EXECUTIVE FUNCTION IMPAIRMENT AND THE INFLUENCE OF A BREAK IN A VIRTUAL NATURE ENVIRONMENT

by

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EXECUTIVE FUNCTION IMPAIRMENT, BREAK IN A VIRTUAL ENVIRONMENT

ABSTRACT

60 (44 in the final sample) full-time or part-time employed or full-time student participants at the University of Central Florida were recruited to see whether a break in virtual nature will help improve upon executive functioning (EF) processing speed; especially in an EF impaired population. The main interest is that if virtual nature breaks aid with mental performance, then the application of virtual nature break can prove beneficial to both normal and, most importantly, the cognitively impaired. The lack of methodological consistency and the limited research on the subject yields mixed results in previous literature. The present study tries to address some of these gaps. Participants had to fill out a demographics survey, perform a cognitive load (Mental Rotation Task) and processing speed task (Stroop Color-Word Task), and then engage in a simulated 15-minute break in nature (video & sounds). Afterwards, they performed the processing speed task again to measure for change. The results failed to demonstrate that a moderately short break consisting of a nature video helps boost EF performance in the normal group. Those who demonstrated impairment in EF in the treatment group had to small of a sample size to be tested on. Numerous limitations and weak statistical power, especially in the impaired group, calls into question the validity of the study. As a result, the study findings are inconclusive.

*Keywords*: executive functioning, work breaks, occupational health, mental fatigue, mental rotation task, stroop task, virtual nature environment, processing speed
Undertaking an undergraduate thesis has been one of the most fulfilling experiences of my undergraduate career. I could not have completed this project if it were not for the tireless efforts and encouraging support of Dr. Kristin Horan. She saw the potential I had, long before I had anything to show for. Her quick thinking ultimately gave me the time I needed to pivot my study into an online version. I couldn’t have asked for a better mentor. I also appreciate Dr. Martha Hubertz for helping me develop my statistical skills, involving me in helping her teach, and joining my thesis committee. Lastly, I appreciate David I. Samuels for teaching me how to utilize Python and NumPy to clean my data in time to complete the project.
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INTRODUCTION

Psychology is an exponentially expanding field nowadays. However, when it comes to treatment options for psychological disorders, the choices and outcomes are not ideal. When it comes to depression, pharmacological interventions, such as selective serotonin reuptake inhibitors (SSRI), have potentially adverse side effects (Mayo Clinic Staff, 2019). Benzodiazepines’ are addictive to vulnerable individuals (Tan et al., 2010). The financial (Chen, J., & Rizzo, J. A., 2012) and emotional (Goodwin et al., 2017) cost of which, a lot of people are unhappy with. Cognitive Behavioral Therapy (CBT) (Hollon et al., 2002) and Transcranial Magnetic Stimulation (TMS) (Griffiths et al., 2019) appear to be more friendly alternatives. Their effectiveness remains to be temporary and the price is steep if one doesn’t have adequate insurance (Griffiths et al., 2019). Inadequate insurance is a major problem mental health patient deal with today (Olfson et al., 2018).

As a result, researchers are starting to look towards nonpharmacological and nonclinical interventions for the answer. Possible interventions include exposure to nature or physical activity. More specifically, how a break in nature affects executive functioning (EF) (Berman et al., 2008 & Fan et al., 2005 & Gamble et al., 2014 & Gatersleben & Andrews, 2013). The present study focuses on EF impairment, which has been linked with depression, and whether or not it can be improved through a break in a virtual nature environment.

EF and Breaks in Nature

Executive Functioning encompasses higher-order cognition, effortful control (EC) over one’s actions, inhibition, working memory, and the ability to plan and coordinate future behavior
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(Gailliot, 2008). A good indicator of EF is having more positive mental health, less risk of contracting a mental disease, positive social relationship skills, and good academic performance. (Gailliot, 2008 & Gioia et al., 2000). Current research describes ‘breaks’ and ‘nature’ very differently. It is important to know the different findings amongst each type of definition. Fan et al. (2005) found that just pictures of nature led to better executive function performance than urban environment pictures. Whereas Bourrier et al. (2018) had similar benefits from nature on EF, but the participants viewed a video of nature, in comparison with an urban video or no video at all, instead. Similar findings were consistent in an older adult population as well (Gamble et al., 2014). Results in favor of the hypothesis were also found when people actually engage in walking through nature (Berman et al., 2008).

The findings are not all supportive. One study produced null results after attempting to replicate Berman’s 2008 findings. There was no significant change in executive function measures when using nature and urban environments as treatments. Bratman (2015) also mentions that the results could be inaccurate due to the nature exposure lasting within an hour.

Leading Theories

There are three major theories in regards to EF and breaks in nature. All of which, are in support of all of the previously mentioned findings. They aim to explain the different sources of reasoning as to why there is an improvement in EF after a nature intervention.

Prospect-refuge theory (PRT), originally coined by Appleton (1975), suggests that what people prefer is not necessarily nature over urban environment. To them, it is much simpler than that. There needs to be a prospect, or an open field of view, so one can feel certain there are no threats nearby. At the same time, there also needs to be refuge, or a place where one can also see
a safe spot to hide. Most urban environments can’t provide for these two necessities. Appleton’s theory fits so far. In response, Gatersleben & Andrews (2013) found supporting evidence for the PRT. They discovered that cognitive restoration was more pronounced for higher prospect nature walks when compared to lower prospect nature walks.

Attention restoration theory (ART), founded by Kaplan in 1995, is based on the notion that attention is either involuntary (capturing) or voluntary (direct). Fan et al. (2002, 2005) refer to this type of attention as executive attention) (Berman et al., 2008). The idea is that when exposed to a nature environment, the ability to direct voluntary attention replenishes and task performance increases. Kaplan (1995) states that there is a catch with the theory. The stimuli in the environment must be “fascinating” and only call on attention to an involuntary degree. If the environment is too rich with stimuli, it produces “bottom-up stimulation” which forces the person to voluntarily alleviate the source of the stimuli (Berman et al., 2008).

Ego-depletion theory (EDT) was first demonstrated by Baumeister, Bratslavsky, Muraven, & Tice in a study conducted in 1998. Essentially, it is the belief that self-control or willpower is a limited resource that gets used up over time. Self-control is defined as the capacity to overcome his or her wants, conditioned responses, and compulsions (Baumeister et al. 1998). Through the employment of active breaks in a nature setting, level of self-control can possibly be replenished. It has been known that self-control is one of the dimensions of EF (Razon et al., 2019)

Depression and Breaks in Nature

The reason this study looks at depression in particular, is grounded in the assumption that depressed individuals suffer from mental fatigue worse than their healthy counterparts (Wang et
al., 2018). The source of this fatigue could be from being constantly lost in thought (rumination), inattention to social needs, and low self-esteem. If participants exhibit EF impairment and improve after the nature treatment, then previous findings can be confirmed, and depressed and other mentally ill individuals can be used as an IV in future studies.

Participants suffering from Major Depressive Disorder (MDD) were found to improve fivefold in executive and affective performance when compared to a healthy control after watching a nature video (Wang et al., 2018). In aid of the finding, nature exposure from both a walk and looking at nature scenes demonstrated an improvement in cognitive performance and relief from cognitive fatigue (Berman et al., 2008). Chow et al. (2015) discovered that nature moderates task performance, but not an increase in motivation or effort to actually perform the task. EDT treatment is exemplified as a result.

In 2012, Berman et al. suspects that having someone suffering with MDD to go out into nature alone might increase rumination in the individual and actively work against helping their cognitive processes, working memory, and overall mood. There are also contrary findings that only healthy individuals yield the cognitive benefits after a low exposure of nature (>5 min) (Craig et al., 2015). It supports the theory that rumination of depressed persons impedes the potentially beneficial qualities of nature.

**EF impairment and Depression**

Many studies have bridged the gap between level of EF performance and depression for both global impairments (Han et al., 2016; Holler, Kavanaugh, & Cook, 2014) and specific EF impairments such as, inhibition (Snyder, 2013 & Colich, Foland-Ross, Eggleston, Singh, & Gotlib, 2016; Wante, Mueller, Demeyer, De Raedt, &
Braet, 2015), working memory (Hasher & Zacks, 1988 & Evans, Kouros, Samanez-Larkin, & Garber, 2016), effortful control (Nishiguchi, Y. et al., 2016), and cognitive flexibility (Evans et al., 2016; Holler et al., 2014). The link between EF impairment and more depressive symptoms was observed in an adolescent population (Wante et al., 2017).

In light of all of the support for the link between EF impairment and depression, inconsistent findings still arise. A recent study found that global EF deficits were not correlated with depression (Anderson, J., & Bolden, J., 2018). However, Anderson attributes these conflicting results to a small sample size of only 27 children.

Previous literature, thus far, has shown to be inconsistent with the effects of nature exposure of EF (Fan et al., 2005 & Gamble et al., 2014 vs. Bratman et al., 2015). Most studies utilize actual nature (Berman et al., 2008 & Gailliot, 2008) and do not take into account consistent nature treatment in seasonal locations and the possibility of Seasonal Affective Disorder (SAD). Virtual nature can stay consistent throughout the year. However, few studies have implemented a virtual nature treatment (Valtchanov et al., 2010). The current study aims to address these gaps in the current literature by analyzing whether an EF impaired population, indicated by the Stroop Color-Word Task (SCWT), can improve after a moderately short (~15 min) virtual nature viewing. The Stroop Task was utilized as it has been proven to effectively measure inhibitory control, EF (cognitive flexibility, capacity to divide attention, inhibition, and response set maintenance ability) (Stroop, 1935). Additionally, it is suspected that the healthy population will also stand to produce significant results, but significantly less when compared to the impaired sample’s results.

Hypotheses
Hypothesis 1: There will be a positive significant difference between pre-intervention SCWT performance and post-intervention SCWT performance in both the normal group and the impaired group EF score.

Hypothesis 2: EF impaired treatment group will have a statistically greater increase in performance when compared to the normal group’s performance on the SCWT post-test measure.
METHODS

Participants

In this experiment, 60 participants were recruited from the University of Central Florida (UCF). Of the 60, only 44 participants were used for the final sample as the rest did not complete the study. The sample was 22 females, 20 males, and 2 who identified as ‘other’. Age ranged from 18 to 33 ($M = 20.25, SD = 3.01$), most were single (n = 36), and predominantly Caucasian/White (n = 26). Full-time student was considered a type of employment and, as such, the majority of the sample was full-time students (n = 36). Consequently, the majority level of education was, ‘some college, but no degree’ (n= 28). The rest of the group consisted of either part-time or full-time employees. The mean income was $75,000-99,999 ($Mo = $0-24,999) Average time spent working per week was 13.3 hours ($SD = 16.17$) with an average length of stay at their work being 9.72 months ($SD = 11.91$). The physical activity during work was the same as the physical activity outside of work; ‘light activity’. Inclusion criteria was as follows, participants had to be at least 18 years of age, be employed part-time or full-time or be a full-time student, speak English, and be able to commit to a single 30-minute online research session in a quiet place.

Recruitment Methods

Subjects were recruited through UCF’s Student Research Participation system (SONA). Participants were screened for eligibility and also prompted whether or not they meet all
eligibility criteria prior to starting the study. They received 0.25 SONA credits for their participation.

**Materials**

The experiment was designed entirely on [www.PsyToolkit.org](http://www.PsyToolkit.org) as an online study. The PsyToolkit Survey comprised of a demographic survey, MRT, SCWT, low fidelity nature-video, and a nature video with sounds. Examples of all the measures are provided in the appendix starting on page 14.

**Mental Rotation Task**

The task was designed to induce a cognitive load on the participant (Sharma, G. et al., 2019) to control for persons who may already be in a calming environment. A working population was also used in order to double down on ensuring that the treatment samples faced a consistently fatigued population. The mental strain is applied through having the participant look at a 2-dimensional figure and trying to guess, out of two other rotated figures, which one is the same as seen before. There was a training block with 5 trials and a test block with 10 trials. The aim was to simulate a similar cognitive fatigue that is experienced at the workplace and in depressed persons (Rose, D. M. et al., 2017, Wang et al., 2018). The task was derived from the PsyToolkit experimenter library.

**Stroop Color-Word Task**

The Stroop Color-Word Task is famously known to measure processing speed and inhibitory control. (Stroop, 1935). As such, it was used as the EF measure for the study. For the
sake of time and to avoid a total fatigue effect, a condensed version of the task was used from the PsyToolkit Library. Unlike in other studies using the stroop task (Scarpina, F., & Tagini, S., 2017), the present study only measures correct congruent (C) word reaction time in milliseconds (eg. The word ‘green’ is in green) and the correct incongruent (I) word reaction time in milliseconds (eg. The word ‘green’ is in blue) by pressing ‘R, G, B, or Y’ on the keyboard for the color of the word. The task contained 40 random trials of congruous and incongruous conditions. The equation used to calculate the Stroop effect (SE) is presented below:

\[ SE = (\bar{x}(I)) - (\bar{x}(C)) \]

In order to determine the EF impaired population, any Z-score of -1.5 and lower was used as a qualifier per the findings of Morrow (2013), who used a North American population to compile normative data for the Stroop task. The task was derived from the PsyToolkit experimenter library.

**Procedure**

Participants completed a 30-minute online experiment in which they took a demographics survey, MRT, and the SCWT. Participants then were given a break by either watching a virtual nature walk video with sound (experimental condition) or no virtual nature video with no sound (control condition). Following the break, participants performed the SCWT again to measure for change. They were awarded 0.25 SONA Credit for completing the study. No identifiable information was collected throughout the entire study.

**RESULTS**
Prior to the study starting, it was anticipated that there will be a positive significant difference between Pre-Stroop Performance and Post-Stroop performance in both the normal group and the impaired group EF score. It is also predicted that the EF impaired group will have a statistically greater increase in performance when compared to the normal group’s performance on the Stroop Post-Test measure. If these predictions prove to be true, future researchers can be more certain about the beneficial effects of virtual nature treatment on EF. The power of this study is relatively weak (n = 44). The main shortcoming is that of the normal and impaired population distribution. The distribution is displayed in Table 1. below.

Table 1.
Distribution of sample sizes

<table>
<thead>
<tr>
<th>Participant Distribution</th>
<th>Normal sample</th>
<th>Impaired sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control: Stroop pre-intervention test</td>
<td>21</td>
<td>3</td>
</tr>
<tr>
<td>Control: Stroop post-intervention test</td>
<td>23</td>
<td>1</td>
</tr>
<tr>
<td>Treatment: Stroop pre-intervention test</td>
<td>17</td>
<td>3</td>
</tr>
<tr>
<td>Treatment: Stroop post-intervention test</td>
<td>19</td>
<td>1</td>
</tr>
</tbody>
</table>

Analysis for Hypothesis 1

The purpose of this analysis was to determine if there will be a positive significant difference between pre-Stroop performance and post-Stroop performance in both the normal group and the impaired group EF score. In order to clean the data and calculate for the Stroop effect, Python and NumPy were used. The data was normally distributed with a kurtosis value of
1.06 (with an assumed sample size of n = 17), but the Welch's t-test was used instead of a paired samples t-test as there was uneven variance. Using IBM SPSS 26 as the analysis software, it was discovered that there was no significant relationship between pre-Stroop performance and post-Stroop performance in the normal group control ($t(41.9) = 1.86, p = .072 \ CI [-4.23, 94.47]$) and treatment ($t(32.08) = .201, p = .842 \ CI [-68.47, 83.48]$) and no analysis could be run on the impaired sample size as it was too small.

*Analysis for Hypothesis 2*

The follow up analysis was that of the relationship between Stroop-post performance scores in the normal and impaired group and whether the impaired group performed significantly better than the normal group. Unfortunately, the sample size was too small to run any type of analysis. Hypothesis 2 can neither be proven nor disproven.
DISCUSSION

The aim of the study was to see if a healthy and impaired working population stood to gain anything from a virtual nature treatment. However, the results are not in support of either of the hypotheses. The design was structured with Appleton’s (1975) Prospect-Refuge theory and the Ego-Depletion theory (Baumeister et al., 1998) in mind. For the former, scenery with open landscapes and bushes and trees in the distance was used to simulate both a prospect and a refuge environment. As for the latter, a working population and the implementation of the MRT was used to generate a reduce level of self-control. If the nature treatment intervention would have demonstrated significant results even in the healthy population alone ($p = .28$), the study would have been in support of the aforementioned theories.

The amount of limitations that were encountered throughout the study are suspected to account for the lack of any significant findings. First of all, the study failed to address the Attention Restoration theory (Kaplan, 1995) as there was no way to tell whether the individual was paying any attention to the video; whether that attention was involuntary or voluntary. Which leads us to the next point, the length of the video. 15 minutes was chosen since the study by Craig et al. (2015) exemplified that a short nature exposure (>5 min) was found to not be beneficial. However, 15 minutes may have been too long and attention towards the video could have been lost rather quickly. Future researchers should probably try for a time around 10 minutes instead. This precaution should be stressed primarily in online studies where the participants attention and environment cannot be controlled for.

The time restrictions caused by the sudden COVID-19 pandemic were a significant factor in the limited design of the study. The halt on all human subjects’ research
forced the present study to be redesigned into an online format. An IRB exemption form had to be used to ensure the completion of the study before the thesis approval deadline. As a result, the study lacked the implementation of a depression measure and more EF measures. Since the study had to be done entirely online, there was a lack of control over the variables and power of the study.

Future researchers should include a depression measure and conduct the research in person when replicating this study. They should also address all the applicable limitations mentioned. Testing whether a virtual nature walk could potentially help alleviate depressive symptoms, may prove vital to those who may require alternative treatment options. A more representative population could also be tested upon in order to generalize the results to a broader group of people. The lack of studies implementing a virtual nature as treatment is something to consider and capitalize on (Valtchanov et al., 2010) as previous research, and the theories it harbors, shows promise.

CONCLUSION

The data showed no evidence that a moderately short virtual nature video will have an impact on EF performance within a normal sample. Unfortunately, the data for the impaired sample was inconclusive. The reason for isolating an impaired sample was the association of EF impairment with depression and that an impaired population stood to gain more from the virtual nature treatment as suggested by Wang’s (2018) research. Much more research needs to be done on the subject (Valtchanov et al., 2010) and it is suggested that the study be replicated again with a much larger sample size at the very least. Ultimately, given the extensive limitations that were endured, the present study was deemed to have inconclusive results.
APPENDIX A

DEMOGRAPHICS SURVEY
1. What is your age?
   Age _______

2. What is your gender?
   o Male
   o Female
   o Other

3. What is your martial status?
   o Cohabiting (Living together, but not married)
   o Long term relationship (not cohabiting or married)
   o Married
   o Single
   o Divorced
   o Widowed
   o Other

4. What is your highest level of education?
   o Some high school
   o High school diploma (or GED)
   o Some college, but no degree
   o Associate’s degree
   o Bachelor’s degree
   o Master’s degree
   o Beyond Master’s degree

5. What is your race (select all that apply)?
   □ American Indian or Alaskan Native
   □ Asian/Pacific Islander
   □ Black/African American
   □ Caucasian/White
   □ Hispanic/Latino
   □ Other

6. What is your approximate total yearly household income?
   o $0-24,999
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- $25,000-49,999
- $50,000-74,999
- $75,000-99,999
- $100,000-124,999
- $125,000-174,999
- $175,000-199,999
- $200,000 and up

7. What is your job title? (If you are unemployed, put: full-time student)
   Job title ________

8. How many hours do you work in an average week?
   Number between zero and one hundred in five number increments ______

9. How long have you worked in your organization?
   Years ______
   Months _____

10. Which of the following describes your physical activity level during work?
    - Sedentary (spending most of your time sitting)
    - Light activity (spending some time on your feet)
    - Moderate Activity (spending much of your time moving or walking)
    - Vigorous Activity (spending much of your time with vigorous movement or heavy lifting)

11. Which of the following describes your physical activity level outside of work?
    - Sedentary (spending most of your time sitting)
    - Light activity (spending some time on your feet)
    - Moderate Activity (spending much of your time moving or walking)
    - Vigorous Activity (spending much of your time with vigorous movement or heavy lifting)
APPENDIX B

MENTAL ROTATION TASK
Click to start

Instructions
You will see three objects. You need to decide which one of the bottom two images matches the top one. When decided, you need to click the matching one with the mouse.

Match this one to one of the bottom. The left red figure is the correct one.

Press space to continue.

Now you get 5 training trials. Press space when ready.

Now that you know the task, please do 10 more to test your mental rotation skills. Press space when ready.

Percentage correct (in second block): 27

Average time per puzzle: 208

Press space to continue.
APPENDIX C

STROOP COLOR-WORD 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...

Your speed in correct trials
congruent: 213 ms
incongruent: 92 ms

Your Stroop effect is incongruent minus congruent: -121 ms

Press space key to end
APPENDIX D

LOW-FIDELITY VIRTUAL NATURE VIDEO
APPENDIX E

VIRTUAL NATURE VIDEO WITH SOUND
APPENDIX F

IRB APPROVAL FORM
**EXECUTIVE FUNCTION IMPAIRMENT, BREAK IN A VIRTUAL ENVIRONMENT**

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**FORM: Request for Exempt Determination**

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<td>HRP-255</td>
<td>1/21/2019</td>
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</table>

Instructions: This form is used to establish whether your research can be determined to be "Human Research" that is exempt from IRB Review according to the federal regulations. To request a determination of exemption, please complete the protocol application and attach this form in Section 1.8 of the Basic Information Page of the online study submission. Also attach recruitment materials, study instruments, and, if a consent process is required, the HRP-254 Summary Explanation for Exempt Research. The IRB Office will then make the final determination on whether the activity meets an exempt category under Health and Human Services regulations (HHS)45 CFR 46.101 (b).

**Investigator:** Kristin Horan  
**Study Title:** Executive Function Impairment and the Influence of a Break in a Virtual Nature Environment  
**Co-Investigators(s) (if Applicable):** Kipras Varkala  
**Faculty Advisor (if Applicable):** Kristin Horan

### Section 1 – Justification of IRB Exemption

In order to be considered exempt, the research study MUST meet the following conditions:

A. The research protocol involves NO more than minimal risk. Minimal risk is the probability and magnitude of physical or psychological harm that is normally encountered in the daily lives, or in the routine medical, dental, or psychological examination of healthy persons. 45CFR46.303 (d).

- [ ] Yes, this research involves NO more than minimal risk.
- [ ] No, this research involves GREATER than minimal risk. STOP, your submission does not qualify for an exemption determination. Discard this form and complete a Protocol using Form HRP-503 for submission to the IRB.

B. This study fits into at least one of the following 6 Exemption categories. Please indicate which of the following categories you think most clearly represents your research.

- [ ] 1. Research conducted in established or commonly accepted educational settings that specifically involves normal educational practices that are not likely to adversely impact students’ opportunity to learn required educational content or the assessment of educators who provide instruction. This includes most research on regular and special education instructional strategies, and research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.
- [ ] 2. Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior (including visual or auditory recording) if at least one of the following criteria is met:
  - (a) The information obtained is recorded by the investigator in such a manner that the identity of the Human Subjects cannot be readily ascertained, directly or indirectly through identifiers linked to the subjects; OR
  - (b) Any disclosure of Human Subjects’ responses outside the research would not reasonably place the subjects at risk of personal or civil liability or be damaging to the subjects’ financial standing, employability, educational advancement, or reputation; OR
  - (c) The information obtained is recorded by the investigator in such a manner that the identity of the Human Subjects can be readily ascertained, directly or indirectly through identifiers linked to the subjects, AND there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of data.

**Note:** If your research includes surveys or interviews with minors, this study will not qualify for an exemption.

- [ ] If the research involves children and is conducted, funded, or subject to regulation by DHHS, Dept. of Defense (DOD), Dept. of Education (ED), Environmental Protection Agency (EPA), or Veterans Administration (VA), the procedures are limited to (1) the observation of public behavior when the investigator(s) do not participate in the activities being observed or (2) the use of educational tests and at least one of the following criteria is met:
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FORM: Request for Exempt Determination

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☐ (i) The information obtained is recorded by the investigator in such a manner that the identity of the Human Subjects cannot readily be ascertained, directly or indirectly through identifiers linked to the subjects; OR
☐ (ii) Any disclosure of Human Subjects’ responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects’ financial standing, employability, educational achievement, or reputation.

☐ 3(i). Research involving benign behavioral interventions in conjunction with the collection of information from an adult subject through verbal or written responses (including data entry) or audiovisual recording if the subject prospectively agrees to the intervention and information collection and at least one of the following criteria is met:
☐ (A) The information obtained is recorded by the investigator in such a manner that the identity of the Human Subjects cannot readily be ascertained, directly or indirectly, through identifiers linked to the subjects; OR
☐ (B) Any disclosure of the Human Subjects’ responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects’ financial standing, employability, educational advancement, or reputation; OR
☐ (C) The information obtained is recorded by the investigator in such a manner that the identity of the Human Subjects can be readily ascertained, directly or indirectly through identifiers linked to the subjects, AND there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of data.

☐ 4. Secondary research for which consent is not required: Secondary research uses of identifiable private information or identifiable biospecimens, if at least one of the following criteria is met:
☐ (i) The identifiable private information or identifiable biospecimens are publicly available; OR
☐ (ii) Information, which may include information about biospecimens, is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained directly or through identifiers linked to the subjects, the investigator does not contact the subjects, and the investigator will not re-identify subjects; OR
☐ The research involves only information collection and analysis involving the investigator’s use of identifiable health information when that use is regulated under 45 CFR parts 160 and 164 (HIPAA), subparts A and E, for the purposes of “health care operations” or “research” as those terms are defined at 45 CFR 164.501 or for “public health activities and purposes” as described under 45 CFR 164.512(b); OR
☐ The research is conducted by, or on behalf of, a Federal department or agency using government-generated or government-collected information obtained for nonresearch activities, if the research generates identifiable private information that is or will be maintained on information technology that is subject to and in compliance with section 208(b) of the E-Government Act of 2002, 44 U.S.C. 3501

☐ 5. Research and demonstration projects which are conducted or supported by a Federal department or agency, or otherwise subject to the approval of department or agency heads (or the approval of heads of bureaus or other subordinate agencies that have been delegated authority to conduct the research and demonstration projects), and that are designed to study, evaluate, improve, or otherwise examine: public benefit or service programs, including procedures for obtaining benefits or services under those programs, possible changes in or alternatives to those programs or procedures, or possible changes in methods or levels of payment for benefits or services under those programs.
☐ (i) Each Federal department or agency conducting or supporting the research and demonstration projects must establish, on a publicly accessible Federal website or in such other manner as the department or agency head may determine, a list of the research and demonstration projects that the Federal department or agency conducts or supports under this provision. The research or demonstration project must be published on this list prior to commencing the research involving human subjects.

☐ 6. Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the Food and
Drug Administration or approved by the Environmental Protection Agency or the Food Safety and Inspection Service of the Dept. of Agriculture.

Section 2 – Study Details
Complete each section

1. Protocol Synopsis/Summary:

60 participants (students at the University of Central Florida) will complete a 30-minute online experiment in which they will complete a baseline survey, mental rotation task, and the Stroop task. Participants will then take a break by either watching a virtual nature walk video (experimental condition) or no virtual nature video (control condition). Following the break, participants will perform the Stroop task again. They will be awarded 1 SONA Credit for completing the study.

2. Objective/Background:

Following a nature exposure treatment, increased Executive Function (EF) performance has been highly debated (Bourne et al., 2018) (Bratman et al., 2015). Few studies have implemented a virtual nature treatment (Vallchanov et al., 2010). The current study aims to address these gaps in the current literature by analyzing whether an EF impaired population (indicated by the Stroop Task) can improve after a short (~15 min) virtual nature viewing. The Stroop Task has been proven to effectively measure processing speed and inhibitory control. (Popov et al., 2019)

The current studies aims to utilize a mental stressor and a psychological measure, that is linked with physiological performance, to test whether watching and hearing a virtual nature video will aid in EF performance. It is hypothesized that there will be a significant positive correlation between initial normally and impaired EF scores and post-treatment scores for both groups. It is also hypothesized that the EF impaired group will have a greater percent increase in performance, but will not surpass the average improved performance of the normal performing group.

3. Study Design:

Randomized Experiment

4. Study Instruments: (List all materials the participant will view or hear. This list must match the document names attached in the Local Site Documents in the Huron IRB system):

Baseline Survey
Mental Rotation Task
Stroop Task
Virtual Nature Video
Low Fidelity Virtual Nature Video

5. Maximum number of participants:

60

6. Study Population:

(check all that apply)

- UCF Students, Faculty or Staff
- Children or Young Adults Under the age of 18
- Adults over 65
- Pregnant Women
- Prisoners
- Adults to Unable to Consent
- Other (specify):

7. Recruitment Methods:

- Flyer
- Email
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(Unless the content is exactly the same for all versions, upload a copy of each type selected)

- [ ] SONA
- [ ] Social Media Post
- [ ] Other (specify):
- [x] The content is the same for all methods

**Describe the recruitment process:** Study will be posted on SONA

### 8. Languages Included:

- [x] English
- [ ] Other (specify):

Note. the IRB will request translated versions of the study materials after the English versions are approved.

### 9. Research Locations:

(check [ ] all that apply)

- [ ] UCF Owned or Operated Locations(s) (specify all applicable locations):
  - [x] Online
    - [ ] Amazon M-Turk
    - [ ] Qualtrics
    - [x] Other (specify): The entire experiment will be conducted on PayToolkit. Including the survey.
- [ ] International (specify all applicable locations):
- [ ] Multi-site (specify all No-UCF locations):
- [ ] Other (specify):

**10. Involves Deception:**

Note. If the research involves deceiving the subjects regarding the nature or purposes of the research, this exemption is not applicable unless the subject authorizes the deception through a prospective agreement to participate in research in circumstances in which the subject is informed that he or she will be unaware of or misled regarding the nature or purposes of the research.

- [x] No
- [ ] Yes
  - [ ] HRP-254 – Explanation of Research states use of deception.

If Yes, describe the nature of the deception:

**11. Illegal activity/sensitive information (Drug use, underage alcohol use, rape, suicidal thoughts, etc.):**

- [x] No
- [ ] Yes

If Yes, describe the nature of the sensitive information:
**EXECUTIVE FUNCTION IMPAIRMENT, BREAK IN A VIRTUAL ENVIRONMENT**

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### 12. Compensation:

- ☐ No
- ☑ Yes

If Yes, specify the form of compensation (check all that apply):

- ☑ Course Credit (students) *(if offering course credit, "Alternate Assignment" below must also be selected)*
- ☐ Alternate Assignment (students)
- ☐ Monetary (cash/check/gift card)
- ☐ Other (specify): SONA Credit
- ☐ Lottery *(Note: In general, due to Florida’s strict state laws regarding lotteries and the appearance of coercion in research studies, the IRB does not allow lotteries unless the study is investigating the lottery process or psychological effects of lotteries as the purpose of the study.)*

### 13. Type of Interaction(s) to Take Place for Research Purposes:

*(check ☑ all that apply)*

- ☑ Online survey
- ☐ In-person/Face-to-Face
- ☐ Voice Call
- ☐ Voice/Video Call *(i.e. Skype)*
- ☐ Voice Recordings *(complete identifiable data retention section)*
- ☐ Video Recordings *(complete identifiable data retention section)*
- ☐ Observation *(describe the nature of the observation):*
- ☐ Other *(specify):*  

### 14. Identifiable Data Collection:

*(check ☑ all that apply and upload the study data collection sheet)*

- ☑ None
- ☐ Name
- ☐ Contact Information *(email, phone number, address, etc.)*
- ☐ NID
- ☐ Video Recording – Face or other identifying personal attribute
- ☐ Protected Health Information *(PHI) (includes any of the 18 HIPAA identifiers associated with medical records, biological specimens, biometrics, data sets)*
- ☐ Biospecimens *(describe):*
- ☐ Other *(specify):*

### 15. Data Retention:

*(check ☑ all that apply for both the identifiable and de-identified sections, as applicable)*

#### A. If You are Collecting Identifiable Data:

- ☐ Identifiers deleted after transcription
- ☐ Identifiers deleted after data analysis
- ☐ Identifiers deleted at a specific timepoint *(specify):*

#### B. De-Identified Data:

- ☑ De-identified data stored for a minimum of 5 years *(per UCF policy)*
- ☐ De-identified data stored for a certain amount of time or specific timepoint *(specify):*

---

### Section 3 – Ethical Considerations

**Complete each section**

1. **Describe how subject selection is equitable** *(describe inclusion/exclusion criteria):*

   To be eligible, participants must be at least 18 years of age, be employed full time or part time or full time student, have a modern browser, internet.
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2. This study involves the collection of identifiable data:

☐ No
☐ Yes

If Yes, describe the provisions in place to protect the confidentiality of the data:

3. There are interactions with participants (including surveys):

☐ No
☐ Yes

If Yes, question number 4 is required.

4. Informed Consent Process (required for all studies involving subject interaction)

Describe the informed consent process. This description should include information about how you are using the HRP-254 – Summary of Research Explanation and any other documents used to facilitate the consent process.

The nature of the study will be disclosed to them when they sign up for the study through SONA. The explanation of research form will be presented on the first page of the survey in PsyToolKit. It will be assumed they consent to the study when they choose to advance to the next page.

Note: The Consent Process Must:
- Disclose that the activities involve research;
- Disclose the procedures to be performed;
- Disclose that participation is voluntary;
- Disclose the name and contact information for the investigator;
- Disclose what identifiable data will be collected and the confidentiality provisions in place to protect that data.

5. Subject Privacy

Describe the provisions to maintain privacy interests:

No identifiable information will be collected. Participants can complete the study in the location of their choosing.

Section 4 – Certification and Investigator Sign-Off

Please be aware that the different activities listed under the categories for exemption do not automatically deem these activities as exempt from IRB review. Exempt determination does not designate that research is automatically excused from IRB submission or review, but rather are exempt only from certain federal regulations. The activities presented here only indicate that a significant portion of these types of research activities could be eligible for exemption procedures. In addition, this eligibility also depends on whether or not the specific circumstances surrounding the proposed research activities involves no more than minimal risk to the participants. Decisions regarding eligibility for exemption will be made on a case-by-case basis by the IRB Office. The IRB Office may request additional documentation, including the full protocol (HRP-503 – Protocol Template), in order to make the appropriate determination.

By entering your initials below you certify that the information you have provided is complete and accurate. In addition, you acknowledge that any intended/proposed modifications to this research must first be submitted to the IRB as certain modifications may increase risk to participants or change the review category.

Investigator Initials | Date
EXECUTIVE FUNCTION IMPAIRMENT, BREAK IN A VIRTUAL ENVIRONMENT

1 For the purpose of this provision, benign behavioral interventions are brief in duration, harmless, painless, not physically invasive, not likely to have a significant adverse lasting impact on the subjects, and the investigator has no reason to think the subjects will find the interventions offensive or embarrassing. Provided all such criteria are met, examples of such benign behavioral interventions would include having the subjects play an online game, having them solve puzzles under various noise conditions, or having them decide how to allocate a nominal amount of received cash between themselves and someone else.

2 Such projects include, but are not limited to, internal studies by Federal employees, and studies under contracts or consulting arrangements, cooperative agreements, or grants. Exempt projects also include waivers of otherwise mandatory requirements using authorities such as sections 1115 and 1115A of the Social Security Act, as amended.

3 Note that for FDA-regulated research exemption (6) is an exemption from IRB review in 21 CFR §56, but unlike DHHS regulations is not an exemption from FDA requirements for consent in 21 CFR §50. If an organization’s policy is to grant exemptions to FDA-regulated research in category (6), then additional criteria for such exemptions would be that consent will be obtained in accordance with 21 CFR §50.20 and §50.25, and the consent will be either be documented in writing in accordance with 21 CFR§50.27 or waived in accordance with 21 CFR §56.109(c)(1).
REFERENCES


EXECUTIVE FUNCTION IMPAIRMENT, BREAK IN A VIRTUAL ENVIRONMENT


4K Relaxation Channel. (2018, November 18). 4K Nature Walk - 4.5 HRS Forest/River Fabulous Views with Calm Music and Birds Chirping [Video]. *Youtube*. [https://www.youtube.com/watch?v=b4AVn8mTuJw&t=2775s](https://www.youtube.com/watch?v=b4AVn8mTuJw&t=2775s)