

Nature Soundscapes and Cognitive Performance in an Office Environment

by

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B.A., University of California, 2016

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Abstract

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Research suggests that interacting with nature has positive psychological, physiological, and cognitive benefits. Views to nature, interacting with nature, and other visual nature stimuli have been widely studied. However, nature soundscapes have received less attention; and the limited research that has been published has mixed findings. The present study assessed whether nature soundscapes influenced performance on cognitive and affective assessments. Participants completed the Flanker task, the Stroop task, a Visual Search task, and the Positive and Negative Affect Schedule, while exposed to either nature sounds alone, nature sounds with outdoor views, or neither. No statistically significant differences in performance were found for any of the three conditions, on either the cognitive and affective assessments. These findings indicate that the relation between nature sounds and cognition is more complex than originally presumed, and potential future directions are discussed.

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Chapter 1: Introduction

Literature Review

Unlike most other living creatures, humans have had a large range of control over the design of our environments and how we utilize them. The complex and symbiotic person-environment relation that resulted has been studied extensively both within and beyond the field of psychology, with findings indicating a marked influence of design over human health, behavior, and perceptions (Al horr et al., 2016; Heerwagen, 1998). One of the most common settings for this research, however, is the work environment, which includes various styles and iterations of office and education spaces. This is an important area of focus because the office is where many humans spend the majority of their waking hours, often confined to a particular workstation or area. Paradoxically, however, workplaces are often inflexible, with little employee control over their design. This creates a second reason why the work environment is an important area of study, which is that without much control over their spaces, employees may inadvertently be subjected to psychologically poor work conditions.

The psychology of work environments has been studied in one form or another since the early 1900s, when workers were viewed as mechanistic components of a larger work machine (Sundstrom & Sundstrom, 1986). During this time, work environments were evaluated based on basic physical habitability, rather than psychological experience. In the 1960s a resurgence of research on workspaces occurred with the inception of environmental psychology, with studies conducted both in laboratory settings and the actual workplaces individuals occupied (Sundstrom & Sundstrom, 1986). In the 1980s

researchers in this field began utilizing the post-occupancy evaluation method of assessment, wherein researchers would assess occupant responses after moving into a space, across a diverse range of factors lighting, thermal comfort, and several others (Sundstrom & Sundstrom, 1986). The psychological experience of a space received much more focus than its operational capability, the reverse of environmental psychology research from earlier decades.

During this time, a handful of researchers began honing in on the relation between specific office design variables and cognitive, health, and well-being outcomes (Vischer & Wifi, 2017; Wineman, 1982). Over the course of the next two decades, a large quantity of research emerged laying the groundwork which the present study is built upon. The office seems to be as consequential an environment as any other, because of the amount of time humans spend there (Vischer & Wifi, 2017).

One researcher theorized that the quality of the work environment is ultimately a quality of life issue, by way of impacting the quality of work life (Vischer & Wifi, 2017). Habitability of the work environment no longer meant satisfying merely the functional needs of occupants. Rather, offices needed to meet psychological needs in order to be considered optimal for occupant success. Where previous researchers had considered workspaces in terms of Taylorism, in this era they focused on more nuanced, acute elements of the work environment, exploring their relation to psychological and health outcomes (*States of mind*, 1997; Sundstrom, Bell, Busby, & Asmus, 1996)(Bell & Sundstrom, 1997; Sundstrom, Bell, Busby, & Asmus, 1996) .

With many workers spending the majority of waking hours in the office, seemingly minute design factors including ventilation and air quality had deleterious

impacts on occupants when not handled properly (Hedge, 1984, 2009). Beyond physical design characteristics, elements like control, flexibility of space, and privacy also played major roles in work performance and overall occupant experience (Becker, 1985; Veitch & Gifford, 1996; Vischer & Wifi, 2017).

Since the 1980s, numerous aspect of the built environment have been studied to some extent, yet most attention has traditionally been given to lighting, acoustics, thermal comfort, air quality, and floorplan. These factors fall under an umbrella label of indoor environmental quality (IEQ); (Al horr et al., 2016). Over the past two decades, an additional variable that has received increasing attention is nature, denoting exposure to nature, in real or artificial form (Bowler, Buyung-Ali, Knight, & Pullin, 2010; Ohly et al., 2016). This research topic has grown in tandem with its increasing popularity amongst the general population, because of nature's growing popularity within our culture. Developments like the Chelsea highline in New York City, rooftop gardens, and vacant lots being converted into parkettes have become widespread, particularly in large cities.

Nature and Well-Being

A multitude of findings have emerged illustrating several well-documented effects of nature exposure on human satisfaction, health and performance (Chang & Chen, 2005; Farley & Veitch, 2001; Heerwagen, 1998; Veitch & Clayton, 2012). In this research, nature constitutes plants and greenery, as well as stimuli found within nature, including, sights, sounds, and smells. Having a nearby window with a view to nature in the workplace, for instance, has been linked to enhanced job satisfaction, self-perceptions of productivity, and perceptions about the quality of the work environment far (Farley & Veitch, 2001). One researcher posits that nature constitutes a “well-being” need for

humans, and therefore access to nature stimuli may directly benefit one's quality of life and sense of fulfillment (Heerwagen, 1998).

Nature and Cognitive Performance

Nature contact, whether direct or indirect, has positive attentional and performance benefits for humans (Berman, Jonides, & Kaplan, 2008; Grinde & Patil, 2009; Laumann, Gärling, & Stormark, 2003; Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009; Raanaas, Evensen, Rich, Sjøstrøm, & Patil, 2011; Tennessen & Cimprich, 1995). Showing participants a video of a natural (as opposed to urban) environment results in lowered physiological arousal, boosted alertness, and subsequently improved performance on an attention-orienting task from the first to second assessment (Laumann et al., 2003). On assessments of attention capacity, student scores improve when the work environment contains plants (Berto, 2005; Raanaas et al., 2011). Additionally, students living in dorm rooms with views to nature perform better on directed attention tasks than those whose windows provide no views to nature (Tennessen & Cimprich, 1995).

Beyond improved cognition, nature also has marked physiological effects. In general, availability of nature correlates positively with human health and longevity (Bjornstad, Patil, & Raanaas, 2016; Bratman, Hamilton, & Daily, 2012; Grinde & Patil, 2009; Haluza, Schoenbauer, & Cervinka, 2014; Hansen-Ketchum, Marck, & Reutter, 2009; Kuo, 2015; McSweeney, Rainham, Johnson, Sherry, & Singleton, 2015).

Individuals who perceive their neighborhoods as having more greenery have 1.6 times greater odds of better mental health than those who perceive the lowest levels of greenery (Sugiyama, Leslie, Giles-Corti, & Owen, 2008). For hospital patients, having access to a window, especially a window with views to nature, has marked benefits including

bolstered recovery time and rehabilitation (Aries, Veitch, & Newsham, 2010; Farley & Veitch, 2001; Grinde & Patil, 2009; Heerwagen, 2009; Raanaas et al., 2011; R. S. Ulrich et al., 1991). Brief walks through nature (e.g., a forest, garden, etc.) are linked to reduced blood pressure, improved immune function, and potentially, reduced sympathetic nerve activity (Li et al., 2011; McSweeney et al., 2015). Interacting with nature may also help mitigate anxiety, depression, and ADHD symptoms (Dzhambov & Dimitrova, 2014; Kuo, 2015; Maas et al., 2009).

Attention Restoration Theory and Biophilia

Several theories have arisen to explain the effects of nature exposure observed across studies. Two of the most prominent are attention restoration theory (ART) and the biophilia hypothesis (Grinde & Patil, 2009; Kaplan, 1995; Kellert & Wilson, 1993; R. Ulrich, 1993). Attention restoration theory posits that exposure to nature and nature stimuli helps individuals recover from attentional fatigue that otherwise would result in a loss of productivity (Kaplan, 1995). Central to this theory are the concepts of voluntary and involuntary attention. Essentially, continuous directed attention to various cognitive tasks diminishes over time, especially when individuals are forced to exert greater effort in suppressing distracting stimuli. The activation of involuntary attention, which entails passive attuning to interesting stimuli, requires no effort and allows voluntary attention to recover. Nature, Kaplan argues, is the most powerful stimulus for engaging involuntary attention and in mitigating attentional fatigue.

The central argument of the biophilic hypothesis (or biophilia) on the other hand, is that humans have an inherent, evolutionary-endowed connection with nature (Browning, Ryan, & Clancy, 2014). We are said to have an implicit preference for natural

environments, and interacting with them has psychological and physiological benefits in turn (Browning et al., 2014; Grinde & Patil, 2009; Kellert & Wilson, 1993). This theory served as the theoretical foundation for the present study.

Nature Soundscapes

Despite the widespread research on the psychological effects of nature, one aspect of this variable that has been given little attention is sound. Visual and tactile interaction with nature have been given ample attention. Yet few controlled studies on the effect of nature sounds on cognition and mental health have been conducted. Furthermore, results from the limited research studies on nature sounds that do exist are mixed. In assessing the impact of nature sounds on simple cognitive assessments, performance significantly improved among individuals exposed to the nature sound condition compared with those who listened to urban landscapes (Hedger et al., 2018). Furthermore, when individuals score the highest number of correct responses on a cognitive task when listening to rain, compared to listening to silence (Newbold, Luton, Cox, & Gould, 2017).

In other studies, however, performance improvements on cognitive tasks approached, but did not reach, statistical significance amongst individuals exposed to nature sounds, compared to those without (Abbott, Taff, Newman, Benfield, & Mowen, 2016). Furthermore, individuals self-rated themselves as lower in motivation and energy, and higher in disinterest in the nature sounds condition compared to any non-nature sounds condition, including silence (Jahncke, Hygge, Halin, Green, & Dimberg, 2011).

Additional research has been conducted assessing the impact of nature sounds on physiological outcomes. Heart rate variability recovered faster from stress induced by arithmetic tasks when participants were exposed to nature soundscapes, although skin

conductance did not change (Alvarsson et al., 2010). Additionally, individuals who underwent a flexible bronchoscopy procedure reported higher pain control ratings when exposed to nature sounds and a large poster than with no nature stimuli (Diette, Lechtzin, Haponik, Devrotes, & Rubin, 2003).

In sum, research on nature soundscapes is less consistent than that of other nature stimuli. The limited research that exists supports the notion that nature sounds do not, or insignificantly impact psychological outcomes. The methodologies employed in these studies vary widely, however, and it is therefore difficult to discern trends from their results. Research on the psychological impact of other forms of nature stimuli has produced encouraging results, however, so nature sounds should be further explored.

Accordingly, the purpose of the present study is to expand upon the limited work on nature sounds to help clarify findings. Specifically, it aimed to help clarify and delineate the relation between nature soundscapes and cognitive and emotional outcomes, with and without the influence of outdoor nature views. The addition of nature views was added to bolster the effect of nature sounds, should one exist. Visual access to nature, as previously discussed, is linked to positive psychological outcomes (Aries et al., 2010; Farley & Veitch, 2001; Haluza et al., 2014). The present study's theoretical foundations are rooted in the biophilia hypothesis, and specifically, the argument that settings with nature present should elicit more positive experiences than those without. I therefore hypothesized that nature sounds, with or without outdoor nature views, will bolster positive affect, mitigate negative affect, and improve cognitive performance.

Chapter 2: Method

Participants

The participants consisted of 132 University of Victoria students recruited as volunteers through the SONA system. They participated as part of course requirements in the social sciences, and were randomly assigned to one of three conditions. Participants included 113 females and 19 males between the ages of 18 and 34. They were granted course credit as compensation for participation in the study.

Conditions

The present study had three experimental conditions, with 45, 44, and 43 participants in the nature sounds and views, nature sounds only, and neither sounds nor views conditions, respectively. In the first, participants completed the assessments without nature sounds or views. The second was nature sounds with no views. In the third, participants were exposed to both the nature sounds and outdoor views while completing the assessments. Across the three conditions, participants were exposed to stimuli for the entire duration of the experiment.

Materials

Participants completed a series of four brief cognitive tasks, and then a measure of self-reported affective state. All five tools were chosen based on their ubiquity within the literature. Although most of these assessments have been used interchangeably by researchers in the past, they were employed together here in order to add strength to the results obtained. Additionally, should participants struggle on one assessment, their overall performance evaluation would not be based solely on that one task.

The first assessment participants completed was the Flanker task. In this task, participants are presented a series of five letters at the same time, and instructed to press certain keyboard keys when they see a particular letters within the five briefly presented on the screen. The Flanker task measures response inhibition, and has been commonly used in research since its creation in the 1970s (Eriksen & Eriksen, 1974).

The second assessment was the Stroop task, which is one of the best-known psychometric measures of response inhibition in the research literature (MacLeod, 1991; Stroop, 1935). The task is deceptively simple: participants are briefly presented a series of words denoting colors across their screen. These words appear in a variety of colors, most often different than the color they denote. For instance, the word “green” may be presented with a blue font. Participants are asked to press certain keys based on which color they see. This forces participants to ignore one source of stimuli and focus on another.

The third assessment participants were given was a visual search task, in which they are flashed clusters of green and orange T’s, both upside down and right-side up (Treisman, 1977). Participants are then asked to press a certain letter on their keyboard when they find a right-side up orange T. Both speed and accuracy are outcomes measured on this task.

The final cognitive assessment was the N-Back task, which has been employed in psychometric studies since development in the 1950s (Jaeggi, Buschkuhl, Perrig, & Meier, 2010; Kirchner, 1958). This deceptively simple task presents participants with a series random alphabetical letters one-by-one, and asks them to identify whether the letter they are currently being presented is the same as the one presented three trials ago. This

task was placed last because it is by far the most challenging and cognitively exhausting of the four.

After completing these tasks, participants were redirected to the Positive and Negative Affect Schedule, a short survey composed of 20 descriptive adjectives that denote various attitudes and feelings (Watson, Clark, & Tellegen, 1988). Participants ranked each of these descriptors on a Likert-scale (1= “Very slightly or not” to 5= “Extremely”) indicating to what extent they identify with that feeling in the given moment. The PANAS has been employed frequently in the literature, and was therefore chosen for its reliability.

The sounds used for the study were downloaded from YouTube (Lawson, 2018). The sounds were selected based on similarity to the soundscapes of the forested areas around the university campus and the city of Victoria. The final sounds chosen were of a wooded forest, which included birds, rustling trees, and a gentle stream of water. The noise level was set at 70 decibels, based on the noise level used by similar studies conducted in the literature (Abbott et al., 2016; Hedger et al., 2018; Newbold et al., 2017).

Location

The study was conducted in a lab office on the third floor of the psychology building at the University of Victoria. The room had simple office carpeting, three windows, and three tables. The participants completed the tasks at the table closest to the entrance, which sits beside the first window. The view from the office includes trees and grass, as well as adjacent buildings and walkways through campus.

Procedure

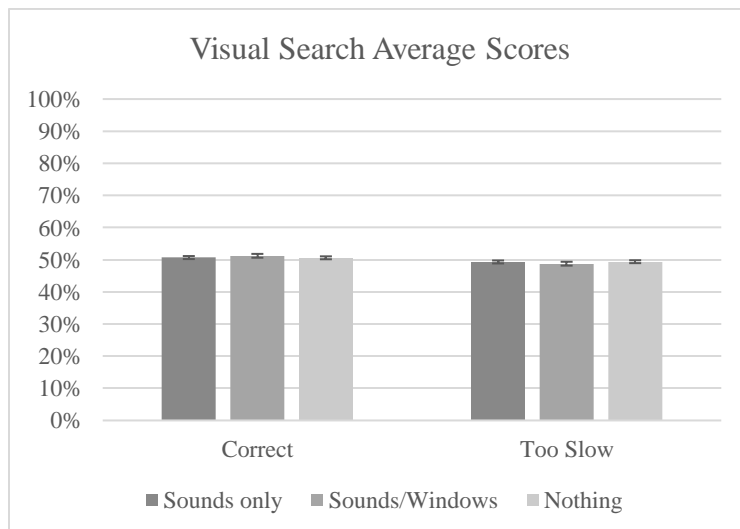
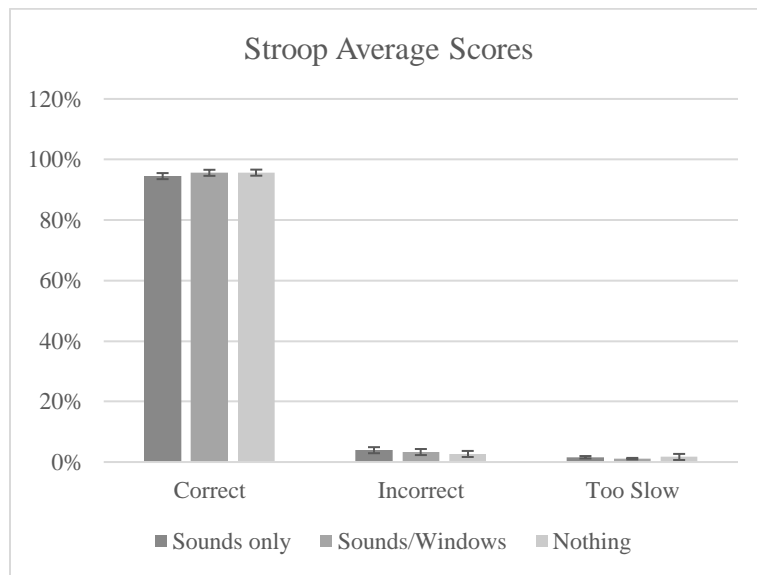
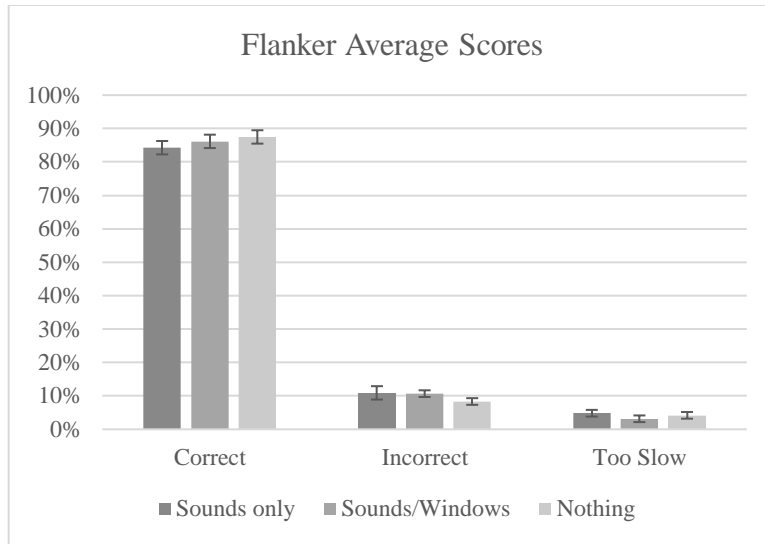
Upon arriving at the office, participants were asked to turn their phones off and then to take a seat at the computer. Prior to their arrival, the office room was set up for the appropriate experimental conditions (e.g., opening or closing the blinds, and turning on/off the nature sounds). Each participant was run alone, and they were not informed of the true nature of the research. Rather, they were simply told the purpose of the study was to assess cognition and affect in an enclosed office environment. The researcher then said he needed to walk next door for a few minutes in order to handle a brief ambiguous errand. The participant was then left alone in the office for five minutes. This was done in order to give each person time to adjust to the environment and allow proper exposure to the experimental condition. Upon returning, the participant was presented the consent form online and then left alone to complete the cognitive tasks and PANAS questionnaire. After completing those, they were prompted by the computer to leave the room and walk next door to inform the researcher they had finished. They were then debriefed on the true purpose of the study and dismissed.

Chapter 3: Results

Descriptive statistics

Noteworthy patterns emerged from descriptive statistics (see Figure 1). On less-cognitively exhausting assessments, scores from the three conditions had greater uniformity than on the more demanding ones. The Visual Search and Stroop tasks were simpler, and therefore showed little variation in scores between the three environmental conditions. The N-Back task, however, which is the most cognitively exhausting of the four, showed the greatest variation in score averages between conditions.

Additionally, across all four assessments, the average number of correct responses was lowest in the 'sounds only' condition. Analyzing the 'too slow' outcome on all four assessments, the 'sounds only' condition had the lowest average performance as well. On the N-Back task, the average number of 'correct' and 'too slow' responses show an inverted pattern between the three conditions (See Figure 1). Specifically, the 'sounds/windows' condition had the highest number correct responses and lowest number of 'too slow' responses. 'Sounds only', however, had the opposite effect, and 'nothing' fell in between these two. This could have been caused, however, by all three conditions having similar 'wrong' response averages.



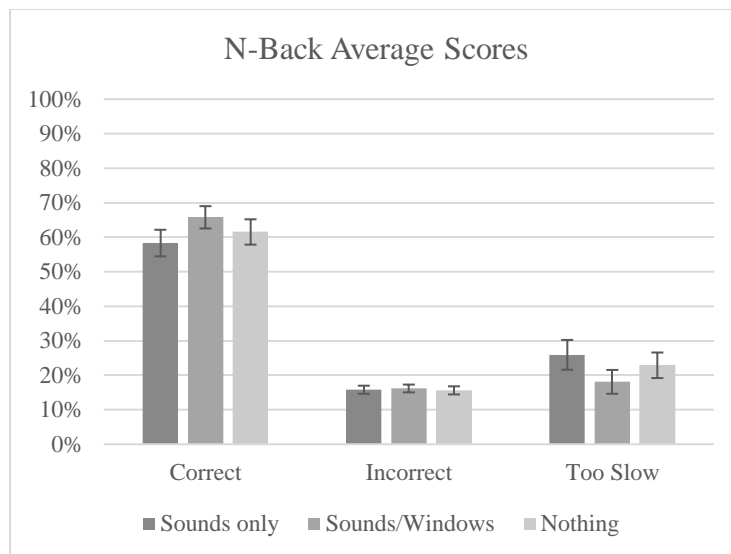
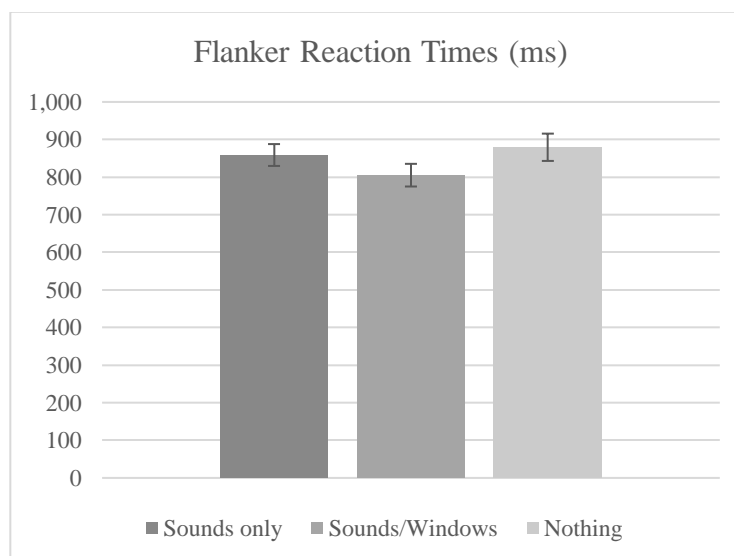


Figure 1. Average performance of the Flanker, Stroop, Visual Search, and N-Back tasks.

A marked pattern also emerged for reaction times. In all four cognitive assessments, the fastest reaction times occurred in the ‘sounds/windows’ condition, although by a small margin (see Figure 2). Additionally, in three of the four tests (excluding Stroop) the slowest reaction time occurred in the ‘nothing’ condition.



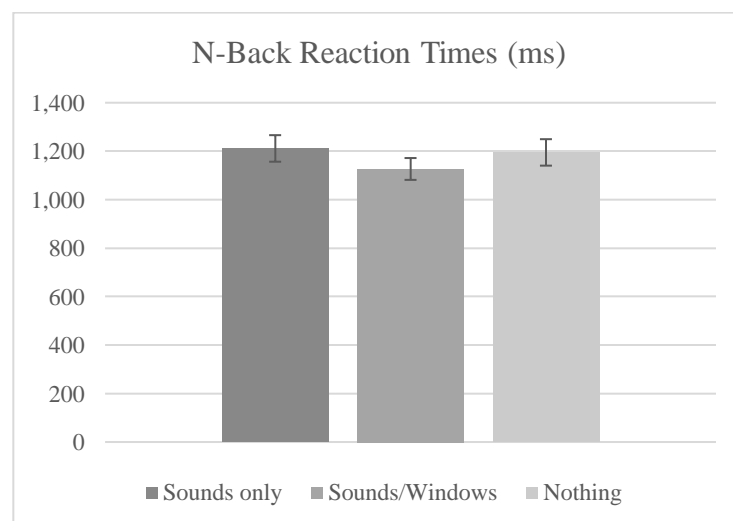
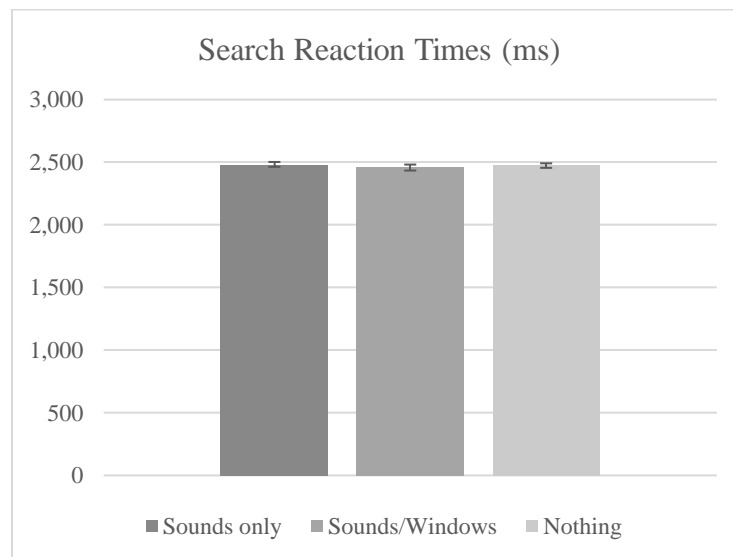
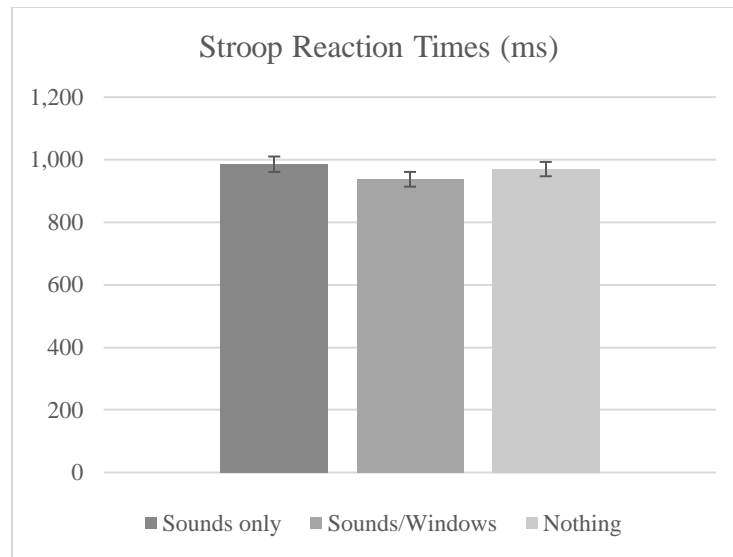


Figure 2. Average reaction times for the Flanker, Stroop, Visual Search, and N-Back tasks.

The PANAS results revealed little differences in both positive and negative affect between the three group conditions (see Figure 3). Consequently, the differences observed were small enough to be attributable to randomness.

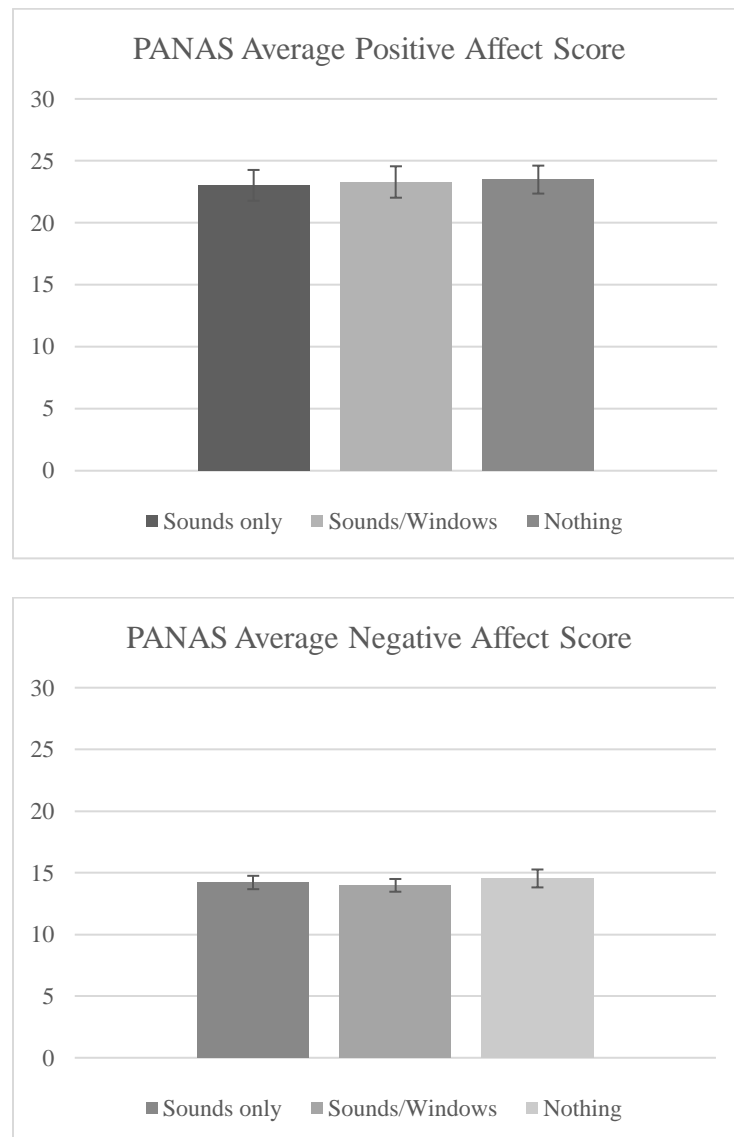


Figure 3. Average PANAS scores.

Differences in affect, cognitive performance, and response time

Prior to testing for these differences, a series of Pearson correlations were performed between all of the dependent variables in order to assess whether the dependent variables would be correlated with one another within a moderate range (i.e., .20 - .60; Meyers, Gamst, & Guarino, 2006). As indicated in Table 1, strong correlations are observed for related dependent variables, as can be expected (e.g. percent correct and incorrect on the Flanker test, percent too slow and reaction time on the Visual Search task, etc.) Apart from these, only four small-to-moderate correlations were observed between dependent measures.

A Box's Test for Equivalence of Covariance Matrices was conducted, in order to assess homogeneity of covariances. The Box's M value obtained was 111.27 with a *p* value of .45. This non-significant value indicates that the covariance matrices between the conditions are assumed to be equal. Additionally, Shapiro-Wilk tests for normality were conducted for each of the 17 outcome variables (see Table 2). All but one (the N-Back 'incorrect') of failed the test. In analyses with group sizes greater than 30, however, MANOVA is robust against violations of normality, so the analysis proceeded.

A one-way multivariate analysis of variance (MANOVA) was then conducted to test the hypothesis that there would be differences in affect, cognitive performance, or response time between the three nature conditions. 12 R packages were used in different stages of this analysis: psych, tidyr, plyr, dplyr, ggplot2, lsr, car, effsize, HH, pwr, lmSupport, and mediation (Champely et al., 2018; Curtin, 2018; Fox et al., 2018; Heiberger, 2018; Navarro, 2015; Revelle, 2019; Tingley, Yamamoto, Hirose, Keele, & Imai, 2017; Torchiano, 2018; Wickham, 2016; Wickham, Chang, et al., 2018; Wickham,

Henry, & RStudio, 2018). A statistically insignificant MANOVA effect was obtained, Pillais' Trace = .11, $F(2, 128) = .66$, $p = .86$. The MANOVA failed to detect any significant differences between the three nature conditions across all assessment dependent variables.

Table 1: *Pearson Correlation Matrix of Dependent Variables*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 N-Back % Correct	1																
2 N-Back % Incorrect	0.04	1															
3 N-Back % Too Slow	-0.95	-0.34	1														
4 N-Back Reaction Time	-0.87	-0.25	0.89	1													
5 Search % Correct	-0.16	-0.05	0.16	0.10	1												
6 Search % Too Slow	0.16	0.05	-0.16	-0.10	-1.00	1											
7 Search Reaction Time	0.02	0.06	-0.04	0.01	-0.83	0.83	1										
8 Flanker % Correct	-0.03	-0.15	0.08	0.08	0.01	-0.01	0.02	1									
9 Flanker % Incorrect	0.03	0.13	-0.06	-0.10	-0.01	0.01	-0.03	-0.85	1								
10 Flanker % Too Slow	0.02	0.11	-0.05	-0.01	-0.01	0.01	0.00	-0.68	0.19	1							
11 Flanker % Reaction Time	-0.06	0.18	0.00	0.08	-0.09	0.09	0.18	-0.50	0.15	0.71	1						
12 Stroop % Correct	0.12	0.10	-0.15	-0.10	0.02	-0.02	-0.03	-0.01	0.04	-0.04	0.14	1					
13 Stroop % Incorrect	-0.04	-0.07	0.06	0.02	0.04	-0.04	-0.10	-0.06	0.04	0.05	-0.16	-0.83	1				
14 Stroop % Too Slow	-0.16	-0.08	0.18	0.15	-0.08	0.08	0.18	0.09	-0.12	0.00	-0.02	-0.64	0.10	1			
15 Stroop Reaction Time	-0.28	0.04	0.25	0.28	-0.14	0.14	0.40	0.04	-0.12	0.08	0.35	-0.12	-0.14	0.41	1		
16 Positive Affect	0.13	0.02	-0.13	-0.08	-0.01	0.01	-0.05	-0.06	-0.03	0.14	0.13	0.05	-0.07	0.01	0.00	1	
17 Negative Affect	0.02	0.05	-0.04	-0.09	-0.14	0.14	0.09	-0.07	0.08	0.02	0.00	0.06	-0.08	0.00	-0.03	0.05	1

Table 2. Normality for Confirmatory Outcomes

	Outcome	Shapiro-Wilk (W)	p -value	p -value	QQ Judgement
Flanker	Reaction time	0.93	3.94E-06	Fail	Right-skew
	Correct	0.80	4.15E-12	Fail	Left-skew heavy
	Incorrect	0.82	2.61E-11	Fail	Right-skew heavy
N-Back	Too Slow	0.55	2.20E-16	Fail	Right-skew heavy
	Reaction time	0.94	4.03E-05	Fail	Light-tailed
	Correct	0.88	5.30E-09	Fail	Left-skew
Visual Search	Incorrect	0.97	1.41E-02	Fail	Normal
	Too Slow	0.77	3.39E-13	Fail	Right-skew heavy
	Reaction time	0.99	5.25E-01	Pass	Normal
Stroop	Correct	0.95	1.34E-04	Fail	Heavy-tailed
	Too Slow	0.95	1.34E-04	Fail	Heavy-tailed
	Reaction time	0.93	3.94E-06	Fail	Right-skew
PANAS	Correct	0.80	4.15E-12	Fail	Left-skew heavy
	Incorrect	0.82	2.61E-11	Fail	Right-skew heavy
	Too Slow	0.55	2.20E-16	Fail	Right-skew heavy
PANAS	Positive Affect	0.97	8.73E-03	Fail	Normal
	Negative Affect	0.88	6.79E-09	Fail	Right-skew heavy

Chapter 4: Discussion

Across the four cognitive assessments and PANAS survey, no significant findings were found. Additionally, analyses of reaction times within each assessment did not return significant findings. Although no statistically significant results emerged, these findings help shed light on the relation between nature soundscapes, cognition and affect.

Prior research on nature soundscapes employed varied methodologies and a range of inconsistent cognitive assessments and nature sound stimuli (Abbott et al., 2016; Hedger et al., 2018; Newbold et al., 2017). As a result, discerning an overarching pattern or theme across the handful of studies published on this topic is difficult. The present thesis attempted to employ a methodology that incorporated elements from these prior studies in an effort to aid in unifying the research literature and further delineate the relation between nature soundscapes, cognition, and affect.

The biggest takeaway from the present results is that if an effect of nature soundscapes on cognition and affect exists, then more sophisticated measures and paradigms are required to capture an effect. The present study employed four different cognitive assessments, analyzing both their results and completion times, and employed an affective measure. Upon conducting a power analysis, it was found that the MANOVA employed had an 80% chance of detecting an eta squared of .25, with an alpha of .05.

An alternative interpretation of the results is that if nature sounds do have an influence on cognition and affect, the relation itself is more complex than assumed by this and prior studies. One possibility is that certain components of the soundscapes,

including bird song, rustling branches, wind, or water sounds of different intensity have varied and different impacts.

By the same token, the present study may have employed a soundscape that had too little of the beneficial components and too much of those that are not. Alternatively, the tasks themselves may have been more cognitively demanding than those faced by the average office worker, or tapped into different working memory processes than those used by most workers. If either were the case, then any nuanced effects of nature stimuli could be masked by these impediments.

Limitations

The first limitation in this study was in the power to detect an effect by the MANOVA. The analysis had an 80% chance of detecting an eta squared of .25 or greater, with an alpha of .05. That is considered a moderate-to-large effect size, indicating little strength in the MANOVA. Therefore, the first potential explanation for the null effects observed is the lack of strength in the analysis. With greater power to detect, the MANOVA may have returned a significant result.

Performance outcomes on the cognitive assessments (apart from N-Back) were similar. It is therefore possible that these assessments were too alike in the constructs they tap into to discern any impacts of nature sounds on cognition. If this were the case, then there may be an effect of nature sounds, but it was not captured due to the measures employed.

Two-thirds of the participants were asked after they completed their session whether they noticed the nature sounds, and almost all said they did. The intent of this study's paradigm was not to employ stimuli that fell below conscious radar, but rather at

a volume matching the levels of prior studies (Abbott et al., 2016; Hedger et al., 2018; Newbold et al., 2017). As a result, however, participant awareness of the sounds could have counteracted any beneficial impacts on their performance. This awareness could also have influenced their responses on the PANAS, although this is less likely because of how similarly the three conditions were responded to.

Alternatively, participants may have tried to mentally suppress the sound stimulus because of its irrelevance to the tasks being completed, just as a person would for any distracting noises. This could also explain why the addition of nature views made no difference on any outcomes assessed, despite quantity of previous findings illustrating a beneficial impact of nature views (Chang & Chen, 2005; Farley & Veitch, 2001; Heerwagen, 1998; Veitch & Clayton, 2012). Perhaps the noise itself was actually a hindrance, and therefore counteracted any potential benefits of outdoor nature views.

The length of exposure to the stimuli may also have played a role in the results observed. Being immersed for five minutes may not be long enough or alternatively, could potentially be too long for participants. Although no participants expressed annoyance or aggravation at being left alone for five minutes, this may have still caused unspoken frustration.

The study was conducted on the third floor of a campus building, overlooking a courtyard. While this elevated vantage point enabled participants to have a wider range of view, it may also have created a greater sense of distance from the scenery. Furthermore, the nature in view was unnatural in the sense that it was landscaped and organized, as opposed to being untouched and unmanicured. Either of these factors could have hampered any benefits derived from the window view.

Another potential influencing variable that the present study did not account for is participants' prior exposure to and experience with nature. Although the study took place in a suburban city with ample nearby nature, participants may still vary in their relation with nature stimuli. For example, a student from a large metropolitan region with little nature access may find nature sounds more foreign and intrusive compared to someone who grew up hearing them passively from regular exposure to nature.

A minor potential confound is the quality of outdoor window view. The view from the office window consisted of grass and trees on a flat landscape, but it did include adjacent buildings and walkways throughout. This landscape may have less of an impact than a view exclusively composed of nature, without any human-made obstructions. Furthermore, a fourth experimental condition consisting of nature views only should perhaps have been included. Adding nature views to nature sounds did not bolster psychological impact, which runs contradictory to previous findings of the benefits of nature views (Farley & Veitch, 2001). It is therefore possible that nature sounds counteracted the effects of nature views. Without a views-only condition, however, this cannot be assessed.

Finally, there is the potential issue of the file-drawer problem. While there are fewer than 10 studies published on the topic of nature soundscapes and cognition, there may be many more studies that were conducted but never shared. If this is the case, then it is possible that there is a large quantity of null findings with similar conclusions as the present study.

Future Directions

Future studies on nature soundscapes and cognition should employ multiple nature sound types, to learn whether differences in how various soundscapes are experienced occur. The volume should also be varied, with particular attention paid to whether participants notice or do not notice the sounds in the background. Participant awareness of these stimuli may inadvertently mediate the cognitive performance and affective outcomes. Prospective analyses should explore the possibility of this mediating role.

Research on this subject should also expose participants to sound conditions for longer than five minutes. This may be difficult, however, because participants may become irritated or restless when left alone for extended periods with no other stimulation.

Additionally, more sophisticated and complex assessments should be employed, which explicitly tap into particular cognitive processes and affective states. Essentially, the instruments employed should be more fine-tuned but still diverse, in order to ensure greater chances of capturing an effect.

Conclusions

A large body of research has demonstrated a marked impact of nature on human health and psychology, and the present study does not discount those findings. This includes those illustrating a positive influence of nature views on psychological outcomes (Aries et al., 2010; Diette et al., 2003; Farley & Veitch, 2001; Grinde & Patil, 2009; Heerwagen, 2009). This study does call into question, however, the particular soundscape stimuli and paradigm employed in this and similar research. Nature stimuli come in a

variety of forms and gradations, from views, to smells, to textures, etc. To therefore claim that nature sounds have no impact based on this study would be foolhardy. Other forms of nature have demonstrated considerable beneficent impacts on psychological and health outcomes, so nature sounds *may* do the same, albeit to a lesser extent. This modality of it should therefore continue to be explored.

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Appendix 1: the Positive and Negative Affect Schedule

Appendix 2

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Therapist's Guide to Positive Psychological Interventions

Worksheet 3.1 The Positive and Negative Affect Schedule (PANAS; Watson et al., 1988)

PANAS Questionnaire

This scale consists of a number of words that describe different feelings and emotions. Read each item and then list the number from the scale below next to each word. **Indicate to what extent you feel this way right now, that is, at the present moment OR indicate the extent you have felt this way over the past week (circle the instructions you followed when taking this measure)**

1	2	3	4	5
Very Slightly or Not at All	A Little	Moderately	Quite a Bit	Extremely

_____ 1. Interested	_____ 11. Irritable
_____ 2. Distressed	_____ 12. Alert
_____ 3. Excited	_____ 13. Ashamed
_____ 4. Upset	_____ 14. Inspired
_____ 5. Strong	_____ 15. Nervous
_____ 6. Guilty	_____ 16. Determined
_____ 7. Scared	_____ 17. Attentive
_____ 8. Hostile	_____ 18. Jittery
_____ 9. Enthusiastic	_____ 19. Active
_____ 10. Proud	_____ 20. Afraid

Scoring Instructions:

Positive Affect Score: Add the scores on items 1, 3, 5, 9, 10, 12, 14, 16, 17, and 19. Scores can range from 10 – 50, with higher scores representing higher levels of positive affect. Mean Scores: Momentary = 29.7 ($SD = 7.9$); Weekly = 33.3 ($SD = 7.2$)

Negative Affect Score: Add the scores on items 2, 4, 6, 7, 8, 11, 13, 15, 18, and 20. Scores can range from 10 – 50, with lower scores representing lower levels of negative affect. Mean Score: Momentary = 14.8 ($SD = 5.4$); Weekly = 17.4 ($SD = 6.2$)

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Appendix 2: the Flanker Task

Instructions

You will see 5 letters at the time.
You need to respond to the one in the middle.
If you see an **X** or a **C**, you press the button **A**.
If you see a **V** or a **B**, you press the button **L**.

For example, if you see the letters **XXCXX**, you press the A key on your keyboard. A and L are chosen as a "left" and "right" positioned button on your keyboard.

Note: You need to get used to the location of the keys. Before the flanker effect can work, you need some training. The flanker effect might not occur until you have done this task a few times.

If you press the correct key, the fixation plus will turn green; wrong key presses will lead to a more slowly flashing red fixation plus.

Press space bar to continue

+

VXW
+

Appendix 3: the Stroop Task

Stroop task instructions

In this task, you will see color names (red, green, blue, yellow) in different "print" colors. You need to respond to the print color. For example, if you see:

GREEN

You need to respond to the print color (red), and press the associated button ("r"). The other buttons used in this study are "g", "b", and "y", for green, blue, and yellow.

press space bar for more instructions...

GREEN → press button "r", because ink is red
YELLOW → press button "y", because ink is yellow
BLUE → press button "g", because ink is green
RED → press button "b", because ink is blue

It can be difficult, because the name and the ink color are conflicting (except for yellow in the example above). So concentrate and ignore the meaning of the color words, instead, look at the ink color.

You get multiple trials and it takes around 5 minutes to complete. At the end, you get your response times.


press space bar to start...



Appendix 4: the Visual Search Task

You know how difficult it is to find your keys in a messy room!!! We want to know how good you are in quickly finding your keys!
Instead of keys, we just to know how quickly you can find an **orange T** amongst blue Ts and upside-down orange Ts. Sounds easy! But is not at all that easy!!!

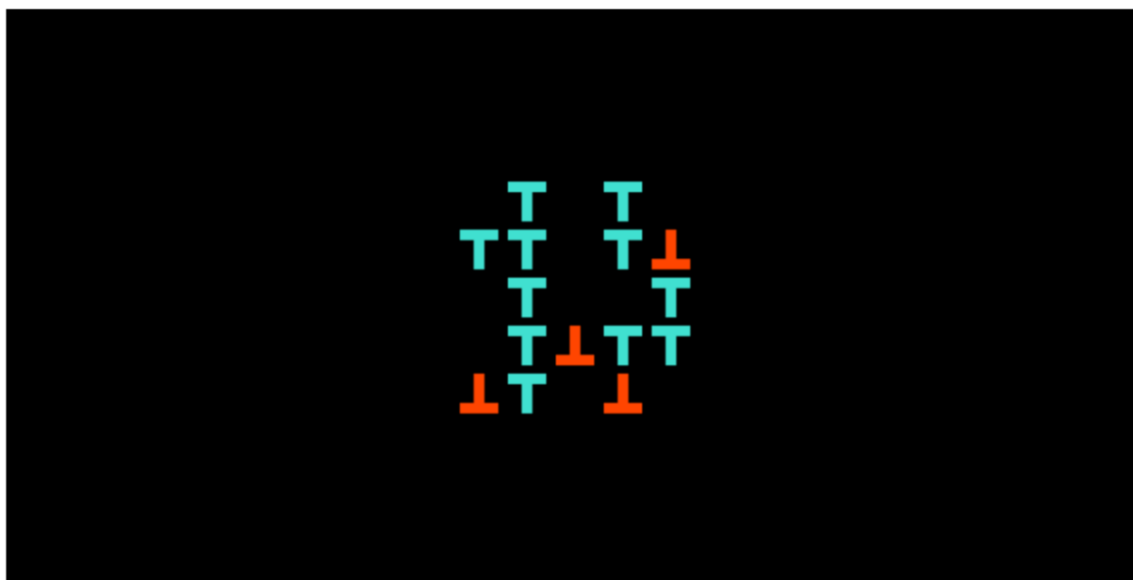
Again, all you need to do is to find an **orange T**. If you see the **orange T** press space. Ignore the upside-down orange T, as well as blue Ts!

It is very import to go respond **AS FAST AS YOU CAN. IF THERE IS NO ORANGE T**, wait for the next trial and do nothing!

Find 

But do not respond to any of these distractors:  

press space to continue



Appendix 5: the N-Back Task

N-back working memory task

In this task, you will see a sequence of letters. Each letter is shown for a few seconds. You need to decide if you saw the same letter 3 trials ago, that is, this is a n=3-back task.

If you saw the same letter 3 trials ago, you type the letter M (M for Memory). If it was Not a letter shown 3 trials ago, you type the N (for No).

press the space bar to next info screen

N-back working memory task

For example, if you get the letters, and below which key to press:

A B L T B R H I R
 n n n n m n n n m

This is actually very difficult! So you need some time to get better at it. When you respond correct, you see the bars around the key turn green, and red if wrong!

press the letter "q" to start, or up arrow to go back.

Appendix 6: Descriptive Statistics of Dependent Variables

Assessment	Condition	Outcome	Mean	SD
Flanker	Sounds Only	Right	0.84	0.15
		Wrong	0.05	0.09
		Too Slow	0.11	0.11
		Reaction Time	858.86	192.94
	Sounds/Windows	Right	0.86	0.12
		Wrong	0.03	0.05
		Too Slow	0.11	0.09
		Reaction Time	805.23	199.99
	Nothing	Right	0.87	0.11
		Wrong	0.04	0.06
		Too Slow	0.08	0.07
		Reaction Time	879.42	241.09
Stroop	Sounds Only	Right	0.94	0.05
		Wrong	0.02	0.03
		Too Slow	0.04	0.04
		Reaction Time	985.49	163.15
	Sounds/Windows	Right	0.96	0.04
		Wrong	0.01	0.02
		Too Slow	0.03	0.04
		Reaction Time	937.41	156.28
	Nothing	Right	0.96	0.05
		Wrong	0.02	0.03
		Too Slow	0.03	0.03
		Reaction Time	969.97	151.84
Visual Search	Sounds Only	Right	0.51	0.03
		Too Slow	0.49	0.03
		Reaction Time	2482.79	129.75
	Sounds/Windows	Right	0.51	0.04
		Too Slow	0.49	0.04
		Reaction Time	2457.47	159.14
	Nothing	Right	0.51	0.03
		Too Slow	0.49	0.03
		Reaction Time	2473.26	119.86
N-Back	Sounds Only	Right	0.58	0.26
		Wrong	0.26	0.29
		Too Slow	0.16	0.08
		Reaction Time	1211.40	363.45

	Sounds/Windows	Right	0.66	0.21
		Wrong	0.18	0.23
		Too Slow	0.16	0.08
		Reaction Time	1126.75	298.77
	Nothing	Right	0.62	0.24
		Wrong	0.23	0.25
		Too Slow	0.16	0.08
		Reaction Time	1195.00	362.04
Pos. Affect	Sounds Only		23.02	8.16
	Sounds/Windows		23.30	8.40
	Nothing		23.49	7.23
Neg. Affect	Sounds Only		14.21	3.55
	Sounds/Windows		13.98	3.43
	Nothing		14.54	4.65

Appendix 7: Raw Data

ID	Age	Gender	Condition	N-Back % Correct	N-Back % Incorrect	N-Back % Too Slow
101	23	female	Nothing	0.83	0.1	0.08
102	26	female	Noise/Windows	0.6	0.1	0.3
103	23	female	Noise only	0.4	0.13	0.48
104	19	female	Nothing	0.43	0.28	0.3
105	22	female	Noise/Windows	0.9	0.05	0.05
106	23	female	Nothing	0.88	0.13	0
107	21	female	Nothing	0.23	0.15	0.63
108	18	female	Nothing	0.43	0.15	0.43
109	21	female	Noise only	0.08	0.08	0.85
110	18	male	Nothing	0.83	0.1	0.08
111	22	female	Nothing	0.05	0.03	0.93
112	22	female	Noise only	0.73	0.18	0.1
113	20	male	Noise only	0.85	0.13	0.03
114	21	female	Noise/Windows	0.68	0.13	0.2
115	23	male	Noise/Windows	0.83	0.1	0.08
116	26	female	Noise/Windows	0.85	0.15	0
117	22	female	Nothing	0.8	0.13	0.08
118	19	female	Noise only	0.78	0.15	0.08
119	18	female	Noise/Windows	0.6	0.18	0.23
120	19	female	Nothing	0.9	0.08	0.03
121	18	female	Noise/Windows	0.7	0.15	0.15
122	19	female	Noise/Windows	0.53	0.18	0.3
123	29	female	Noise/Windows	0.18	0.08	0.75
124	21	female	Noise only	0.7	0.25	0.05
125	20	female	Noise/Windows	0.58	0.28	0.15
126	21	female	Noise/Windows	0.78	0.2	0.03
127	26	female	Noise only	0.25	0	0.75
128	23	female	Noise only	0.2	0.03	0.78
129	19	female	Noise/Windows	0.75	0.23	0.03
130	18	female	Noise only	0.65	0.13	0.23
131	18	female	Noise only	0.78	0.15	0.08
132	27	female	Nothing	0.78	0.15	0.08
133	23	female	Nothing	0.73	0.15	0.13
134	23	male	Noise only	0.93	0.08	0
135	22	male	Nothing	0.88	0.13	0

136	20	male	Nothing	0.65	0.05	0.3
137	19	female	Noise/Windows	0.83	0.13	0.05
138	20	female	Noise only	0.15	0.15	0.7
139	32	male	Noise/Windows	0.13	0.08	0.8
140	22	female	Noise/Windows	0.6	0.28	0.13
141	26	female	Noise/Windows	0.58	0.13	0.3
142	19	female	Noise/Windows	0.25	0	0.75
143	21	female	Noise only	0.78	0.15	0.08
144	22	female	Noise only	0.5	0.1	0.4
145	20	female	Noise/Windows	0.13	0.15	0.73
146	26	female	Noise/Windows	0.75	0.18	0.08
147	18	female	Nothing	0.58	0.13	0.3
148	18	female	Nothing	0.78	0.2	0.03
149	21	female	Noise only	0.75	0.15	0.1
150	20	female	Noise only	0.65	0.05	0.3
151	20	female	Noise/Windows	0.8	0.2	0
152	18	female	Noise/Windows	0.78	0.18	0.05
152	18	female	Noise/Windows	0.78	0.18	0.05
153	19	female	Noise only	0.65	0.2	0.15
154	18	female	Nothing	0.8	0.15	0.05
155	20	female	Nothing	0.6	0.25	0.15
156	22	female	Nothing	0.93	0.05	0.03
157	22	male	Noise only	0.08	0.13	0.8
158	18	female	Nothing	0.38	0.18	0.45
159	19	female	Noise only	0.83	0.15	0.03
160	18	male	Nothing	0.63	0.2	0.18
161	18	female	Nothing	0.63	0.28	0.1
163	21	female	Nothing	0.83	0.15	0.03
164	18	female	Noise only	0.9	0.08	0.03
165	19	female	Noise only	0.7	0.2	0.1
166	22	female	Noise/Windows	0.8	0.13	0.08
167	25	female	Noise/Windows	0.13	0.2	0.68
168	18	female	Noise only	0.68	0.18	0.15
169	24	female	Noise only	0.73	0.23	0.05
170	19	female	Nothing	0.75	0.15	0.1
171	34	female	Noise only	0.63	0.23	0.15
171	34	female	Noise only	0.63	0.23	0.15
172	20	female	Noise only	0.73	0.2	0.08
173	21	female	Noise only	0.68	0.2	0.13
174	19	female	Nothing	0.78	0.13	0.1

176	30	female	Noise/Windows	0.8	0.18	0.03
177	21	female	Noise only	0.63	0.23	0.15
178	19	female	Noise/Windows	0.85	0.1	0.05
179	21	female	Nothing	0.73	0.2	0.08
180	19	female	Noise only	0.15	0.08	0.78
181	22	male	Noise/Windows	0.7	0.2	0.1
182	20	female	Noise/Windows	0.75	0.18	0.08
183	21	female	Noise only	0.48	0.33	0.2
185	21	male	Noise/Windows	0.73	0.23	0.05
186	20	female	Noise/Windows	0.83	0.1	0.08
187	26	female	Nothing	0.55	0.33	0.13
188	22	female	Noise only	0.58	0.18	0.25
189	27	female	Nothing	0.25	0.33	0.43
190	20	female	Nothing	0.83	0.1	0.08
191	20	female	Noise/Windows	0.68	0.3	0.03
192	18	female	Nothing	0.13	0.1	0.78
193	29	female	Noise/Windows	0.43	0.28	0.3
194	19	female	Noise only	0.93	0.08	0
195	18	female	Noise only	0.83	0.15	0.03
196	21	male	Nothing	0.7	0.1	0.2
197	21	male	Nothing	0.6	0.1	0.3
198	20	female	Noise only	0.8	0.15	0.05
199	19	female	Nothing	0.53	0.23	0.25
199	19	female	Nothing	0.53	0.23	0.25
200	20	female	Noise/Windows	0.85	0.1	0.05
201	22	female	Noise/Windows	0.75	0.13	0.13
202	20	male	Noise only	0.73	0.2	0.08
203	21	female	Noise/Windows	0.8	0.2	0
204	21	female	Noise only	0.28	0.25	0.48
205	19	female	Noise/Windows	0.7	0.23	0.08
206	20	male	Noise only	0.75	0.15	0.1
207	23	male	Nothing	0.65	0.28	0.08
208	27	female	Nothing	0.15	0.08	0.78
209	22	female	Nothing	0.88	0.13	0
210	27	female	Noise only	0.65	0.2	0.15
211	19	female	Nothing	0.05	0.08	0.88
212	20	female	Noise/Windows	0.78	0.13	0.1
213	23	male	Noise/Windows	0.45	0.08	0.48
214	18	female	Noise only	0.8	0.2	0
217	27	male	Noise only	0.25	0.18	0.58

218	18	female	Nothing	0.48	0.2	0.33
219	19	female	Noise only	0.08	0.05	0.88
220	19	female	Nothing	0.93	0.05	0.03
221	22	female	Noise/Windows	0.65	0.18	0.18
222	19	female	Noise/Windows	0.8	0.18	0.03
223	20	female	Noise only	0.6	0.3	0.1
224	20	female	Nothing	0.8	0.08	0.13
225	24	female	Noise only	0.55	0.35	0.1
226	23	female	Nothing	0.7	0.23	0.08
227	20	female	Noise/Windows	0.6	0.38	0.03
228	23	female	Noise/Windows	0.8	0.1	0.1
229	19	female	Noise/Windows	0.93	0.05	0.03
230	21	female	Noise/Windows	0.73	0.25	0.03
231	29	female	Noise only	0.15	0.03	0.83
232	24	male	Noise only	0.73	0.23	0.05
233	23	female	Nothing	0.43	0.15	0.43

ID	N-Back Reaction Time	Search % Correct	Search % Too Slow	Search Reaction Time	Flanker % Correct	Flanker % Incorrect
101	848.03	0.52	0.48	2428.48	0.92	0.08
102	1061.13	0.5	0.5	2363.62	0.88	0.1
103	1335.93	0.5	0.5	2504.18	0.94	0.04
104	1625.6	0.52	0.48	2359.38	0.94	0.02
105	1090.03	0.5	0.5	2498.24	0.86	0.14
106	563.98	0.56	0.44	2341.68	0.86	0.12
107	1428.5	0.48	0.52	2536.82	0.88	0.06
108	1360.13	0.52	0.48	2554.14	0.72	0.2
109	1845	0.58	0.42	2239.98	0.78	0.2
110	1042.9	0.5	0.5	2502.96	1	0
111	1929.68	0.52	0.48	2348.82	0.94	0.04
112	1247.5	0.5	0.5	2422.64	0.3	0.2
113	877.68	0.5	0.5	2558.2	0.94	0.04
114	1289.08	0.52	0.48	2433	0.88	0.1
115	1137.23	0.54	0.46	2258.36	0.92	0.08
116	954.45	0.5	0.5	2429.18	0.92	0.08
117	898.15	0.5	0.5	2515.36	0.94	0.06
118	1182.28	0.52	0.48	2465.72	0.66	0.22
119	1143.53	0.52	0.48	2332.82	0.96	0.04
120	1087.1	0.54	0.46	2385.6	0.96	0.04
121	1228.93	0.5	0.5	2623.38	0.92	0.06
122	1266.08	0.52	0.48	2506.78	0.9	0.08
123	1771.9	0.56	0.44	2388.12	0.88	0.1
124	1011.55	0.54	0.46	2278.96	0.94	0.06
125	1440.65	0.52	0.48	2535.62	0.98	0
126	1115.4	0.44	0.56	2642.92	0.86	0.14
127	1722.08	0.54	0.46	2388.34	1	0
128	1821.1	0.5	0.5	2615.94	0.8	0.14
129	889.65	0.48	0.52	2814.38	0.92	0.06
130	1040.9	0.58	0.42	2183.94	0.84	0.16
131	955.33	0.46	0.54	2528.32	0.56	0.36
132	925.35	0.48	0.52	2498.68	0.84	0.08
133	1213.25	0.5	0.5	2498	0.96	0.04
134	925.85	0.5	0.5	2492.64	0.98	0.02
135	668.2	0.54	0.46	2326	0.82	0.18
136	1521.03	0.54	0.46	2219.68	0.94	0.06
137	947.18	0.54	0.46	2315.02	0.82	0.14

138	1709.6	0.48	0.52	2602.72	0.5	0.46
139	1766.33	0.64	0.36	2296.22	0.86	0.06
140	978.6	0.48	0.52	2537	0.88	0.12
141	1388.65	0.5	0.5	2523.3	0.98	0.02
142	1721	0.5	0.5	2597.44	0.9	0.06
143	881.33	0.52	0.48	2393.1	0.94	0.04
144	1505.63	0.46	0.54	2613.58	0.9	0.1
145	1756.65	0.52	0.48	2406.68	0.96	0.04
146	1038.63	0.52	0.48	2399.2	0.98	0.02
147	1316	0.46	0.54	2701.62	0.86	0.06
148	1012.18	0.52	0.48	2399.62	0.84	0.12
149	1029.55	0.52	0.48	2315.86	0.8	0.18
150	1259.53	0.52	0.48	2393.46	0.94	0.06
151	913.93	0.52	0.48	2358.08	0.84	0.16
152	983	0.52	0.48	2462.82	0.82	0.18
152	983	0.52	0.48	2462.82	0.82	0.18
153	1407.88	0.5	0.5	2586.94	0.9	0.04
154	1057.7	0.56	0.44	2238.7	0.98	0
155	858.45	0.46	0.54	2586.2	0.9	0.06
156	743.58	0.54	0.46	2351.8	0.96	0.04
157	1877.55	0.52	0.48	2431.8	0.8	0.16
158	1515.53	0.46	0.54	2598.88	0.92	0.02
159	867.85	0.5	0.5	2472.86	0.9	0.02
160	988.48	0.56	0.44	2362.7	0.88	0.1
161	1182.75	0.5	0.5	2506.56	0.96	0.02
163	830.4	0.52	0.48	2483.36	0.9	0.1
164	868	0.48	0.52	2576.94	0.82	0.14
165	934.23	0.48	0.52	2561.32	0.98	0.02
166	1102.03	0.5	0.5	2564.54	0.68	0.3
167	1654.03	0.52	0.48	2516.52	0.98	0.02
168	1321.08	0.52	0.48	2417.74	0.92	0.06
169	840.63	0.48	0.52	2488.52	0.98	0.02
170	906	0.46	0.54	2551.3	0.96	0.02
171	1115.1	0.5	0.5	2635.46	0.88	0
171	1115.1	0.5	0.5	2635.46	0.88	0
172	1069.83	0.54	0.46	2336.68	0.9	0.06
173	930.38	0.46	0.54	2544.72	0.92	0.06
174	885.45	0.48	0.52	2650.12	0.58	0.32
176	981.13	0.46	0.54	2586.34	0.8	0.06
177	1049.83	0.54	0.46	2442.86	1	0

178	978.7	0.48	0.52	2541.6	0.98	0
179	845.73	0.52	0.48	2450.76	0.86	0.1
180	1814.93	0.52	0.48	2474.88	0.88	0.1
181	1020.73	0.52	0.48	2447.16	0.54	0.42
182	696.25	0.56	0.44	2258.08	0.8	0.2
183	1122.2	0.48	0.52	2634.9	0.76	0.2
185	977.68	0.48	0.52	2736.88	0.94	0.04
186	1074.85	0.52	0.48	2436.08	0.92	0.04
187	1149.7	0.5	0.5	2541.98	0.72	0.24
188	1033.33	0.52	0.48	2570.52	0.96	0.02
189	1487.55	0.48	0.52	2602.78	0.84	0.02
190	947.4	0.48	0.52	2558.66	0.92	0.08
191	811.68	0.48	0.52	2519.8	0.84	0.14
192	1795.38	0.5	0.5	2500.4	0.86	0.06
193	1329.35	0.48	0.52	2642.28	0.94	0.06
194	946.8	0.48	0.52	2538.5	0.88	0.1
195	855.48	0.48	0.52	2578.38	0.96	0.02
196	1327.6	0.54	0.46	2331.46	0.98	0
197	1365.83	0.56	0.44	2239.9	0.44	0.2
198	635.73	0.52	0.48	2462.8	0.82	0.18
199	1288.08	0.52	0.48	2465.74	0.82	0.1
199	1288.08	0.52	0.48	2465.74	0.82	0.1
200	1076.88	0.48	0.52	2592.54	0.6	0.24
201	1202.88	0.5	0.5	2503.82	0.94	0.06
202	661.55	0.54	0.46	2431.6	0.6	0.08
203	835.4	0.48	0.52	2562.52	0.9	0.06
204	1438.65	0.52	0.48	2416.34	0.88	0.1
205	758.33	0.54	0.46	2292.64	0.84	0.14
206	1026.78	0.5	0.5	2486.44	0.68	0.26
207	1019.53	0.52	0.48	2362.2	0.9	0.1
208	1787.1	0.48	0.52	2624.46	0.64	0.3
209	771.08	0.46	0.54	2724.98	1	0
210	1568.65	0.44	0.56	2764.56	0.96	0.02
211	1834.3	0.52	0.48	2403.5	0.94	0.06
212	1205.8	0.5	0.5	2447.7	0.92	0.06
213	1514.68	0.54	0.46	2247.28	0.64	0.14
214	798.18	0.5	0.5	2471.88	0.58	0.4
217	1637.48	0.56	0.44	2263.76	0.96	0.04
218	1335.78	0.5	0.5	2541.54	0.92	0.06
219	1884.98	0.48	0.52	2492.68	0.72	0.2

220	802.63	0.5	0.5	2513.2	0.86	0.1
221	1189.43	0.52	0.48	2413.46	0.94	0.02
222	661.6	0.52	0.48	2406.54	0.46	0.4
223	1178.7	0.54	0.46	2231.34	0.9	0.08
224	1031.1	0.52	0.48	2411.86	0.9	0.08
225	1107.1	0.5	0.5	2738.64	0.84	0.06
226	1133.3	0.48	0.52	2481.06	0.94	0.02
227	952.98	0.58	0.42	2113.84	0.82	0.12
228	1192.08	0.54	0.46	2232.42	0.92	0.06
229	674.65	0.4	0.6	2790.28	0.9	0.1
230	677	0.6	0.4	2077.24	0.8	0.18
231	1887.53	0.52	0.48	2549.14	0.96	0.02
232	1070.25	0.46	0.54	2642.82	0.92	0.06
233	1511.1	0.48	0.52	2589.16	0.92	0.04

ID	Flanker		Stroop		Stroop	
	Flanker % Too Slow	% Reaction Time	% Correct	% Incorrect	% Too Slow	Stroop Reaction Time
101	0	630.36	0.92	0.08	0	630.36
102	0.02	569.66	0.88	0.1	0.02	569.66
103	0.02	787.58	0.94	0.04	0.02	787.58
104	0.04	791.72	0.94	0.02	0.04	791.72
105	0	592.36	0.86	0.14	0	592.36
106	0.02	638.1	0.86	0.12	0.02	638.1
107	0.06	842.48	0.88	0.06	0.06	842.48
108	0.08	1067.72	0.72	0.2	0.08	1067.72
109	0.02	822.68	0.78	0.2	0.02	822.68
110	0	910	1	0	0	910
111	0.02	760.82	0.94	0.04	0.02	760.82
112	0.5	1381.72	0.3	0.2	0.5	1381.72
113	0.02	688.4	0.94	0.04	0.02	688.4
114	0.02	828.64	0.88	0.1	0.02	828.64
115	0	725.74	0.92	0.08	0	725.74
116	0	667.94	0.92	0.08	0	667.94
117	0	680.04	0.94	0.06	0	680.04
118	0.12	1426.2	0.66	0.22	0.12	1426.2
119	0	738.28	0.96	0.04	0	738.28
120	0	626.96	0.96	0.04	0	626.96
121	0.02	972.42	0.92	0.06	0.02	972.42
122	0.02	804	0.9	0.08	0.02	804
123	0.02	791.5	0.88	0.1	0.02	791.5
124	0	767.88	0.94	0.06	0	767.88
125	0.02	1082.8	0.98	0	0.02	1082.8
126	0	631.12	0.86	0.14	0	631.12
127	0	611.64	1	0	0	611.64
128	0.06	991.72	0.8	0.14	0.06	991.72
129	0.02	758.3	0.92	0.06	0.02	758.3
130	0	769.3	0.84	0.16	0	769.3
131	0.08	1089.18	0.56	0.36	0.08	1089.18
132	0.08	1088.4	0.84	0.08	0.08	1088.4
133	0	1010.14	0.96	0.04	0	1010.14
134	0	611	0.98	0.02	0	611
135	0	622.24	0.82	0.18	0	622.24
136	0	641.58	0.94	0.06	0	641.58
137	0.04	719.54	0.82	0.14	0.04	719.54

138	0.04	942.78	0.5	0.46	0.04	942.78
139	0.08	888.9	0.86	0.06	0.08	888.9
140	0	634.34	0.88	0.12	0	634.34
141	0	696.72	0.98	0.02	0	696.72
142	0.04	879.42	0.9	0.06	0.04	879.42
143	0.02	644.66	0.94	0.04	0.02	644.66
144	0	768.34	0.9	0.1	0	768.34
145	0	645.6	0.96	0.04	0	645.6
146	0	662.5	0.98	0.02	0	662.5
147	0.08	961.56	0.86	0.06	0.08	961.56
148	0.04	882.06	0.84	0.12	0.04	882.06
149	0.02	662.26	0.8	0.18	0.02	662.26
150	0	603.14	0.94	0.06	0	603.14
151	0	650.46	0.84	0.16	0	650.46
152	0	658.98	0.82	0.18	0	658.98
152	0	658.98	0.82	0.18	0	658.98
153	0.06	1029.14	0.9	0.04	0.06	1029.14
154	0.02	733.72	0.98	0	0.02	733.72
155	0.04	886.46	0.9	0.06	0.04	886.46
156	0	549.62	0.96	0.04	0	549.62
157	0.04	994.46	0.8	0.16	0.04	994.46
158	0.06	898.1	0.92	0.02	0.06	898.1
159	0.08	1027.82	0.9	0.02	0.08	1027.82
160	0.02	719.06	0.88	0.1	0.02	719.06
161	0.02	791.3	0.96	0.02	0.02	791.3
163	0	616.52	0.9	0.1	0	616.52
164	0.04	992.74	0.82	0.14	0.04	992.74
165	0	745.62	0.98	0.02	0	745.62
166	0.02	905.44	0.68	0.3	0.02	905.44
167	0	735.52	0.98	0.02	0	735.52
168	0.02	657.58	0.92	0.06	0.02	657.58
169	0	657.66	0.98	0.02	0	657.66
170	0.02	679.58	0.96	0.02	0.02	679.58
171	0.12	1152.88	0.88	0	0.12	1152.88
171	0.12	1152.88	0.88	0	0.12	1152.88
172	0.04	889.24	0.9	0.06	0.04	889.24
173	0.02	880.7	0.92	0.06	0.02	880.7
174	0.1	1239.54	0.58	0.32	0.1	1239.54
176	0.14	1101.4	0.8	0.06	0.14	1101.4
177	0	845.12	1	0	0	845.12

178	0.02	781.98	0.98	0	0.02	781.98
179	0.04	804.84	0.86	0.1	0.04	804.84
180	0.02	755.44	0.88	0.1	0.02	755.44
181	0.04	741.68	0.54	0.42	0.04	741.68
182	0	610.86	0.8	0.2	0	610.86
183	0.04	855.66	0.76	0.2	0.04	855.66
185	0.02	775.64	0.94	0.04	0.02	775.64
186	0.04	894	0.92	0.04	0.04	894
187	0.04	916.32	0.72	0.24	0.04	916.32
188	0.02	1070.28	0.96	0.02	0.02	1070.28
189	0.14	1360.1	0.84	0.02	0.14	1360.1
190	0	701.9	0.92	0.08	0	701.9
191	0.02	676.28	0.84	0.14	0.02	676.28
192	0.08	973.72	0.86	0.06	0.08	973.72
193	0	711.14	0.94	0.06	0	711.14
194	0.02	751.08	0.88	0.1	0.02	751.08
195	0.02	761.54	0.96	0.02	0.02	761.54
196	0.02	1018.6	0.98	0	0.02	1018.6
197	0.36	1332.48	0.44	0.2	0.36	1332.48
198	0	685.5	0.82	0.18	0	685.5
199	0.08	969.28	0.82	0.1	0.08	969.28
199	0.08	969.28	0.82	0.1	0.08	969.28
200	0.16	1317	0.6	0.24	0.16	1317
201	0	766.16	0.94	0.06	0	766.16
202	0.32	1134.04	0.6	0.08	0.32	1134.04
203	0.04	816.16	0.9	0.06	0.04	816.16
204	0.02	724.68	0.88	0.1	0.02	724.68
205	0.02	670.12	0.84	0.14	0.02	670.12
206	0.06	871.08	0.68	0.26	0.06	871.08
207	0	981.52	0.9	0.1	0	981.52
208	0.06	1056.56	0.64	0.3	0.06	1056.56
209	0	877.64	1	0	0	877.64
210	0.02	752	0.96	0.02	0.02	752
211	0	622.76	0.94	0.06	0	622.76
212	0.02	783.82	0.92	0.06	0.02	783.82
213	0.22	909.06	0.64	0.14	0.22	909.06
214	0.02	787.9	0.58	0.4	0.02	787.9
217	0	635.8	0.96	0.04	0	635.8
218	0.02	909.48	0.92	0.06	0.02	909.48
219	0.08	923.08	0.72	0.2	0.08	923.08

220	0.04	773.36	0.86	0.1	0.04	773.36
221	0.04	840.44	0.94	0.02	0.04	840.44
222	0.14	1072.18	0.46	0.4	0.14	1072.18
223	0.02	845.82	0.9	0.08	0.02	845.82
224	0.02	798.5	0.9	0.08	0.02	798.5
225	0.1	1029.62	0.84	0.06	0.1	1029.62
226	0.04	1031.22	0.94	0.02	0.04	1031.22
227	0.06	905.54	0.82	0.12	0.06	905.54
228	0.02	668.3	0.92	0.06	0.02	668.3
229	0	679.54	0.9	0.1	0	679.54
230	0.02	693.36	0.8	0.18	0.02	693.36
231	0.02	786.28	0.96	0.02	0.02	786.28
232	0.02	978.42	0.92	0.06	0.02	978.42
233	0.04	691.76	0.92	0.04	0.04	691.76

ID	Positive Affect	Negative Affect
101	19	25
102	24	17
103	17	17
104	17	13
105	14	12
106	15	11
107	26	16
108	23	14
109	20	17
110	34	13
111	23	10
112	33	14
113	18	11
114	31	12
115	22	14
116	14	16
117	14	10
118	35	14
119	16	22
120	28	15
121	25	15
122	14	11
123	14	10
124	34	11
125	25	13
126	23	16
127	30	10
128	21	11
129	27	17
130	20	13
131	15	15
132	22	13
133	19	10
134	15	10
135	18	18
136	37	15
137	31	10

138	10	11
139	17	14
140	16	11
141	19	10
142	24	16
143	22	17
144	19	10
145	27	14
146	23	11
147	19	16
148	25	14
149	33	11
150	19	15
151	17	15
152	30	10
152	16	14
153	31	10
154	19	12
155	16	13
156	24	13
157	NA	NA
158	21	30
159	23	10
160	29	10
161	20	16
163	23	11
164	26	10
165	16	18
166	25	14
167	11	16
168	16	20
169	31	11
170	27	21
171	30	10
171	26	10
172	26	19
173	25	13
174	11	14
176	10	13
177	18	13

178	40	12
179	20	13
180	16	11
181	22	19
182	13	10
183	17	13
185	20	19
186	32	10
187	24	20
188	31	25
189	42	19
190	20	15
191	37	12
192	24	14
193	23	13
194	19	13
195	20	15
196	19	12
197	32	15
198	37	18
199	15	12
199	27	16
200	22	12
201	24	12
202	11	14
203	18	12
204	35	13
205	30	12
206	26	15
207	18	10
208	26	10
209	36	15
210	20	13
211	33	14
212	28	16
213	37	15
214	25	19
217	23	15
218	17	12
219	23	15

220	20	13
221	14	14
222	33	22
223	16	14
224	19	11
225	13	10
226	22	12
227	12	13
228	16	11
229	25	17
230	32	10
231	19	18
232	23	19
233	20	10