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Exploratory fNIRS Assessment of Differences in Activation in Virtual Reality Visual Self-Expression Including With a Fragrance Stimulus

Girija Kaimal, Katrina Carroll-Haskins, Yigit Topoglu, Arun Ramakrishnan, Asli Arslanbek, and Hasan Ayaz

Abstract

A within-subjects experimental design examined differences in functional near-infrared spectroscopy (fNIRS) assessment of prefrontal cortex (PFC) activation with two virtual reality (VR) drawing conditions (rote tracing and creative self-expression) with and without a fragrance stimulus. Participants were healthy adults and included 18 women, 6 men: age range = 18–54 years. Findings indicate significant differences such that rote tracing resulted in higher PFC activity than the creative self-expression task. Although there was no significant impact of fragrance on the overall sample, emergent differences in responsiveness to fragrance were seen by age and gender. The study suggests that repetitive tasks like rote tracing can enhance focus and the creative self-expressive tasks can reduce PFC load and induce relaxation and flow.

Keywords: *fNIRS; art therapy; virtual reality; fragrance; creative self-expression; rote tracing*

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There is increasing evidence of the impact of digital technologies like VR in the treatment of psychological conditions such as trauma, phobias, eating disorders (McLeod, 1999; Riva et al., 2016), however, there is limited understanding of how digital art media activate creative and therapeutic change. To date only self-report data is available indicating that VR offers novel possibilities to create one's own customized environment (Hacmun et al., 2018), enabling participants to produce three-dimensional (3 D) drawings, engage in creative embodied experiences and audio-visual sensory simulation free from the constraints of the physical world (Hacmun et al., 2018; Kaimal et al., 2020; McLeod, 1999; Thornhill-Miller & Dupont, 2016). Improvements in affect, self-efficacy, reduced stress, and enhanced creative agency (self-perceptions of having imaginative ideas and being creative) have also been documented (Kaimal et al. (2020). Although there is an emerging body of research that has investigated neural activation during creative expression and performance (Kaimal et al., 2017; Limb & Braun, 2008; Oh et al., 2020) there is limited bio-behavioral evidence on the effects of VR as a creative expressive tool.

Creative Expression and Brain Activation

Dietrich (2019) proposes three neural mechanisms through which creativity emerges: the deliberate mode, the spontaneous mode and the flow mode. The deliberate mode involves conscious prefrontal activity and cognitive flexibility. In the spontaneous mode ideas emerge suddenly unintentionally; and in the flow mode creative thoughts bypasses consciousness altogether. Dietrich (2003) refers to this as *transient hypofrontality* and suggests that altered states of consciousness (E.g., meditation, hypnosis, exercise or creative activities) are caused by a reduction in prefrontal cortex activity.

In studies of approaches to creative problem solving, analytical problem solvers were found to have higher frontal cortex activity while insightful problem solvers had higher temporal and parietal lobe activation (Erickson et al., 2018; Oh et al., 2020). Further confirming these findings that creative thoughts emerge through unconscious processing when there is lower conscious focus, in a functional magnetic resonance imaging (fMRI) study on musical creativity, Limb and Braun (2008) found that there was deactivation of lateral portions of the prefrontal cortex. Similarly, Bolwerk et al. (2014) in a fMRI study with older adults found that engaging in creative visual expression increased the activity in default mode network (DMN). Lusebrink (2004) asserts that art therapy engages multiple brain systems. This sensory and affective activation is essential to therapeutic change such that the PFC involved in conscious cognitive meaning making. These activations can vary by artistic skill with non-artists activating more cognitive control (Belkofer et al., 2014; Solso, 2001) but Rosen et al. (2017) found that explicit directives to be creative may improve creative performance with people who have less prior experience.

Measuring Physiological Outcomes of Creative Visual Self-Expression Using fNIRS

Contemporary wearable neuroimaging technologies such as EEG and functional near-infrared spectroscopy (fNIRS) have made it possible to measure brain function while the participant is engaged in naturalistic activities like art-making (Kaimal et al., 2017; King & Kaimal, 2019). fNIRS, as a noninvasive, portable, and wearable technology emerged in the early 2000s as a new neuroimaging technique that can measure cortical hemodynamics similar to fMRI and evolved to mobile, battery-operated, and wireless tool (Ayaz et al., 2013; Ferrari & Quaresima, 2012). fNIRS has been used with adults, children, and infants to monitor underlying mechanisms in neural functioning (Curtin & Ayaz, 2018; Pinti et al., 2018) ; including creativity and neural functioning (Lu et al., 2020; Xue et al., 2018). Mayseless et al. (2019), looked at inter-brain synchrony when solving a creative task using fNIRS and found increased inter-brain synchrony in cognitive control system and activation in mirror neurons, and mentalization areas.

In the context of art therapy, creative self-expression refers to visual works that mirrors or reflects with authentic personal perspectives and mental states (Beghetto & Kaufman, 2007; Kaimal et al., 2020). Kaimal et al. (2017) found that visual self-expression including doodling, coloring, and free drawing activates the reward pathways in the medial prefrontal cortex. King et al. (2017), found that art making showed greater effect in cortical activation pattern as compared to baseline and rote tasks. While there are studies on creative tasks, there is a lack of literature on using fNIRS in visual arts research especially using VR.

Fragrance and Creative Self-Expression

Given that VR makes participants detach temporarily from their physical reality into an alternate experiential space, the sense of smell was considered in this study as a potentially impactful stimulus that could impact participant responses and promote a sense of awareness and grounding during the artmaking tasks. Olfactory perception is well known to have strong connections with the amygdala and activates brain areas that regulate emotions, such as the orbitofrontal cortex, hippocampus, and amygdala (Kadohisa, 2013; Wilson & Stevenson, 2003). Willander and Larsson (2006) demonstrated that memories induced by olfactory stimulation were associated with stronger feelings compared to other visual and auditory systems including relaxant effects and impacts on mood (Chen et al., 2020; Genc & Saritas, 2020; Krusemark et al., 2013). Recent research shows that the existence of pleasant fragrances resulted in improved creativity (Baron & Thomley, 1994; Ehrlichman & Bastone, 1992), and that olfactory cues helped participants better perceive emotions (Xiang et al., 2016). Due to the limited number of studies examining the relationship and mechanisms between olfactory stimuli and creativity, Zhu and Mehta (2017) conclude that improved mood can be the reason explaining improved creativity under pleasant olfactory stimuli while they also point out the necessity of future evidence-based research. Across the lifespan, there is evidence that women are on average more sensitive to odors (Sorokowski et al., 2019) and that the sense of smell declines with age (Doty & Kamath, 2014). Given the importance of sensory activation in art therapy, the inclusion of fragrance in conjunction with VR artmaking was expected to provide additional information on impact of this less understood sensory stimulus.

Present Study

As seen above, there is limited literature on physiological impacts of creative visual self-expression - particularly in VR. Given that the literature indicates reduced PFC activation during creative expressive activities, for this exploratory study we chose two distinct drawing tasks inspired by King et al. (2017) adapted to the context of VR including with a diffused fragrance stimulus. A calming scent was used to help facilitate and ease the participant experience, since the study equipment included the physical burden of the headset equipment and hardware. Using fNIRS, we investigated the following two main research questions:

- Research questions #1: What are the differences in PFC activation during a repetitive tracing task (T) versus a creative-self-expressive (CSE) task?
- Research questions #2: What are the differences in PFC activation based on a tracing task (T) versus a creative-self-expressive (CSE) task with the addition of a calming fragrance in the room?

Methods

Research Design

The study used a within-subject experimental design with balanced randomization of session order. Ethical approval was obtained from Drexel University's Institutional Review Board (IRB) The project team included a research collaboration between three art therapist-researchers and three biomedical engineers.

Setting and Participants

Participants were recruited via postings on online research webpages and publicly displayed flyers in community spaces. Inclusion criteria included being a healthy adult between 18 and 70 years old with no prior experience with artmaking or VR being required. Exclusion criteria included inability to work with handheld controls or VR headset, fragrance allergies, or a history of seizures or head trauma. Although 38 adults initially expressed interest in the study, 13 did not participate due to scheduling conflicts or were unresponsive to scheduling emails. One participant left the study due to experiencing nausea associated with the VR procedure and 3 participants were only able to attend one session. Twenty-four adults participated in the study (18 women, 6 men) ranging in age from 18 years to 54 years ($M = 27.5$ years). Participants identified as White ($n = 11$), African American ($n = 3$), Asian ($n = 6$), and Mixed-Race ($n = 4$). Participants received $10 cash in compensation for participation in each session. All data collection sessions took place in a dedicated lab room at a large urban university.

Procedure

Technology Tools. The lab space tools included an optical brain imaging (fNIRS) sensor, VR headset, and hand-controller equipment, and a fragrance diffuser system. VR hardware included the Windows Mixed-Reality [1]headset and remote-control devices running on a personal laptop with the following capabilities: (a) Laptop PC: Acer Predator Helios 300 (G3-571-77QK), 15.6" Full HD IPS, Intel i7 CPU, 16GB DDR4 RAM, 256GB SSD, GeForce GTX 1060-6GB, VR Ready, Windows 10 64-bit, (b) HMD: Lenovo Explorer (G0A20001WW) Mixed Reality Headset. A virtual reality software program, Tilt Brush by Google[2], was used to create 3-D drawings in VR.

Fragrance was diffused into the lab using a standard diffuser system (Ascents® diffuser system by Aeroscena®[3]) containing the fragrance Calm No. 34 (Aeroscena® scent gel) consisting of a blend of essential oils (lavender, orange, juniper berry, patchouli, and ylang-ylang). Fragrance was diffused into the lab on alternating weeks and dissipated within 30 min after turning off the diffuser.

Study Plan. Participants attended two 1 hour sessions, scheduled at least 1 week apart. Participants were blinded to the fragrance stimulus and were assigned to receive either the fragrance or the non-fragrance condition for the first session through a simple randomization plan (alternating odd and even number assignments). At the beginning of the first session, participants completed informed-consent and then engaged in a brief 5-min orientation to the VR headset, remote controls, and Tilt Brush software. To reduce the risk of disorientation while in VR and to ensure a consistent process, participants remained seated for the entire session. An armless swivel chair was used to avoid restricting arm movement during drawing in VR. After orientation to VR, participants were fitted with the fNIRS headband and the VR headset. A baseline measurement was taken for one-minute during which participants were instructed to remain still and stare at a focal point (on a gray-black horizon scene). Figure 1 shows the set up for the participants for data collection in the virtual environment and fNIRS headset.

Thereafter, participants completed 2 virtual drawing conditions: a *rote tracing condition* and a *creative self-expression condition*. The rote tracing condition consisted of tracing basic shapes on a pre-drawn virtual template (Figure 2). In the creative self-expression condition, participants created an adapted version of the scribble drawing technique, an approach frequently used in art therapy to encourage creativity and spontaneous artistic expression. Figures 3 and 4 are examples of creative artworks made by participants. The facilitator read from a protocol script for both conditions with step by step instructions (Tables 1 and 2). Each condition lasted for approximately 5 min, with each instruction timed for 1 min. Participants completed both drawing conditions twice during the session.

Data Collection. We used a continuous wave fNIRS sensor Imager 2000S (fNIR Devices LLC, Potomac, MD; www.fnirdevices.com) to samples cortical hemodynamic changes at 16 cortical measurement locations (channels/optodes) in a rectangular grid of 2 by 8 over the anterior PFC (Ayaz et al., 2011, 2012). This system uses 730 nm and 850 nm light wavelengths at each measurement location to calculate oxygenation changes with 10 Hz sampling with 2.5 cm source-detector separation. Each participant's PFC was monitored throughout the entire time the participants were engaged with the artmaking and rest conditions. COBI Studio software was used for data acquisition and visualization (Ayaz et al., 2011).

For each participant, raw fNIRS light intensities were low-pass filtered with a finite impulse response, linear phase filter with an order of 100 and a cutoff frequency of 0.1 Hz to attenuate the high-frequency noise,

[1]https://www.microsoft.com/en-us/windows/windows-mixed-reality
[2]http://www.tiltbrush.com
[3]https://www.aeroscena.com/

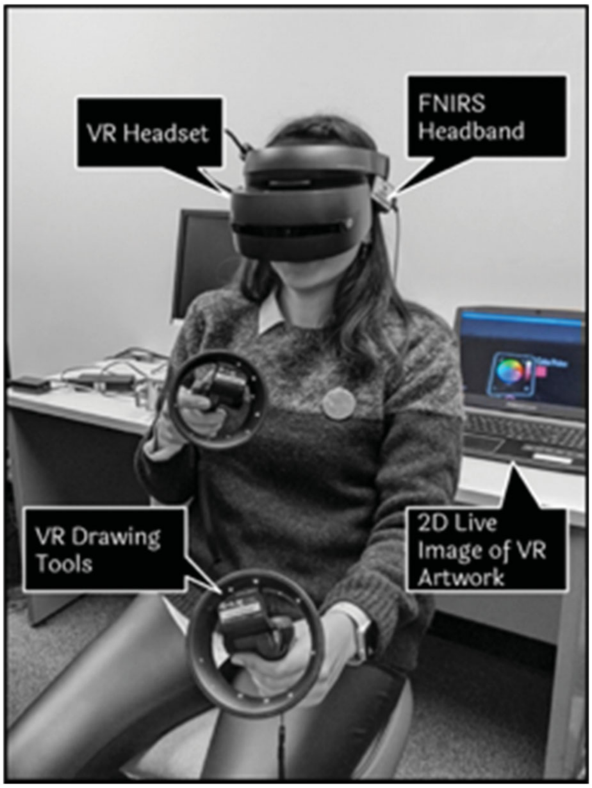

Figure 1. Data Collection Setup With Participants

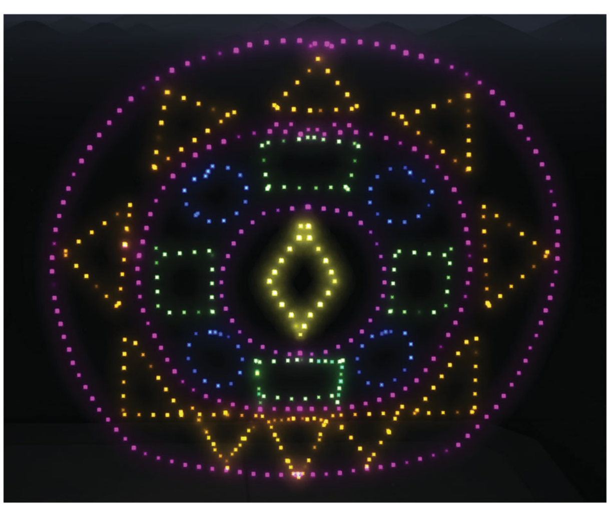

Figure 2. Template for Rote Tracing Condition

Figure 3. An Example of a Creative Self-Expressive Artwork. Nature Image by 28-Year-Old Female Participant: *"[I] began with a style of fire I used to doodle, which transformed into living flowers."*

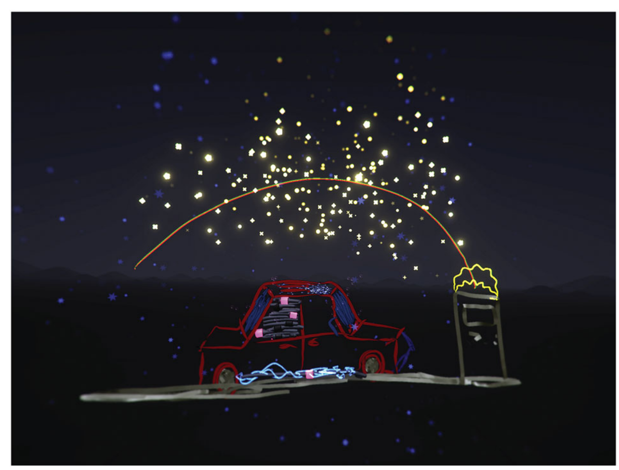

Figure 4. Example of Artwork of a Childhood Memory Created by 27-Year-Old Male Participant: *"Since my childhood, I have not engaged with art much. Whenever I drew something, it was a car. So, it represented my childhood."*

respiration, and cardiac cycle effects (Ayaz et al., 2011). Each participant's data were inspected for any (1) potential saturation (when light intensity at the detector was higher than the analog-to-digital converter limit); and (2) motion artifacts caused by the movement of the sensors or the head. The contamination from the motion artifacts is mitigated by the sliding-window motion artifact rejection (SMAR) method (Ayaz et al., 2010). After pre-processing, fNIRS data for each condition block were extracted using time synchronization markers indicating onset and completion of each condition.

Table 1. Directive Script for Rote Tracing Task

***Rote Tracing Condition* (5 minutes)**
1. Trace the purple circles, starting from the smallest to largest circle. Please time your time and trace the dotted lines as accurately as possible. When you finish, please repeat this step. (1 min)
2. Remember to take your time and trace as accurately as possible. Trace the orange triangles, starting at the top and going clockwise. When you finish, please repeat this step. (1 min)
3. Remember to take your time and trace as accurately as possible. Trace the green squares, starting at the top and going clockwise. When you finish, please repeat this step. (1 min)
4. Remember to take your time and trace as accurately as possible. Trace the small blue circles and the yellow diamond. When you finish, please repeat this step. (1 min)
5. Remember to take your time and trace as accurately as possible. Retrace the purple circles, starting from largest to smallest circle. When you finish, please repeat this step. (1 min)

Validity

Table 2. Directive Script for Creative Self-Expression Task

***Creative Self-Expression Condition* (5 min)**
1. Select and try different brushes. Select a brush you would like to draw with. Any questions before you begin? (1 min)
2. Select one brush and begin creating a scribble in front of you. (1 min)
3. Look at the scribble and try to find shapes or images that you can create from your scribble. You may use different colors and brushes. There is no right or wrong way to add details to your scribble. Any questions? (1 min)
4. Continue to add details to your image. (1 min)
5. While you add any final touches to your image, silently reflect on any meanings or associations you may have to your drawing. (1 min)

In this interdisciplinary collaboration, consistent with biomedical study designs, the drawing tasks were operationalized with consistent scripts and time bounds, and, the conditions were randomized for each participant to minimize any practice effects. fNIRS served as an objective biomarker of PFC activation in response to drawing tasks. To ensure minimal bias, all data were aggregated and analyzed independent of identifying information on participants or experimental conditions.

Data Analysis

Oxygenated and deoxygenated hemoglobin concentration changes for each of the 16 optodes during each condition block were calculated from the pre-processed light intensity data via the modified Beer-Lambert law (MBLL), separately for each block. The hemodynamic response for each optode was averaged across time for each condition block. The final output of each optode was the average oxygenated-hemoglobin (oxyHb) level for each condition. The differences were first compared between creative visual self-expression and rest conditions and then compared across conditions and artistic skill using a two-way repeated measures ANOVA, with gender and age included as covariates. The PFC activity differences were compared using linear mixed-effects models with repeated measures using NCSS 2020 software. Within fixed factors for the model were artwork (creative visual self-expression vs. tracing conditions) and fragrance (with and without) as well as gender and age included as covariates.

Results

The results indicate that there were consistent and significant differences in PFC activation between the tracing condition and the creative self-expressive artmaking. Although there was no distinct effect of fragrance in each condition, emerging differences were seen by the age and gender of the participants.

Tracing vs. Creative-Self-Expressive Artmaking Main Effect

There was significantly lower oxy-Hb activity during creative-self-expressive vs. tracing task (main effect) at optode 3 ($F_{1,860.8} = 12.888$, $p = 0.0003$), optode 5 ($F_{1,853.1} = 28.417$, $p < 0.0001$), optode 6 ($F_{1,865.3} = 5.209$, $p = 0.0227$), optode 7 ($F_{1,866.3} = 19.755$, $p < 0.0001$), optode 8 ($F_{1,854.3} = 19.882$, $p < 0.0001$), optode 9 ($F_{1,859} = 27.920$, $p < 0.0001$), optode 10 ($F_{1,828.7} = 17.661$, $p < 0.0001$), optode 11 ($F_{1,847.2} = 23.661$, $p < 0.0001$), optode 12 ($F_{1,849.7} = 14.056$, $p = 0.0002$), optode 13 ($F_{1,867.4} = 16.068$, $p = 0.0001$), optode 15 ($F_{1,783.9} = 9.3419$, $p = 0.0023$).

Fragrance Main Effect

There was a significant fragrance (with vs. without) the main effect only at optode 6 ($F_{1,880.7} = 3.915$, $p < 0.05$). The oxy-Hb activity was lower when fragrance was present.

Artwork and Fragrance Interaction

There was a significant interaction only at optode 13 ($F_{1,867.4} = 5.548$, $p = 0.0187$) as depicted in Figure 5.

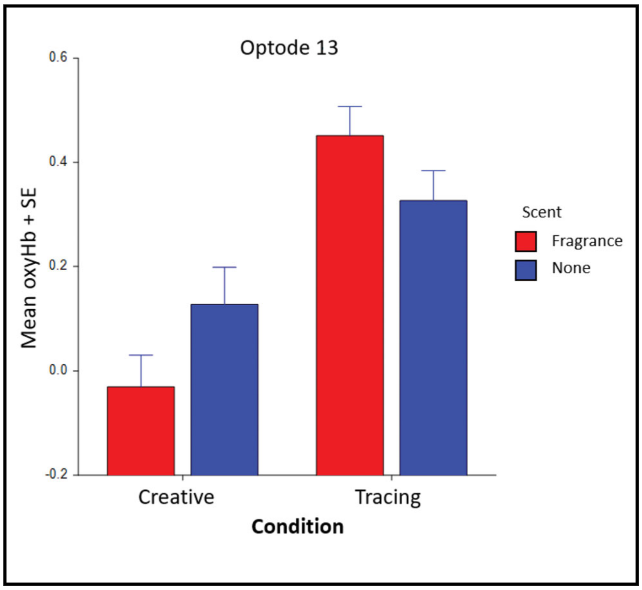

Figure 5. Average oxyHb Changes for All Participants Indicating an Interaction for Creative Expression at Right Medial Anterior Prefrontal Cortex (Optode 13)

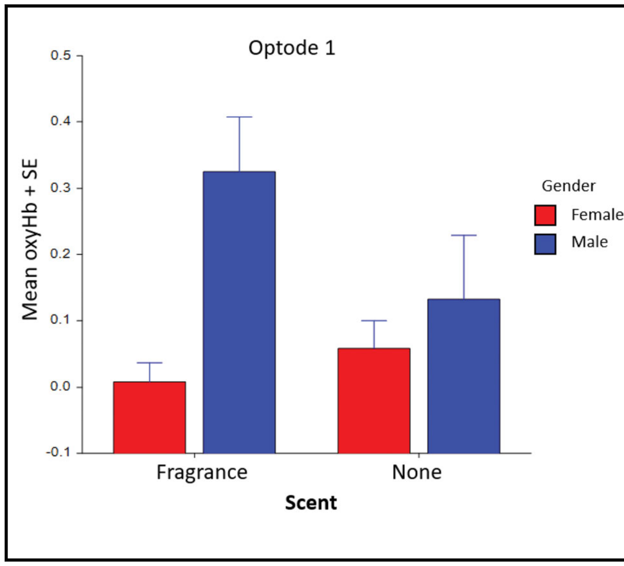

Figure 6. Average oxyHb Changes for All Participants Indicating an Interaction of Gender and Fragrance at Left Lateral Anterior Prefrontal Cortex (Optode 1)

Age Differences

For creative-self-expression tasks, there were significant interactions of drawing with age at optode 5 ($F_{1,853.1} = 14.825, p = 0.0001$), optode 7 ($F_{1,866.3}=10.2062$, $p = 0.0015$), optode 8 ($F_{1,854.8} = 4.6582$, $p = 0.0312$), optode 9 ($F_{1,859} = 14.262$, $p = 0.0002$), optode 11 ($F_{1,847.2} = 9.988$, $p = 0.0016$), optode 13 ($F_{1,867.4} = 7.233$, $p = 0.0073$), optode 15 ($F_{1,783.9} = 5.826$, $p = 0.0160$). For Fragrance with age, only optode 7 was significant ($F_{1,877.9} = 4.552$, $p = 0.0332$).

Gender Differences

There were significant interactions of gender with creative self-expression at optode 1 ($F_{1,850.8} = 5.727$, $p = 0.0169$) laterally symmetric optode 15 ($\mathrm{F}_{1,783.9} = 5.521$, $\mathrm{p} = 0.019$). There were also significant interaction with fragrance at optode 1 ($F_{1,860.1} = 8.497$, $p < 0.004$) (shown in Figure 6), optode 3 ($F_{1,867.5} = 4.7853$, $p < 0.03$), optode 5 ($F_{1,858.4} = 5.14$, $p < 0.024$) and optode 6 ($F_{1,871} = 4.96$, $p < 0.027$).

Discussion

In this study, we examined the differences in PFC activation between two distinct drawing tasks in VR including with the introduction of a calming fragrance stimulus. To the best of our knowledge, this is among the first studies to examine the relationships between PFC activation (as measured using fNIRS) and visual artmaking using digital media such as VR.

For the first research question, the study findings indicate that there were sustained and significant differences in PFC activation between the rote visual tracing task and the creative-self-expressive artmaking task. This indicates that the conscious mental effort required to do the focused and repetitive task of rote tracing, by following a pre-drawn pattern, resulted in higher PFC activity than that of the creative self-expression tasks. Confirming the hypofrontality hypothesis in flow mode wherein fears of failure, time, and self-reflective processes disappear (Dietrich, 2003), it is possible that the creative expressive artmaking task activated other parts of the brain including long-term memory centers, the limbic system, and additional inner brain regions. The study protocol for the creative self-expression part included a guiding script inspired by the clinical practices of art therapy. The directives were created also to align with the experimental method enabling comparable conditions between the rote task and the creative task. Derived from the scribble drawing task in art therapy, the directive-led creative self-expression task also invited participants to engage in a task that was not externally defined, rather it engaged the participant's own memory and self-defined image which could potentially reduce the need for conscious executive functioning and induce a relaxation response. The creative task condition directives derived from art therapy principles invited participants to create whatever they liked without judgment on the esthetic quality of the artwork: only personal association and meaning. The clear guidelines indicating that the artwork was a way to engage in the process (and not worry about the art product or artistic abilities) could have led participants to function more like improvising experts rather than as novices such that scripted drawing mimics artistic skill. This role of a facilitating presence and guiding scripts (Rosen et al., 2017) operationalized in this study are a way to measure the impacts of art therapy with different drawing tasks.

As found in studies on musical improvization (Erickson et al., 2018; Limb & Braun, 2008), the findings highlight the role of reduced PFC load in creative expression. The facilitated support of the art therapist providing the guiding script potentially enabled participants to let go of conscious cognitive effort and likely move into a more intuitive visual self-expressive mode. Our findings highlight the potential benefits of creative self-expression as a way to reduce conscious control and invite engagement of multiple parts of the brain including possibly entering a state of flow (Csikszentmihalyi, 1992).

For the second research question, we examined the impact on the impact of fragrance diffused in the room. Participants were blinded to the fragrance and as can be seen from the results, there was no significant impact of the fragrance stimulus overall on PFC activation. However emergent trends were seen when examined by age and gender. PFC activation was lower for women for both the creative self-expression and tracing tasks in the fragrance session compared with the no-fragrance session indicating that the fragrance induced the expected effect of enhancing relaxation and reduced mental load. Although women in general are considered to be more sensitive to smells (Sorokowski et al., 2019) in our study male participants seemed to have experienced a differential impact of the presence of fragrance. It was expected that the impact of fragrance would be in enhancing relaxation including medial PFC activation and the role of smell in evoking memories (Willander & Larsson, 2006; Wilson & Stevenson, 2003). Similarly, there were some interactions related to age on optode 7. These emergent trends in the activation of the PFC with age and gender need further study to draw definitive conclusions.

Practical Implications

Given that the rote task was repetitive (requiring participants to engage in a focused motor activity of tracing over a pre-drawn shape), a potential clinical applications of this finding around tracing using VR could be that it is a way to activate attention and bring participants to activate the PFC as needed, especially if executive functioning is a challenge. Similarly, the creative self-expressive tasks in VR could be a way to reduce PFC load and engage multiple brain regions including initiating of a relaxation response (Kaimal et al., 2016), meditative feelings (Kruk et al., 2014) and flow-like responses. A related behavioral study (Kaimal et al., 2020) found that participants almost unanimously reported finding the rote tracing experience as boring and enjoying the creative self-expression tasks more. Building on existing findings around creative expression and reduced PFC activity, these findings lend credence to the differential roles of VR-based rote and creative self-expression in promoting goals of health and well-being. Recognizing that repetitive or boring tasks might also have benefits of focusing attention can be used by art therapists to activate conscious and unconscious engagement among patients using digital media tools. The findings also highlight how drawing tasks can potentially be used in tandem to engage different brain networks in patients.

Limitations

The study has a small sample size, and the findings need to be replicated in a larger fully powered trial in order to be able to generalize the results. The study protocol itself was designed to align with the measurement tools and although inspired by art therapy practice, the actual artmaking time was much shorter than is typically seen in a regular therapy session. The physical set up and weight of the fNIRS band and wires as well as the VR headset could have impacted the participants' experiences and responses. Participants were blinded to the presence of fragrance stimulus and only two participants reported noticing the diffused fragrance in the room. It is possible that with a more pronounced fragrance stimulus as well as different types of fragrance options (in this study we used a calm-inducing fragrance) the findings might have been different. The findings around gender also need to be interpreted with caution because there were many more women than men in our study.

This study also points to several areas for further research. Given that the sessions with directives for the creative self-expression condition led to a relaxation response with lower activation of the PFC, future studies might examine differences between facilitated sessions versus self-led creative visual expression. The scripted directives are an example of how art therapy facilitation can be operationalized for imaging studies. Future studies might examine the differences between facilitated forms of creative self-expression compared with self-led efforts including comparing artists and non-artists. Studies might also examine differences between VR artmaking and artmaking with traditional tools to see if the responses are comparable.

We only used one fragrance which was designed to be calming. Outcomes might be different if the fragrance was meant to be simulating or promote other mood states. This study also focused on a relatively high functioning and healthy population of mostly young adults. The findings need to be examined for clinical populations. The outcome of facilitated relaxation enhanced further by fragrance could be of value to hospitalized patients, those who are immune-compromised and unable to freely interact with others, and those who are unable or psychologically impaired by movement and creative expression.

Conclusions

In this study, we reported the findings from two visual tasks in VR. Increased PFC load was seen with rote visual tasks like tracing. Relatedly there was reduced PFC activation for creative self-expressive tasks indicating a possible relaxation response. A diffused fragrance was not found to impact the outcomes, but emergent differences were seen by age and gender indicating areas for further research.

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