LC Music	13.89[c]	14.03[c]
	(4.64)	(4.33)
HC Music	14.96[c]	12.74[c]
	(5.50)	(4.47)
F	36.13***	21.58***

Numbers represent the means (standard deviations) of the composite scores of the salience items. *Note*.*** = $p < .001$, Standard deviations appear in parentheses below means. Means within rows with differing subscripts are significantly different at least at the $p < .05$ level, using Tukey's HSD post hoc test.

Table 33

Means and Standard Deviations for Salience between Phase and Extraversion on the Word-Pair Task

Condition	Phase 1		t
	Introverts	Extraverts	
Absence	5.04[a]	5.28[a]	
	(0.00)	(.82)	-1.266
Coactor	6.67[a]	7.36[a]	
	(2.96)	(3.20)	-.582
Evaluator	10.43[b]	6.38[a]	
	(5.00)	(2.88)	2.089*
LC Music	13.50[bc]	14.29[b]	
	(4.01)	(4.58)	-.483
HC Music	15.75[c]	14.93[b]	
	(4.59)	(6.47)	.367
F	22.964***	17.645***	

Numbers represent the means (standard deviations) of the composite score of salience.
Note. * = $p < .05$, *** = $p < .001$, Standard deviations appear in parentheses below means. Means within columns with differing subscripts are significantly different at least at the $p < .05$ level, using Tukey's post hoc test.

Table 34

Means and Standard Deviations for the Energetic Arousal Aspect of the DSSQ Between Phase and Extraversion on the SART task.

Condition	Phase 1		Phase 2		
	Introverts	Extraverts	Introverts	Extraverts	F
Absence	21.75	23.50	21.22	19.78	
	(3.46)	(3.50)	(5.40)	(4.10)	.986
Coactor	22.78	22.50	20.63	21.73	
	(3.07)	(4.39)	(4.08)	(4.02)	.316
Evaluator	23.57[a]	20.13	19.33[a]	18.57[a]	
	(3.32)	(6.31)	(3.34)	(4.24)	4.110*
LC Music	21.23	20.42	20.50	21.31	
	(2.98)	(5.54)	(3.58)	(4.03)	1.260
HC Music	21.25	21.93	21.31	20.74	
	(3.96)	(4.20)	(3.22)	(4.67)	2.344

Numbers represent the means (standard deviations) on the energetic arousal measure on the DSSQ..*Note*.* = $p < .05$. Means with the same superscript are significantly different at least at the $p < .05$ level, using Tukey's HSD post hoc test.

Table 35

Means and Standard Deviations for the Nervousness Measure of the DSSQ between Phase and Extraversion on the SART Task.

Condition	Phase 1		Phase 2		
	Introverts	Extraverts	Introverts	Extraverts	*F*
Absence	16.90	16.64	19.11	16.68	
	(4.18)	(3.46)	(3.62)	(3.63)	1.01
Coactor	15.56[a]	16.23[a]	19.94[b]	16.71[ab]	
	(2.30)	(4.45)	(6.08)	(3.17)	2.80*
Evaluator	16.54	18.50	18.88	15.93	
	(2.30)	(5.13)	(3.33)	(3.77)	2.00
LC Music	17.17	17.50	19.31	15.71	
	(6.42)	(4.86)	(3.88)	(5.73)	1.21
HC Music	15.88	16.64	18.00	16.14	
	(4.64)	(5.72)	(4.14)	(5.39)	.464

Numbers represent means (standard deviations) on the nervousness measure on the DSSQ. *Note*.* = $p < .05$, Standard deviations appear in parentheses below means. Means with the same superscript are significantly different at least at the $p < .05$ level, using Tukey's HSD post hoc test.

Table 36

Means and Standard Deviations for the Hedonic Tone Measure of the DSSQ Between Phase and Extraversion on the SART Task.

Condition	Phase 1		Phase 2	
	Introverts	Extraverts	Introverts	Extraverts
Absence	18.15	18.64	19.78	18.75
	(4.87)	(3.50)	(5.52)	(4.91)
Coactor	19.89	17.43	19.07	17.23
	(2.93)	(4.98)	(3.25)	(4.38)
Evaluator	18.43	18.63	19.19	17.61
	(4.47)	(4.41)	(3.80)	(3.62)
LC Music	17.67	18.00	18.00	18.75
	(5.45)	(4.72)	(3.82)	(5.72)
HC Music	17.50	19.93	20.11	15.73
	(2.27)	(6.43)	(5.53)	(3.55)

Numbers represent means (standard deviations) on the hedonic tone measure on the DSSQ. Standard deviations appear in parentheses below means. Means with the same superscript are significantly different at least at the $p < .05$ level, using Tukey's HSD post hoc test.

Table 37

Means and Standard Deviations for the Energetic Arousal Aspect of the DSSQ Between Phase and Extraversion on the Word-Pair Task.

Condition	Phase 1		Phase 2		
	Introverts	Extraverts	Introverts	Extraverts	*F*
Absence	21.04	20.86	17.78[a]	20.48	
	(4.38)	(4.94)	(4.15)	(3.86)	1.325
Coactor	21.22	21.70	21.50[ab]	19.87	
	(2.33)	(4.63)	(2.65)	(3.81)	.855
Evaluator	21.07	19.13	19.83[b]	19.21	
	(3.02)	(4.52)	(3.63)	(3.17)	.829
LC Music	19.92	20.00	20.87[b]	19.69	
	(3.06)	(4.67)	(3.52)	(2.56)	.317
HC Music	18.75[cd]	20.85[c]	21.35[cb]	17.17[d]	
	(3.15)	(3.57)	(2.66)	(3.41)	5.171**
F	.893	.639	2.518*	1.855	

Numbers represent means (standard deviations) on the energetic arousal measure on the DSSQ..*Note*.* = $p < .05$, .**= $p < .01$. Means with different superscripts are significantly different at least at the $p < .05$ level, using Tukey's HSD post hoc test. ([ab] refer to introverts in phase 2 and [cd] refer to HC music).

Table 38

Means and Standard Deviations for the Nervousness Measure of the DSSQ Between Phase and Extraversion on the Word-Pair Task.

Condition	Phase 1		Phase 2	
	Introverts	Extraverts	Introverts	Extraverts
Absence	20.90	22.07	18.66	21.90
	(4.54)	(2.13)	(4.74)	(4.19)
Coactor	20.11	21.26	21.06	21.53
	(2.04)	(3.82)	(5.07)	(4.24)
Evaluator	20.21	20.50	19.07	21.07
	(4.42)	(4.93)	(3.78)	(2.81)
LC Music	19.33	21.35	20.25	21.61
	(4.79)	(3.69)	(4.39)	(4.86)
HC Music	22.00	21.14	20.25	22.00
	(4.07)	(4.63)	(3.80)	(4.28)

Numbers represent means (standard deviations) on the nervousness measure on the DSSQ. Means with different superscripts are significantly different at least at the $p < .05$ level, using Tukey's HSD post hoc test.

Table 39

Means and Standard Deviations for the Hedonic Tone Measure of the DSSQ Between Phase and Extraversion on the Word-Pair Task

Condition	Phase 1		Phase 2	
	Introverts	Extraverts	Introverts	Extraverts
Absence	18.59	18.07	20.33	17.95
	(5.60)	(4.32)	(6.58)	(4.29)
Coactor	21.22	18.00	20.18	17.07
	(3.41)	(5.37)	(4.40)	(3.47)
Evaluator	19.28	16.62	19.72	20.14
	(4.21)	(4.77)	(3.52)	(4.40)
LC Music	20.83	17.14	19.31	17.07
	(4.93)	(4.70)	(4.65)	(3.10)
HC Music	17.00	19.50	20.26	16.85
	(4.47)	(5.60)	(6.35)	(5.03)

Numbers represent means (standard deviations) on the hedonic tone measure on the DSSQ. Means with different superscripts are significantly different at least at the $p < .05$ level, using Tukey's HSD post hoc test.

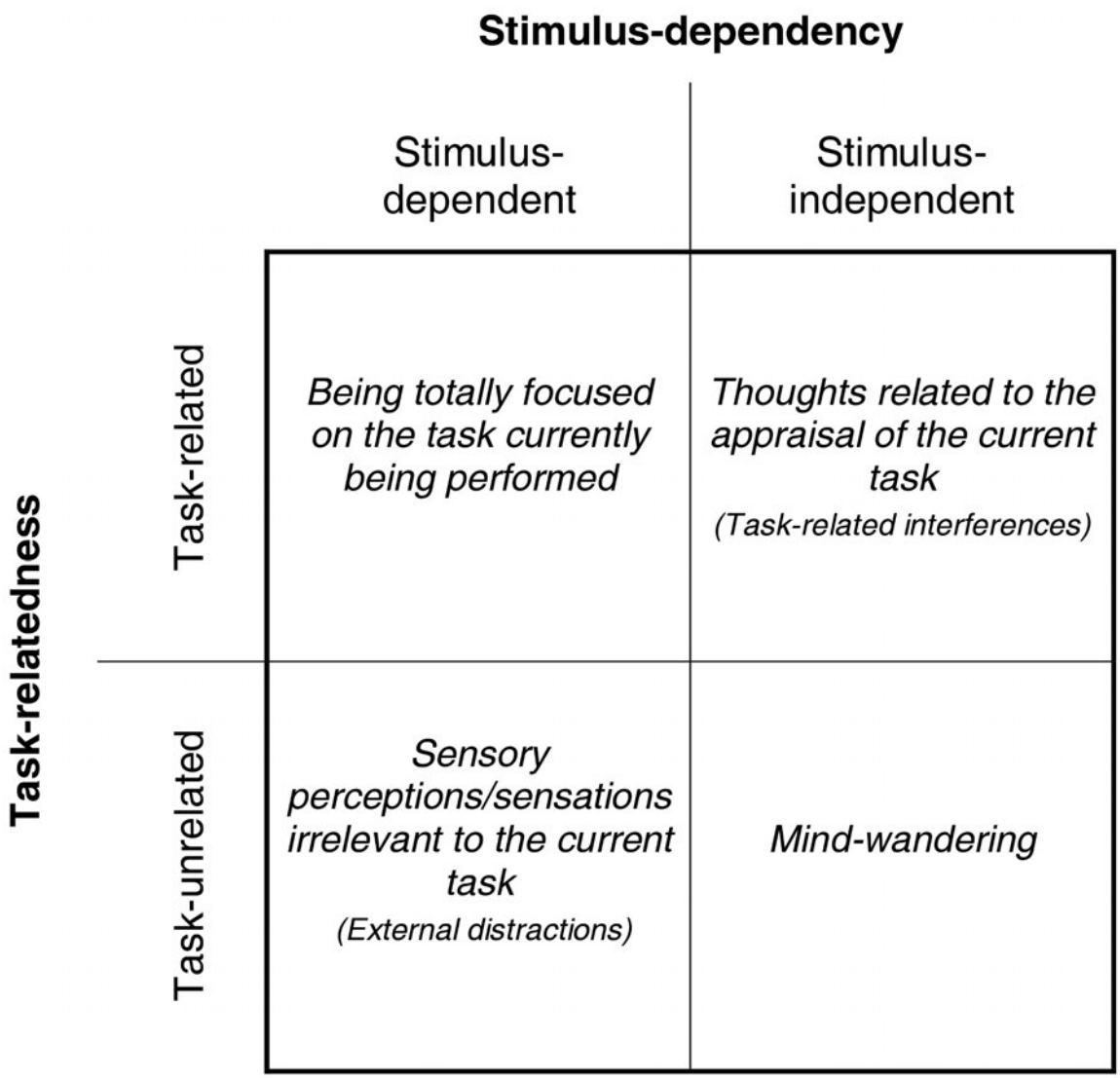

Figure 1. Dimensions of ongoing conscious experiences. Conceptual division of ongoing conscious experiences occurring during tasks sustained externally-driven attention according to their ‘‘stimulus-dependency’’ and ‘‘task-relatedness’’ dimensions adapted from (Stawarczyk, Majerus, Maquet, & D’Argembeau, 2011)

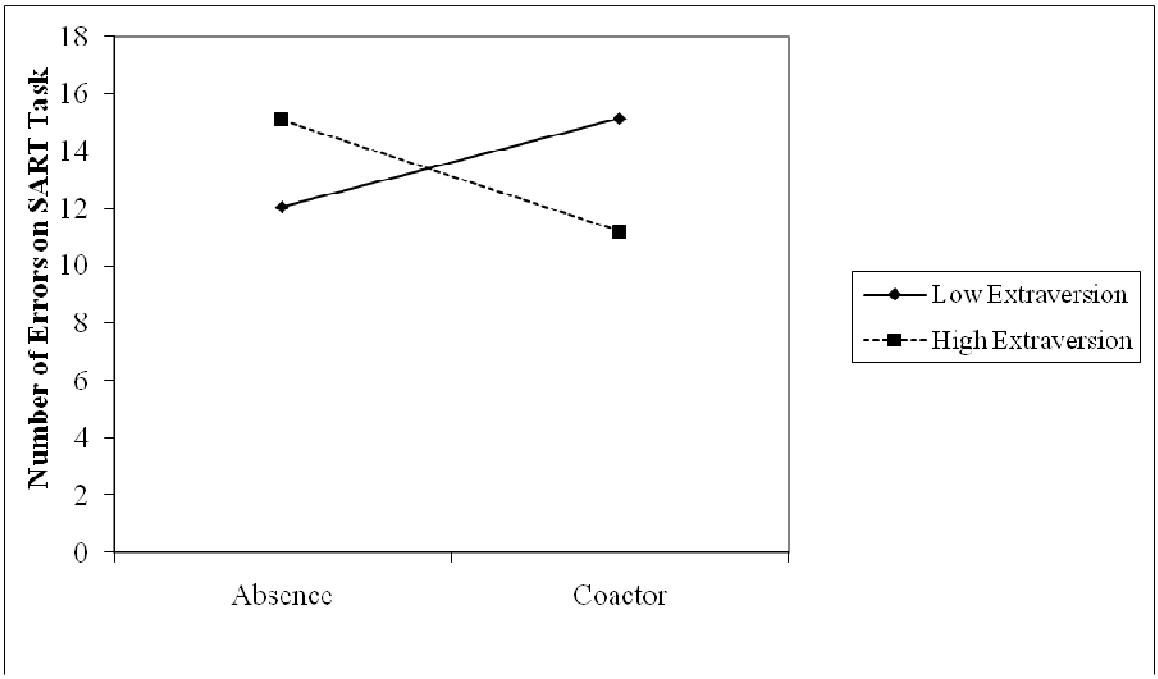

Figure 2. The hierarchical regression model showing the interaction for performance in phase 1 of the SART between condition (absence and coactor) and extraversion.

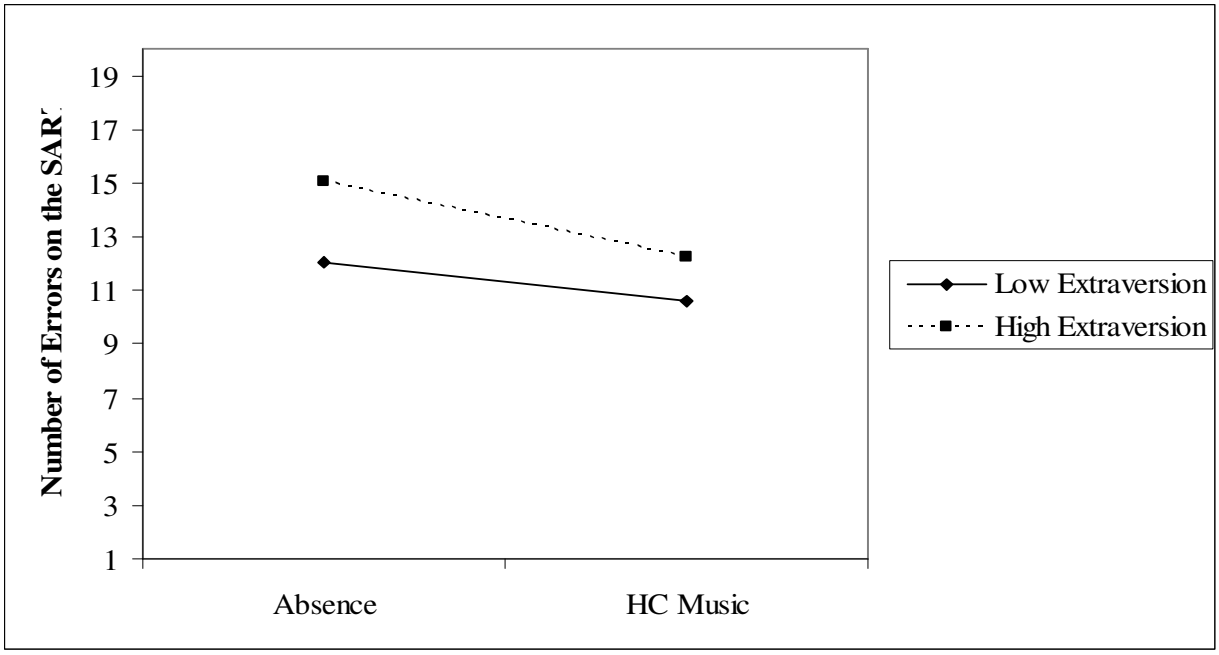

Figure 3. The hierarchical regression model showing the interaction for performance in phase 1 of the SART between condition (absence and high complexity music) and extraversion.

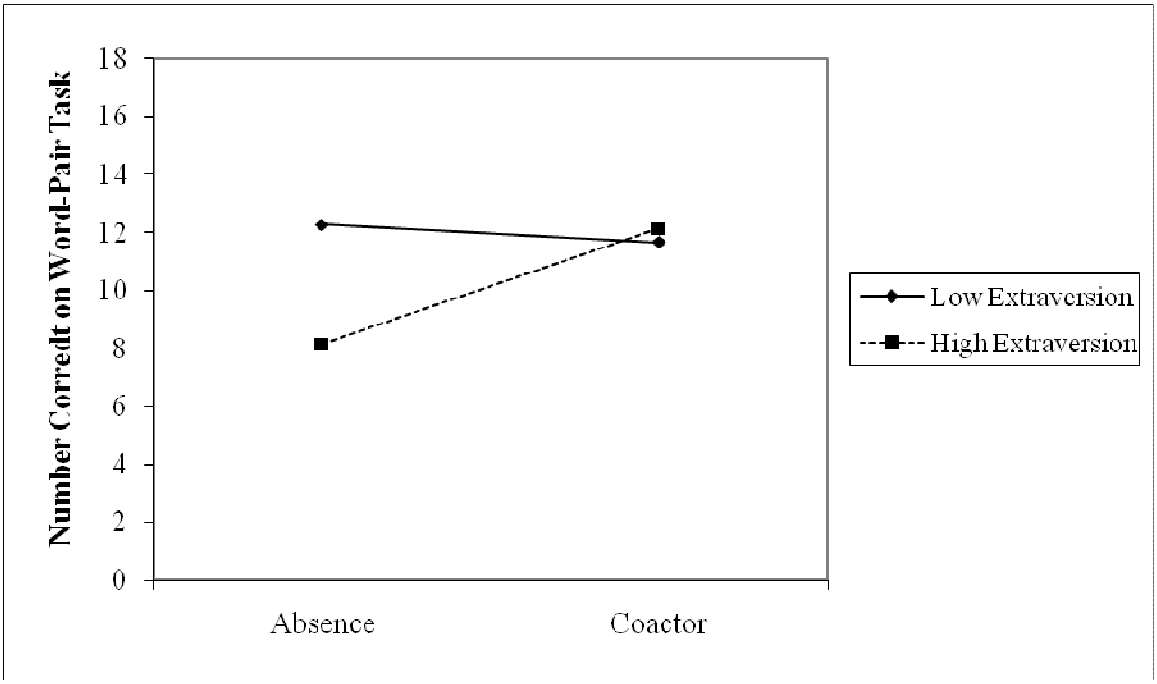

Figure 4. The hierarchical regression model showing the interaction for performance in phase 2 of the word-pair task between condition (absence and coactor) and extraversion.

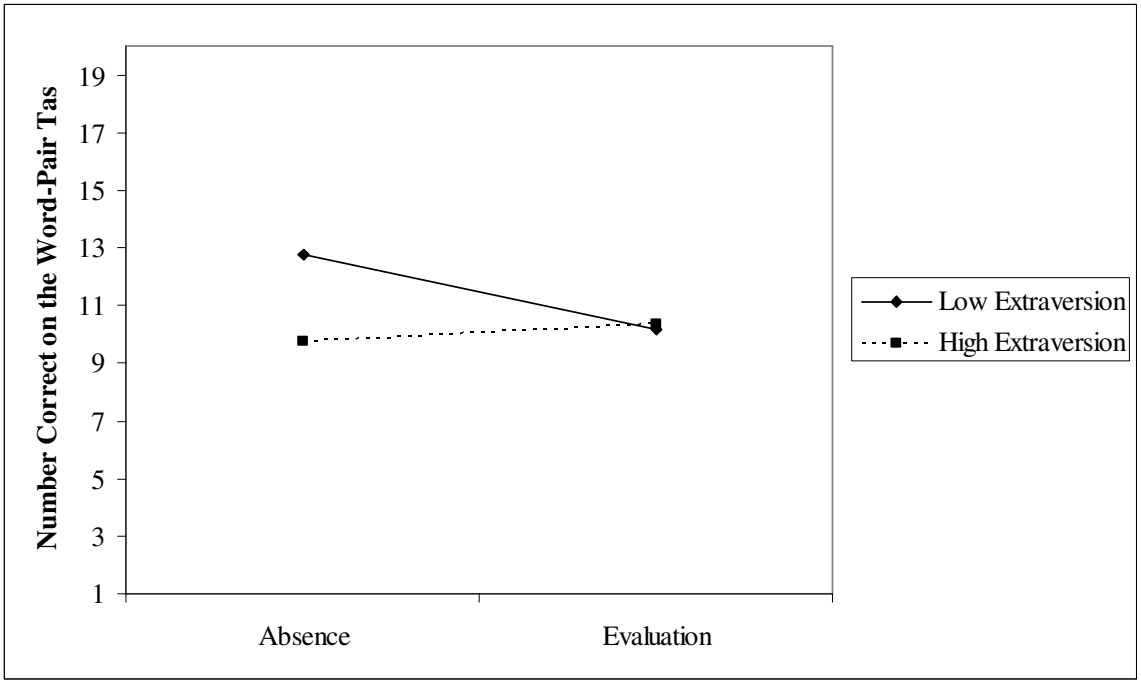

Figure 5. The hierarchical regression model showing the interaction for performance in phase 2 of the word-pair task between condition (absence and evaluation) and extraversion.

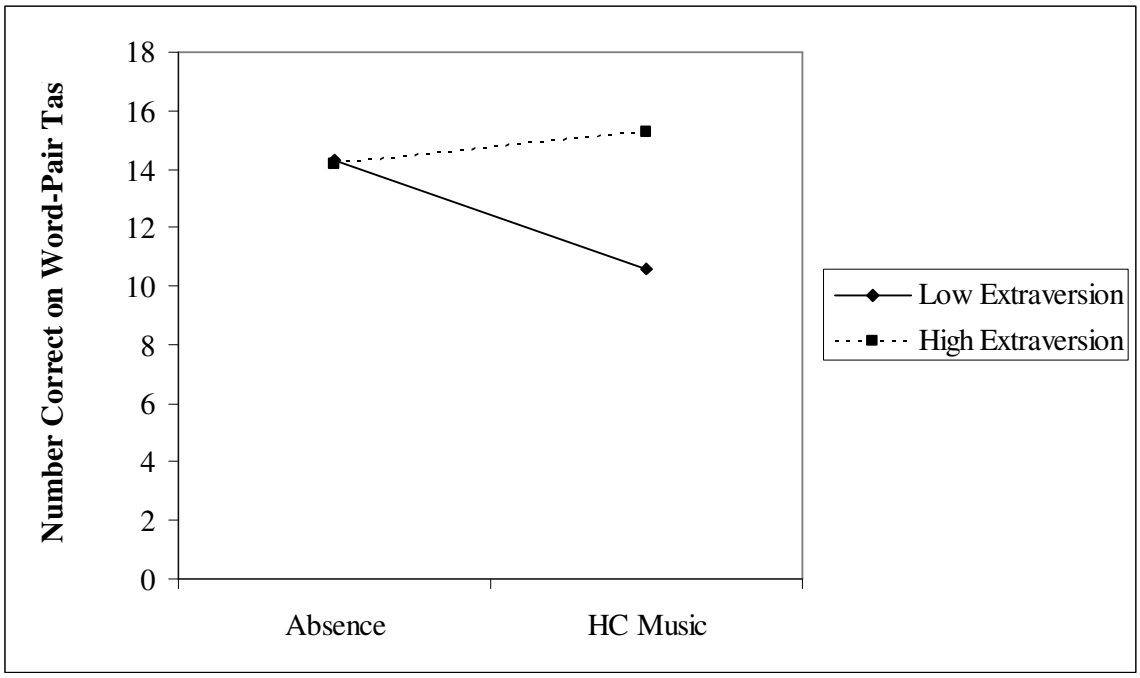

Figure 6. The hierarchical regression model showing the interaction for performance in phase 1 of the word-pair task between condition (absence and high-complexity music) and extraversion.

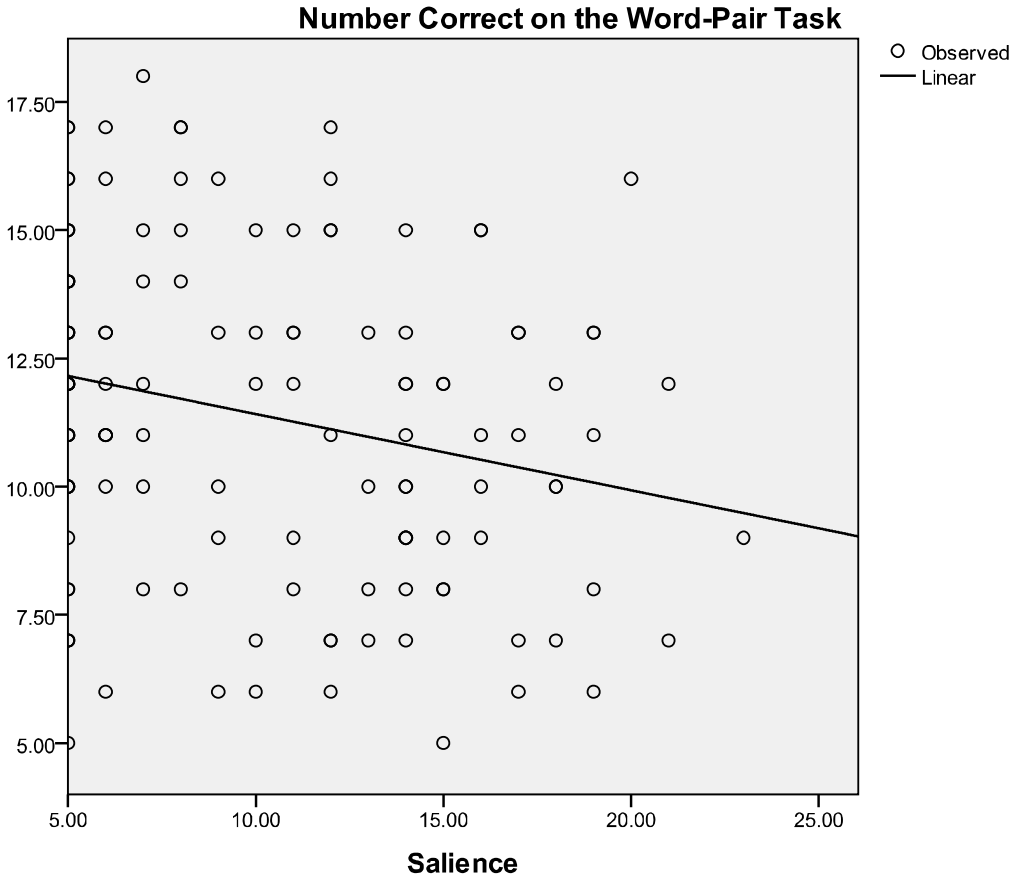

Figure 7. The linear relationship between salience and number correct on the word-pair task.

Appendix A

Stimulus-Response Word-Pair List

Adept-Skillful
Barren-Fruitless
Compete-Thorough
Distant-Remote
Empty-Vacant
Frigid-Arctic
Insane-Crazy
Little-Minute
Mammoth-Oversize
Pious-Devout
Roving-Nomad
Tranquil-Quiet
Wicked-Evil
Rural-Country
Grouchy-Cranky
Ragged-Tattered
Cautious-Careful
Dirty-Unclean

Appendix B

BOREDOM PRONENESS SCALE

(Farmer & Sundberg, 1986)

Please indicate whether you agree or disagree with the statement based on the following scale.

1 2 3 4 5 6 7

Highly Disagree Highly Agree

_____ 1. It is easy for me to concentrate on my activities.

_____ 2. Frequently when I am working I find myself worrying about other things.

_____ 3. Time always seems to be passing slowly.

_____ 4. I often find myself at "loose ends", not knowing what to do.

_____ 5. I am often trapped in situations where I have to do meaningless things.

_____ 6. Having to look at someone's home movies or travel slides bores me tremendously.

_____ 7. I have projects in mind all the time, things to do.

_____ 8. I find it easy to entertain myself.

_____ 9. Many things I have to do are repetitive and monotonous.

_____ 10. It takes more stimulation to get me going than most people.

_____ 11. I get a kick out of most things I do.

_____ 12. I am seldom excited about my work.

_____ 13. In any situation I can usually find something to do or see to keep me interested.

_____ 14. Much of the time I just sit around doing nothing.

_____ 15. I am good at waiting patiently.

_____ 16. I often find myself with nothing to do, time on my hands.

_____ 17. In situations where I have to wait, such as in line, I get very restless.

_____ 18. I often wake up with a new idea.

_____ 19. It would be very hard for me to find a job that is exciting enough.

_____ 20. I would like more challenging things to do in life.

_____ 21. I feel that I am working below my abilities most of the time.

_____ 22. Many people would say that I am a creative or imaginative person.

_____ 23. I have so many interests; I don't have time to do everything.

_____ 24. Among my friends, I am the one who keeps doing something the longest.

_____ 25. Unless I am doing something exciting, even dangerous, I feel half-dead and dull.

_____ 26. It takes a lot of change and variety to keep me really happy.

_____ 27. It seems that the same things are on television or the movies all the time and it's getting old.

_____ 28. When I was young, I was often in monotonous and tiresome situations.

Appendix C

BOREDOM SCALE
(Fisher, 1998)

1) While working on the task, to what extent did you feel alert?

1	2	3	4	5
Not at all		somewhat		very much

2) While working on the task, to what extent did you feel time was dragging?

1	2	3	4	5
Not at all		somewhat		very much

3) While working on the task, to what extent did you feel bored?

1	2	3	4	5
Not at all		somewhat		very much

4) While working on the task, to what extent did you feel restless?

1	2	3	4	5
Not at all		somewhat		very much

5) While working on the task, to what extent were you fascinated by the task?

1	2	3	4	5
Not at all		somewhat		very much

6) While working on the task, to what extent did you feel irritable?

1	2	3	4	5
Not at all		somewhat		very much

7) While working on the task, to what extent were you unable to concentrate?

1	2	3	4	5
Not at all		somewhat		very much

8) While working on the task, to what extent were you focused on the task?

1	2	3	4	5
Not at all		somewhat		very much

9) While working on the task, to what extent was your mind wandering?

1	2	3	4	5
Not at all		somewhat		very much

10) While working on the task, to what extent did you feel frustrated?

1	2	3	4	5
Not at all		somewhat		very much

11) While working on the task, to what extent did you enjoy the task?

1	2	3	4	5
Not at all		somewhat		very much

12) While working on the task, to what extent were you attentive?

1	2	3	4	5
Not at all		somewhat		very much

13) While working on the task, to what extent were you distracted?

1	2	3	4	5
Not at all		somewhat		very much

14) While working on the task, to what extent were you interested in the task?

1	2	3	4	5
Not at all		somewhat		very much

15) While working on the task, to what extent were you daydreaming?

1	2	3	4	5
Not at all		somewhat		very much

16) While working on the task, to what extent were you involved in the task?

1	2	3	4	5
Not at all		somewhat		very much

17) While working on the task, to what extent were you off in another world?

1	2	3	4	5
Not at all		somewhat		very much

18) How frustrating was the task?

1	2	3	4	5
Not at all		somewhat		very much

19) To what extent did your mind wander to other topics while working on this task?

1	2	3	4	5
Not at all		somewhat		very much

20) How hard was it to keep your attention on the task?

1	2	3	4	5
Not hard		somewhat		very hard

21) How boring or interesting was the task?

1	2	3	4	5
Very Interesting		neither boring nor interesting		Very boring

22) During the work period, how often did you think about other things outside of the study?

1	2	3	4	5
Always		Half the time		Never

Appendix D

Dundee Stress State Questionnaire

General Instructions. This questionnaire is concerned with your feelings and thoughts at the moment. We would like to build up a detailed picture of your current state of mind, so there are quite a few questions, divided into two sections. Please answer **every** question, even if you find it difficult.

Answer, as honestly as you can, what is true of **you**. Please do not choose a reply just because it seems like the 'right thing to say'. Your answers will be kept entirely confidential. Also, be sure to answer according to how you feel **AT THE MOMENT**. Don't just put down how you usually feel.

describes your **MOOD STATE**

	Definitely Not	Slightly Not	Slightly	Definitely
1. HT-Happy	1	2	3	4
2. HT-Dissatisfied	1	2	3	4
3. EA- Energetic	1	2	3	4
4. NR-Relaxed	1	2	3	4
5. EA –Alert	1	2	3	4
6. NR- Nervous	1	2	3	4
7. EA- Passive	1	2	3	4
8. HT- Cheerful	1	2	3	4
9. NR- Tense	1	2	3	4
10. NR-Jittery	1	2	3	4
11. EA- Sluggish	1	2	3	4
12. HT – Sorry	1	2	3	4
13. NR- Composed	1	2	3	4
14. HT-Depressed	1	2	3	4
15. EA- Restful	1	2	3	4
16. EA-Vigorous	1	2	3	4
17. NR- Anxious	1	2	3	4
18. HT- Satisfied	1	2	3	4
19. EA- Unenterprising	1	2	3	4
20. HT- Sad	1	2	3	4
21. NR –Calm	1	2	3	4
22. EA- Active	1	2	3	4
23. HT- contented	1	2	3	4
24. EA-Tired	1	2	3	4
25. NR-Impatient	1	2	3	4
26. HT-Annoyed	1	2	3	4
27. HT-Angry	1	2	3	4

EA-Energetic Arousal, NR-Nervousness, HT-Hedonic Tone

APPENDIX E

This set of questions concerns the kinds of thoughts that go through people's heads at particular times, for example while they are doing some task or activity. Below is a list of thoughts, some of which you might have had recently. Please indicate roughly how often you had each thought during the task, by circling a number from the list below.

1= Never 2= Once 3= A few times 4= Often 5= Very often

1. I thought about how I should work more carefully.	1	2	3	4	5
2. I thought about how much time I had left.	1	2	3	4	5
3. I thought about how others have done on this task	1	2	3	4	5
4. I thought about the difficulty of the problems	1	2	3	4	5
5. I thought about my level of ability	1	2	3	4	5
6. I thought about the purpose of the experiment	1	2	3	4	5
7. I thought about how I would feel if I were told how I performed	1	2	3	4	5
8. I thought about how often I get confused.	1	2	3	4	5
9. I thought about members of my family	1	2	3	4	5
10. I thought about something that made me feel guilty	1	2	3	4	5
11. I thought about personal worries.	1	2	3	4	5
12. I thought about something that made me feel angry.	1	2	3	4	5
13. I thought about something that happened earlier today.	1	2	3	4	5
14. I thought about something that happened in the recent past.	1	2	3	4	5
15. I thought about something that happened in the distant past	1	2	3	4	5
16. I thought about something that might happen in the future	1	2	3	4	5

.
.

Appendix F

MUSIC QUESTIONNAIRE

1) How distracted were you during the study?

1	2	3	4	5
Not at all		somewhat		very much

2) Did you notice the music?

1 (Yes) 2 (No)

3) How familiar were you with the music?

1	2	3	4	5
Not at all		somewhat		very much

4) How much did you like the music?

1	2	3	4	5
Not at all		somewhat		very much

5) Where you thinking about the music during the tasks?

1	2	3	4	5
Not at all		somewhat		very much

6) While working on the tasks, did the music improve your performance?

1	2	3	4	5
Not at all		somewhat		very much

7) While working on the tasks, to what extent did your mind drift to the music?

1	2	3	4	5
Not at all		somewhat		very much

8) While working on the tasks, to what extent were you focused on the tasks?

1	2	3	4	5
Not at all		somewhat		very much

9) While working on the tasks, did the music impair your performance?

1	2	3	4	5
Not at all		somewhat		very much

10) While working on the tasks, do you think the music relieved frustration?

1	2	3	4	5
Not at all		somewhat		very much

11) While working on the tasks did the music upset you?

1	2	3	4	5
Not at all		somewhat		very much

12) While working on the tasks, to what extent were you involved in the music?

1	2	3	4	5
Not at all		somewhat		very much

13) Is your hearing within the average range and/ do not need hearing aids?

1=Yes 2=No

14) If you could control the music volume what would you make it?

1	2	3	4	5
Much quieter		The same		Much louder

15) How complex did you perceive the music to be?

1	2	3	4	5
Not at all		Somewhat		very complex

16) Did the music improve your mood?

1	2	3	4	5
Not at all		Somewhat		very much

17) How distracting did you find the music?

1	2	3	4	5
Not at all		Somewhat		very much

18) To what extent did the music affect your performance?

1	2	3	4	5
Not at all		Somewhat		very much

19) Would you have preferred that the music was quieter?

1	2	3	4	5
Not at all		Somewhat		very much

20) Did the music impact your performance on the task?

1	2	3	4	5
Not at all		Somewhat		very much

Appendix G

SALIENCE SCALE

1) Was there someone in the room with you when you completed the task?

1) Yes 2) No

2) If someone was present, were they evaluating your work?

1	2	3	4	5
Not at all		somewhat		very much

3) If someone was present, were you thinking about their presence during the tasks?

1	2	3	4	5
Not at all		somewhat		very much

4) Did you find the person/music in the room to be distracting?

1	2	3	4	5
Not at all		somewhat		very much

5) To what extent did the person in the room/music affect your performance?

1	2	3	4	5
Not at all		somewhat		very much

6) Would you have preferred that the person in the room/music were quieter?

1	2	3	4	5
Not at all		somewhat		very much

7) Did the person in the room/music impact your performance during the tasks?

1	2	3	4	5
Not at all		somewhat		very much

1

Performance

SART

Mean error for target for all participants was 11.53 (*SD* = 4.88) out of 30 target presentations. The mean for phase 1 was 12.43 (*SD* = 4.88) and the mean for phase 2 was 10.73 (*SD* = 4.75). The difference between phase 1 and phase 2 was significant, $t(295) = 3.032$, $p < .01$. Two one-way analysis of variance (ANOVA) (one for phase 1 and one for phase 2 with condition as the independent variable and total errors as the dependent variable) showed that the number of errors for phase 1 and phase 2 were not significantly different in performance. To determine if there were any differences in performance for introverts and extraverts, extraversion was divided by a median split (Median = 50.1). Five pair-wise comparisons were conducted to determine if there were any differences between introverts and extraverts for each condition. None of the comparisons were significant (Table 27).

Two one-way ANOVAs were run (one for phase 1 and one for phase 2 with the independent variable was condition and dependent variable the number of errors) to determine if there were any significant differences between introverts and extraverts in phase 1 and phase 2. The ANOVA was significant, $F(3, 60) = 4.973$, $p < .05$, with Tukey HSD post-hoc follow up comparisons indicating that extraverts in phase 1 (*M* = 15.11, *SD* = 4.69, *n* = 13) performed significantly worse than introverts in phase 1 (*M* = 10.11, *SD* = 2.61, *n* = 12) and extraverts in phase 2 (*M* = 10.63, *SD* = 5.33, *n* = 20). There were no differences in performance for the other 4 conditions (Table 28).

Word-Pair

The mean correct words recalled out of 18 was 14.70 (*SD* = 3.51) and the mean for phase 1 was 14.53 (*SD* = 3.87) and for phase 2 was 14.89 (*SD* = 3.10). There was no significant differences in difficulty (1 = not difficult, 5 = very difficult) between the SART (*M* = 2.66, *SD* = 1.22) and the word-pair task (*M* = 2.55, *SD* = 1.28). In addition, there were no differences in performance between phase 1 and phase 2. Since there were no significant differences between phase 1 and phase 2, pair-wise comparisons were conducted to determine if there were any differences between introverts and extraverts between conditions. The pair-wise comparisons were not significant except for the difference between introverts (*M* = 15.71, *SD* = 2.72, *n* = 28) and extraverts (*M* = 13.64, *SD* = 4.67, *n* = 28) in the high complexity music condition, $t(54) = 2.03$, $p < .05$. A one-way ANOVA showed that (independent variable was extraversion x phase and dependent variable was number correct) there was a significant difference for the high complexity music condition, $F(3.52) = 2.34$, $p < .05$ between introverts and extraverts. Follow-up Tukey HSD pair-wise comparisons indicate that introverts in phase 2 (*M* = 16.35, *SD* = 1.63, *n* = 30) perform significantly better than the extraverts in phase 1 (*M* = 12.93, *SD* = 6.03, *n* = 13) (Table 29).

Salience

SART

The salience scale was adapted from Glushakow (2011) and consisted of the following items: were you thinking about the presence/music during the tasks? Did you find the person in the room/music to be distracting? To what extent did the person in the room/music affect your performance? Would you have preferred that the person in the room/music were quieter? And did the person in the room/music impact your performance during the tasks? Cronbach's α for the absence condition was (α = .91, for the coactor condition, α = .78, for the evaluation condition, α = .84, for the low complexity music condition, α = .70 and the high complexity music condition, α = .85.

The hypotheses of the study assumes a significant different between the coactor and evaluation conditions. Two one-way ANOVAs (independent variable was condition and dependent variable was perceived salience) were run to determine if there was a difference in condition for phase 1 and phase 2. The ANOVA for phase 1 was significant, $F(4, 129) = 31.81$, $p < .001$. Follow-up Tukey HSD post-hoc pair-wise comparisons indicate that for phase 1 the absence condition ($M = 5.34$, $SD = 1.72$, $n = 32$) was significantly different from the evaluator condition ($M = 10.00$, $SD = 3.36$, $n = 22$), the low complexity music condition ($M = 13.63$, $SD = 4.64$, $n = 27$), and the high complexity music condition ($M = 14.40$, $SD = 5.49$, $n = 25$). The coactor condition ($M = 7.20$, $SD = 2.75$, $n = 30$) was significantly different from the high and low music conditions. The evaluator condition was significantly different from the absence condition and the 2 music conditions. The ANOVA (independent variable was condition and dependent variable was performance) was significant for phase 2, $F(4, 150) = 21.57$, $p < .001$ with the same pattern of differences (Table 30).

The hypotheses of the current study made certain assumptions about the salience of the conditions. The first was that the absence condition would be significantly different from the coactor, presence, LC music and HC music. This was the case except for the coactor condition. The second was that the coactor and evaluation conditions would be significantly different from each other, which was the case. The third was that the high complexity and low complexity music conditions would be significantly different from each other, which was not the case. The fourth was that the coactor condition would have the same salience as the low complexity music condition which was not the case. The fifth was that the evaluator condition would have the same salience as the high complexity condition, which also was not the case. It appears that the salience linearly increases in the following fashion absence < coactor < evaluation < low complexity music < high complexity music. A linear relationship was significant for salience, $R^2 = .383$, $F(1, 185) = 114.65$, $p < .001$. Thus, the conditions will be treated as increasing salience for this study.

The difference in salience was also assessed for introverts and extraverts. A one-way ANOVA was conducted (independent variable was condition and dependent variable was perceived salience) for introverts for salience, $F(4, 59) = 27.22$, $p < .001$. Follow up Tukey HSD post-hoc comparisons indicate that the absence ($M = 5.00$, $SD = 0.00$, $n = 18$) did not differ from the coactor ($M = 6.44$, $SD = 2.50$, $n = 9$) condition, the evaluator condition ($M = 10.85$, $SD = 3.23$, $n = 14$) did not differ from the low complexity music condition ($M = 13.61$, $SD = 4.15$, $n = 13$) and the low complexity music did not differ from the high complexity music condition ($M = 15.80$, $SD = 5.07$, $n = 10$) (Table 31).

A one-way ANOVA for extraverts was run (independent variable was condition and dependent variable was perceived salience) absence and the absence condition (M = 6.07, SD = 2.62, n = 13), coactor condition (M = 7.52, SD = 2.84, n = 21) and the evaluator condition (M = 8.50, SD = 3.25, n = 8) did not differ from each other and the low complexity music condition (M = 13.64, SD = 5.21, n = 13) and the high complexity music conditions did not differ from each other (M = 14.00, SD = 5.55, n = 14) (Table 31).

Salience

Word-Pair

The salience for the word-pair shows reliability for the absence condition was α = .49, for the coactor condition, α = .83, for the evaluation condition, α = .94, for the low complexity music condition, α = .70 and the high complexity music condition, α = .85.

Two one-way ANOVAs were run (one for phase 1 and one for phase 2 with condition as the independent variable and perceived salience as the dependent variable) to determine if there was a difference in condition for phase 1 and phase 2. The ANOVA for phase 1 was significant, $F(4, 139) = 36.13$, $p < .001$. Follow-up Tukey HSD post-hoc pair-wise comparisons indicate that the absence condition (M = 5.13, SD = .54, n = 36) was significantly different from the evaluator condition (M = 8.96, SD = 4.72, n = 22), the low complexity music condition (M = 13.89, SD = 4.25, n = 28), and the high complexity music condition (M = 14.96, SD = 5.77, n = 27). The coactor (M = 7.16, SD = 3.10, n = 22) was significantly different from the high and low music conditions. The evaluator condition was significantly different from the absence condition and the 2 music conditions. The low-complexity music condition was significantly different from the absence, coactor and presence conditions and the high complexity music condition was significantly different from the absence, coactor and evaluation conditions (Table 32).

The hypotheses of the study made certain assumptions about the salience of the conditions. The first was that the absence condition would be show a significant difference from the coactor, evaluator, low-complexity music and high-complexity music. This was the case except for the coactor condition. The second was that the coactor and evaluation conditions would be significantly different from each other, which was the case. The third was that the high complexity and low complexity music conditions would be significantly difference from each other which was not the case. The fourth was that the coactor condition would have the same salience as the low complexity music condition which was not the case. The fifth was that the evaluator condition would have the same salience as the high complexity condition, which also was not the case (Table 32). It appears that the salience linearly increases in the following fashion absence < coactor < evaluation < low complexity music < high complexity music. A linear relationship was significant for salience, $R^2 = .49$, $F(1, 142) = 137.45$, $p < .001$. Thus, the conditions will be treated as increasing salience for this study.

The difference in salience was also assessed for introverts and extraverts. A one-way ANOVA (independent variable was condition and dependent variable was perceived salience) was significant for introverts for salience in phase 1, $F(4, 65) = 22.97$, $p < .001$.

Follow up Tukey HSD post-hoc comparisons indicate that the absence (M = 5.05, SD = .21, n = 21) did not differ from the coactor (M = 6.67, SD = 2.96, n = 9) condition. The coactor condition did not differ from the absence or evaluator condition (M = 10.43, SD = 5.00, n = 14). And the low complexity music condition (M = 13.50, SD = 4.01, n = 13) did not differ from the evaluator or the high complexity music condition (M = 15.75, SD = 4.59, n = 10) (Table 33).

SART DSSQ

Participants were given measures from the Dundee Stress State Questionnaire (DSSQ) which assessed their mood on three different aspects of emotional reaction. The first were questions that related to their energetic arousal. The mean for the SART task for phase 1 was 22.09 (SD = 4.10) and phase 2 was 20.5 (SD = 4.00) and the difference was significant $t(289) = 3.19$, $p < .01$ which indicates that participants were more energized during phase 1. A one-way ANOVA (independent variable was phase x extraversion and dependent variable was energetic arousal) showed that there was a significant difference for energetic arousal in the evaluator condition $F(3, 50) = 4.110$, $p < .01$. Follow-up Tukey HSD pair-wise comparisons indicates that introverts in phase 1 (M = 23.57, SD = 3.32, n = 14) were significantly higher in energetic arousal than introverts in phase 2 (M = 19.33, SD = 3.34, n = 18) and extraverts in phase 2 (M = 18.57, SD = 4.24, n = 14) (Table 34).

The second measure on the DSSQ was that of nervousness. The mean for the SART task for phase 1 was 16.72 (SD = 4.47) and phase 2 was 17.69 (SD = 4.48) and the difference was significant $t(287) = -1.85$, $p < .05$ indicating that participants in phase 2 were more nervous than those in phase 1. Pair-wise comparisons indicate that for phase 1, there was no difference between introverts (M = 16.54, SD = 4.33) and extraverts (M = 16.89, SD = 4.63). For phase 2, there was a significant difference between introverts (M = 19.02, SD = 4.30) and extraverts (M = 16.26, SD = 4.30), $t(148) = 3.92$, $p < .01$. A one-way ANOVA (independent variable was phase x extraversion and dependent variable was nervousness) indicated that was a significant difference in nervousness in the coactor condition $F(3, 57) = 2.80$, $p < .05$. Follow-up Tukey HSD pair-wise comparisons indicate that introverts in phase 2 (M = 19.93, SD = 6.08, n = 14) were significantly more nervous than introverts in phase 1 (M = 15.56, SD = 2.30, n = 9) and extraverts in phase 1 (M = 17.71, SD = 3.17, n = 14) (Table 35).

The third measure on the DSSQ was that of hedonic tone. The mean for phase 1 was 18.38 (SD = 4.63) and phase 2 was 18.53 (SD = 4.47) and the difference was not significant. Pair-wise comparisons indicated that for phase 1, there was no difference between introverts (M = 18.28, SD = 4.35) and extraverts (M = 18.40, SD = 4.89). For phase 2, there was a significant difference between introverts (M = 19.21, SD = 4.39) and extraverts (M = 17.07, SD = 4.52), $t(133) = 1.96$, $p < .05$ indicating that introverts had a more positive affective state in phase 2. A one-way ANOVA (independent variable was condition and dependent variable was hedonic tone) was run to determine if there were any differences for the phases for introverts and extraverts. There was no difference in conditions for hedonic tone for introverts $F(4, 66) = .571$, $p > .05$ or extraverts $F(4, 58) = .423$, $p > .05$ in phase A one-way ANOVA for phase 2 shows that there was not a

significant difference between groups and no difference for introverts in hedonic tone between groups and no significant difference for extraverts (Table 36)

Word- pair DSSQ

Though the DSSQ is based on change in affect due to performance on vigilance (SART) tasks (Smallwood et al., 2006), the three measures were applied to the word-pair task. The mean for energetic arousal was 20.33 (*SD* = 3.86). Pair-wise comparisons indicated that there was not a significant difference between phase 1 (*M* = 20.65, *SD* = 33.97) and phase 2 (*M* = 19.94, *SD* = 3.51), t(295) = 1.640, *p* > .05. There was also not a significant difference between introverts (*M* = 20.56, *SD* = 3.42) and extraverts (*M* = 21.07, *SD* = 4.01), *t*(290) = 1.309, *p* > .05. Differences were analyzed by a two one-way ANOVAs (independent variable was condition and dependent variable was energetic arousal) for phase and extraversion. There was a significant difference for introverts in phase 2 between conditions, *F*(4, 74) = 2.518, *p* <. 05. Post Hoc Tukey HSD pair-wise comparisons indicate that participants in the absence condition (*M* = 17.79, *SD* = 4.14, *n* = 9) were significantly less aroused than in the evaluator condition (*M* = 19.83, *SD* = 3.63 *n* = 18), the low complexity music condition (*M* = 20.87, *SD* = 3.52, *n* = 16) and the high complexity music condition (*M* = 21.35, *SD* = 2.66, *n* = 20). Within the conditions, the ANOVA was significant for the high complexity music condition *F*(3, 50) = 5.171, *p* <. 01. Follow up Tukey HSD post-hoc comparisons indicate that extraverts in phase 2 (*M* = 17.16, *SD* = 3.41, *n* = 12) were less energized than extraverts in phase 1 (*M* = 20.92, *SD* = 3.70, *n* = 13) and introverts in phase 2 (*M* = 21.35, *SD* = 2.66, *n* = 20) (Table 37).

The mean for nervousness was 23.17 (*SD* = 4.50). Pair-wise comparisons indicated that there was not a significant difference between phase 1 (*M* = 23.23, *SD* = 4.39) and phase 2 (*M* = 23.25, *SD* = 4.54), *t*(296) = -.039, *p* > .05. Pair-wise comparisons indicated a significant difference between introverts (*M* = 23.87, *SD* = 4.32) and extraverts (*M* = 22.61, *SD* = 4.49), *t*(291) = -2.449, *p* < .05 with introverts being more nervous than extraverts (Table 38).

The mean for hedonic tone for the word-pair task was 18.78 (*SD* = 4.72). Pair-wise comparisons indicated that there was not a significant difference between phase 1 (*M* = 18.78, *SD* = 4.75) and phase 2 (*M* = 18.78, *SD* = 4.70), *t*(295) = -.012, *p* > .05. There was a significant difference between introverts (*M* = 17.90, *SD* = 4.96) and extraverts (*M* = 19.65, *SD* = 4.91), *t*(290) = 3.196, *p* < .01 with extraverts experiencing a more positive affect than introverts. (Table 39).