Art in Hospitals Project

Psychophysiology experiment

Baceviciute, Sarune; Bruni, Luis Emilio; Burelli, Paolo; Wulff-Jensen, Andreas

Publication date:
2016

Document Version
Version created as part of publication process; publisher's layout; not normally made publicly available

Art in Hospitals Project
Psychophysiology experiment

Sarune Baceviciute, Luis Emilio Bruni,
Paolo Burelli, Andreas Wulff-Jensen

The Augmented Cognition Lab,
Aalborg University Copenhagen

1. Study Goals

The idea of this pilot experiment within the context of the "Art in Hospitals" project was to explore the fruitfulness and future perspectives for integrating psychophysiological methods to the ethnographic approach so far implemented in the project. As a pilot study it serves to open the doors to experimental avenues that can support the ethnographic investigation. Therefore in order to form a basis for applications of these methodologies in future studies in the field, this pilot was concentrated in one of the initial premises of the project, which intended to challenge current recommendations for art in hospitals. Most of these guidelines favor figurative over abstract art, based on ideas leaning to the emotional congruence theory, which would claim that abstract art leads to ambiguity and therefore it could augment the current emotional base-line of an already stressed patient. The early ethnographic studies of the "Art in Hospitals" project challenged this perspective by investigating the positive or negative effects of "lower-level" specific features (e.g.: bright colors vs. darker, contrast, predominant shapes) independent of whether they were present in abstract or figurative art, which as such could not be said to have universal positive or negative effects respectively. In this sense it was retained necessary to assess whether significant differences can be detected in cognitive processes when processing figurative or abstract art that has been manifestly reported as pleasant or unpleasant by the subject – by providing a sample of stimuli that could statistically contain both liked and disliked art pieces in two conditions (abstract and figurative), under the assumption that it is not, abstract or figurative art *per se*, that makes the difference. In other words, one may expect a significant difference in cognitive processing between the abstract and figurative condition, but this difference in processing mode (or effect) would not have necessarily to correlate with the subject's aesthetic experience, whether he or she enjoyed the painting or not.

2. Method

2.1. Experimental design

In order to carry out a psychophysiological analysis of the viewer's experience while viewing art paintings, we have designed an experiment that features the absolute power of different frequency bands (i.e. *delta, theta, alpha, beta* & *gamma*) as the EEG parameter to be considered, and which tracks eye movement (i.e. *gaze positions and pupillometry*) in two primary experimental conditions: i) abstract paintings condition and ii) figurative paintings condition. In order to manage high intra-individual variability and create viable EEG averages, each of the two conditions was designed to encompass 20 experimental stimuli (i.e. a total of 40 paintings), which were pre-selected and assigned to each condition by an external contributor (*see rationale and procedures below*). In order to comply with the standard EEG epoching and segmentation procedures, the viewing of each painting was decided to last for a period of 40 seconds. The rationale here was also to provide enough time for the participants to analyze and interpret the paintings. The sequence of appearance of the paintings was completely randomized for each participant and each painting was shown only once. To reduce error variance associated with individual differences, a within-subjects design study was chosen for the experiment. As the aim was to carry out a fully-controlled lab study (due to sensitive psychophysiological measurement procedures), and because of the strict synchronization requirements between the different signals, digital representations of actual paintings were chosen to be shown instead of their original or printed counterparts.

In order to obtain baseline EEG measurements (for later elimination of any voltage offsets from the signals), the experimental design included two additional conditions: i) a pre-session baseline of 80 sec (open-eye, grey screen with a fixation cross), and ii) a rest period of 5 sec before the appearance of each painting (open-eye, grey screen). Open-eye baseline measurements were chosen due to the fact that visual stimuli are used in the experimental design.

To obtain participants' subjective evaluations of paintings, a questionnaire was designed and shown after the viewing of each painting. The questionnaire asked the participants to rate their aesthetic experience with the painting (e.g., by choosing among three categories of *pleasant*, *unpleasant* and *none*) and to indicate if they have seen the painting before. The questionnaire was designed to appear automatically after the viewing of each painting, it remained identical for each painting and the time spent for its completion depended on every individual subject.

As an additional objective, the aim was to gather psychophysiological data from the 10 paintings used in the second ethnographic study carried out in the prior stage of the "Art in Hospitals" project. Due to the small amount of paintings utilized during the ethnographic study (and their abstract/figurative ratio), it was not possible to carry out any viable EEG measurements on the 10 paintings. Similarly, in order not to introduce bias to the selection of experimental stimuli, the 10 paintings of the ethnographic study could not be mixed together with the other paintings used in the lab experiment. Therefore, only eye-tracking measurements were decided to be included for the 10 paintings used in the hospital setting. The presentation of these paintings was decided to be incorporated at the end of the experiment, after the presentation of the main experimental stimuli in order to provide some eye-tracking data for the ethnographic study. These paintings were shown following the same experimental design guidelines described above.

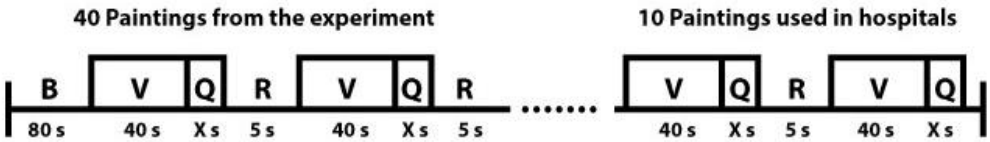


Figure 1 - Experimental sequence: B – Baseline; V – Viewing of the images; Q – Questionnaire, R -Rest

2.2. Selection of Paintings

In order to select the paintings to be used as stimuli for the two experimental conditions a voluntary participant was chosen with the criterion that he/she had to be a faithful representative of the eventual study population that was to be later recruited. The participant was selected with the following pre-requisites: i) no formal training in visual arts; ii) not considered a professional in visual arts (by himself and others); iii) have a general interest in visual arts. These pre-requisites were set to assure that the selection of paintings was not arbitrary (by the research group), and at the same time that it was not influenced by a trained pre-defined stylistic or artistic preference. The recruited participant was a 27-year old male student from the Sound and Music Computing education at Aalborg University Copenhagen.

The paintings were selected from the Tate Gallery's digital online database. The participant was instructed to choose 60 paintings – 30 for each category. In order to ensure that there is a variety of styles represented in both abstract and figurative paintings, the participant was instructed to select paintings from five different time periods (16th-17th century; 18th century; 19th century; 20th century 1900-1945; 20th century post -1945). Furthermore, the participant was instructed to select the abstract and figurative paintings according to his taste so that 50 % were to his liking and 50 % to his distaste (under the assumption that probabilistically this would assure a similar *relative* percentage distribution of likes and dislikes in the sample population). 40 of these paintings were finally selected to be used in the experiment (20 abstract and 20 figurative), eliminating duplicates in similarity and style, and those that could be considered borderline abstract or borderline figurative (see Appendix1 for the final list of paintings used during the experiment).

2.3. Test Participants

A total of 30 subjects participated in the experiment. The sample was selected to represent a diverse population from various cultural and ethnical backgrounds, occupations and age groups. In order to account for the possible differences in brain processing that might occur when comparing artist and non-artist populations, this study focused exclusively on non-artists. Therefore, the final sample consisted of subjects that do not consider themselves artists, and excluding those that had any prior professional training in visual arts, such as fine arts or plastic arts (set as a pre-condition during the recruitment process). Since the testing population focused only on healthy participants, the sample was also selected with a pre-condition of not being diagnosed with any neurological illness or a neurological disorder.

A total of 20 males and 10 females with an average age of 24.6 (s=4.6) were recruited for the study. The final sample mostly consisted of staff and students of Aalborg University Copenhagen, however from 4 different international educations. Participants were recruited via the internal university email system and through various social networking platforms. The participation in the study was voluntary and each of the participants was rewarded with a gift certificate for their participation. In order to ensure optimal EEG recordings, the participants were instructed not to consume any caffeinated or alcoholic substances a day prior to the experiment and were asked to minimize the use of hair products on the day of the study. Each of the subjects in the study was asked to consent to the procedures, informing of any discomfort and confidentiality issues associated with their participation through a written consent form.

2.4. Experimental Procedures

The experiment took place at the Augmented Cognition Lab at Aalborg University Copenhagen. Upon arrival, the participant was greeted at the laboratory facilities and debriefed about the procedures of the experiment. Subsequently, the participant was asked to fill out a demographic questionnaire and to sign the consent form. The EEG cap was mounted on the participants head, performing a standard signal quality check for all electrodes, following by the calibration of the eye-tracking device. At last the participant was guided through the experimental sequence and introduced to the subjective rating questionnaire. One test session per subject took around 90 minutes to complete, including the mounting of the psychophysiology measurement equipment and pre-testing. Participants were seated in a comfortable condition and were asked to keep as still as possible during the entire procedure, to minimize the possible signal interference due to movement.

3. Psycho-physiological Data Acquisition and Recording

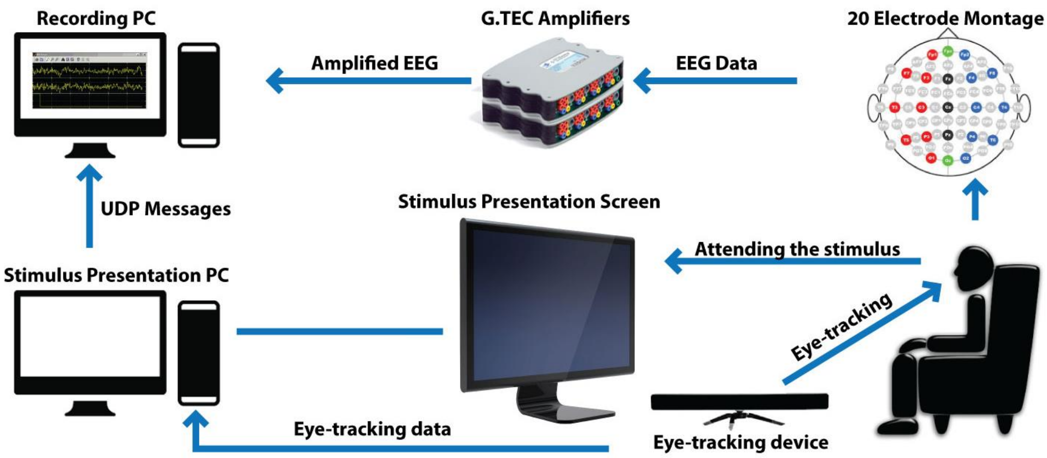


Figure 2 - Diagram of the experimental set-up for psycho-physiological data acquisition and recording

3.1. Signal Acquisition Hardware

For recording EEG data, we used a g.Tec (g.Tec Medical Engineering, Austria) hardware system consisting of two g.USBamp bio-signal amplifiers, g.GAMMA box, g.GAMMA extension box, g.Cap with an array of 20 active electrodes plus reference and ground. Electrodes were positioned according to a standard referential full-scalp electrode montage, based on the international 10-20 system (Fp1, Fp2, Fz, Cz, Pz, F3, F4, F7, F8, C3, C4, T7, T8 , P3, P4, P7, P8, O1, O2, OZ). The reference electrode was placed on the right earlobe, while the ground electrode was set at the Fpz position. EEG data was collected unfiltered, using 256 Hz sampling rate. The recording of the signals was done on a separate PC (see *Stimulus Recording PC* on figure 2).

Eye-tracking data was recorded using the stationary Eye tribe eye-tracker with 60 Hz sampling rate. The eye-tracker was calibrated using the native Eye tribe calibration system, set to 12-point mode. During the experiment, the following eye data was tracked and recorded: i) x and y coordinates for the on-screen gaze positions of the eyes, ii) pupil dilation for right and left eyes iii) x and y coordinates for on-screen left and right eye positions. The calibrations and recording was carried out on the stimulus *Presentation PC*, and the recorded data was sent to the *Recording PC* via UDP networking (see figure 2). The recorded eye-tracker data was additionally stored as a .txt file on the *Presentation PC*.

3.2. Stimulus Presentation Hardware

Experimental stimuli were presented on a 27'' computer screen, with a 2560x1440 spatial resolution (see *Presentation PC*, figure 2), which was chosen to comply with the eye-tracker specifications. The participants were placed about 50-60 cm from the screen to obtain optimal eye-tracking area, minimize head movement and to obtain an appropriate field of view for the participant. The original proportions of the paintings were maintained, however the size was scaled to fit the screen dimensions. All of the paintings were centralized to the middle of the screen for efficient psychophysiological signal acquisition procedures.

3.3. Software for stimulus presentation

To run the aforementioned experimental design conditions, custom-made stimulus presentation software was implemented using Unity3D. The application was implemented to handle the following functions: i) present the stimuli, ii) randomize the stimuli presentation order, iii) present baseline experimental conditions iv) assign unique identification triggers to each of the presented conditions, v) send the triggers to the EEG recording computer, vi) present the questionnaire to the participants, vii) save the questionnaire answers. See figure 3 for a visual representation of the software. The stimulus presentation software application was run on the *Stimulus Presentation PC* (see figure 2).

Figure 3 – Screenshots, visualizing the stimulus presentation software: left- 80s baseline screen; mid-left - stimulus presentation; mid-right - questionnaire; right - rest period

3.4. Software for data synchronization and EEG recording

For recording and synchronizing the acquired EEG and eye-tracking data and for receiving unique triggers from the stimulus presentation software, a MATLAB patch was implemented, utilizing g.HIsys Simulink high-speed on-line processing block-set from g.tec. The implemented Simulink model contains (see figure 4): two amplifier blocks for receiving signals from the EEG signal acquisition hardware components, a signal quality check block (set to check the signal according to the standard deviation of a running sample of 1000ms voltage signal at a 2.5-25 microvolt range), the signal filtering blocks (band pass filter from 0.01Hz-60Hz and a 50Hz notch filter, used only for real-time visualization), the scope block, for real-time visualization of the signal, the UDP receiver blocks (one for receiving the eye-tracking data, and one for receiving the trigger data), data conversion blocks, and a block for saving all the data in one file. The MATLAB patch was run on the *Recording PC* (see figure 2).

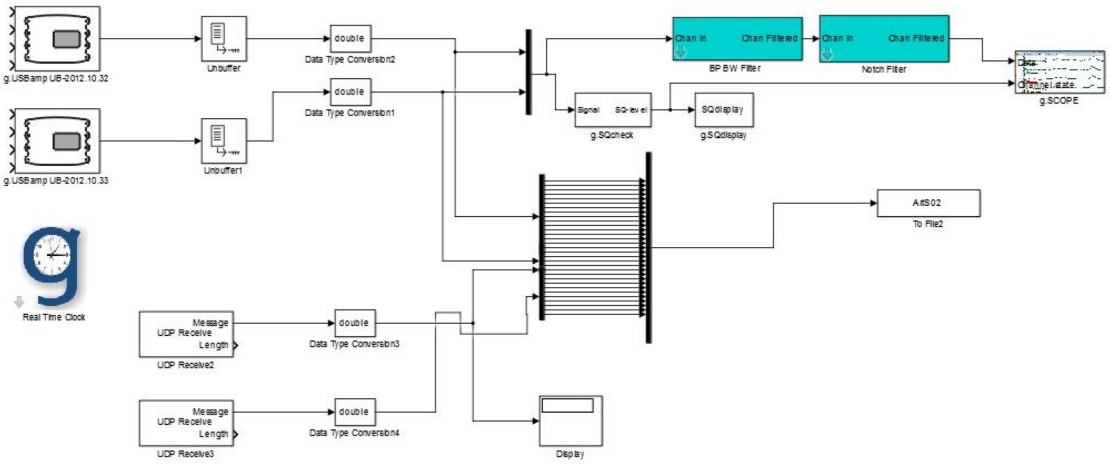


Figure 4 - Simulink model for EEG Recordings and Data Synchronization

4. Analysis of psychophysiological signals

4.1. EEG Data Analysis

EEG data analysis was performed using g.BSanalyze bio-signal offline processing toolbox and analysis software (g.tec). Data was filtered using a band pass filter with lower cut-off frequency set to 0.5 Hz and upper cut-off frequency set to 100 Hz. Additionally, a notch filter was applied with low cut-off frequency set to 48Hz and high cut-off frequency set to 52 Hz. All filters applied used a Butterworth filter realization with filter order of 5. The filtered data set was triggered into 40 trials, with unique triggers assigned to group the images into one of the two experimental conditions (i.e. Trigger1 for 20 trials of abstract paintings and Trigger2 for 20 trials of figurative paintings). Additional triggers were implemented for distinguishing the baseline, rest and questionnaire conditions. Data gathered from participants 1, 3, 8, 10, 23 and 30 was eliminated from data analysis due to bias introduced in the experimental set-up or do to overly noisy or insufficient recording data-sets.

To compute absolute band power measurements in certain frequency ranges a band-pass filter with the Fast Fourier Transformation (FFT) filter realization was used. The band-pass filter was set to 0,5-3 Hz for Delta, 4-7 Hz for Theta, 7-13 Hz for Alpha, 14-32 Hz for Beta and 34-46 for Gamma. FFT was calculated on 500ms long segments (128 samples), with an overlap of 496ms (127 samples) for all channels. The computed band powers were then averaged across all 20 trials in one experimental condition per subject per electrode. Individual averages were baseline-corrected, with reference interval set to 500ms before the onset of the stimulus (i.e. the rest period). Statistical significances between the two experimental conditions were computed using the Mann-Whitney-U-Test with a significance threshold of 0.05. This analysis resulted in a total of 2400 graphs, visualizing significant differences between the two experimental conditions for each electrode per subject for each band-power (see figure 5 for exemplary visualizations). These graphs were manually inspected and quantified in excel tables (one per specific frequency range) to find out if, and how often, activation in a specific frequency band was significantly more predominant when comparing conditions.

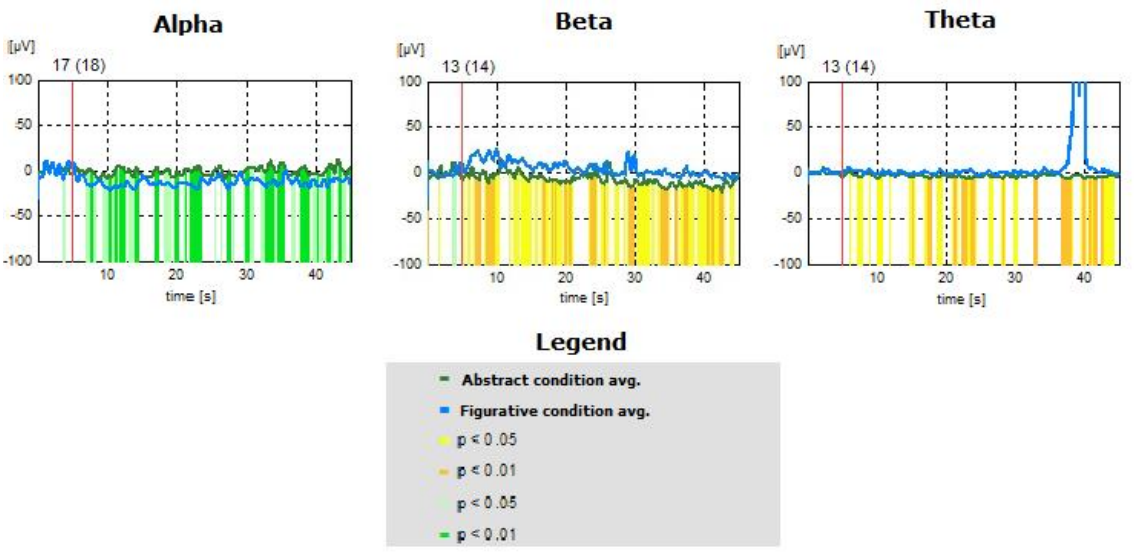


Figure 5 - Exemplary statistical significances (Mann-Whitney-U-Test) in Alpha (subject 26, T8), Beta (subject 13, O2) and Theta (subject 15, P7) when comparing abstract and figurative conditions: Yellow/Orange lines - band powers are significantly higher for figurative paintings; Green lines - band powers are significantly higher for abstract paintings.

4.2. Eye-tracking Data Analysis

Due to time limitations, for this experiment, eye-tracking data was computed only for the 10 paintings from the hospital. The eye-tracking data was analyzed using the Ogama software (OpenGazeAndMouseAnalyzer). Data gathered from participants 4 and 6 were omitted from further analysis due to incomplete data sets and poor calibration procedures. Each on-screen gaze position recorded by the eye-tracker was converted to a fixation point. For a classification of a fixation point, the maximum gaze position was set to a 160 pixels distance from previous sampled gaze position and the minimum number of samples was set to 6 Hz. Fixation detection ring size was set to 31. The data was utilized to create an attention map to visualize the landscape of visited and unvisited screen locations on the stimuli. The attention map was calculated for each participant per painting and then a cumulative attention map was produced for all participants per each painting. The attention maps were calculated as aggregated Gaussian distributions of each fixation in a stimulus presentation. The summed Gaussian distributions were then overlaid on the original stimulus presentation. A Gaussian kernel seize of 201 was used for the calculations.

5. Results of the Eye-tracking study for the 10 hospital paintings

Preliminary cumulative attention map analysis for 10 paintings used in the hospital showed that during the experiment the participants did spend most of their time looking at the paintings presented on the screen, as opposed to wondering out of the boundaries of the paintings. Additionally, it was observed that in paintings, which had spatially more homogeneously distributed visual elements most of the participant's visual attention was focused towards the central areas of the painting, and their less prominent eye fixations were more disperse throughout the entire space of the painting. On the other hand, in paintings that had visually more salient elements (i.e. shapes, as in painting 10, contrast as in painting 8, and objects as in painting 6) the attention maps showed more prominent fixations on these elements. The only figurative painting (painting 6) included in this analysis did not reveal any particularly different fixation patters for the subjects, and therefore a valid comparison between abstract and figurative paintings cannot be made. See Appendix 2 for visualization for all 10 attention maps produced in this study.

6. General Results and Discussion

Band power analysis for the five investigated frequency bands revealed that largest significant differences between the two conditions (abstract and figurative) were apparent in Theta, Alpha and Beta activations (see Table 1). Theta activation was observed to be significantly higher in figurative paintings, with Theta activity observed in 14 subjects in the figurative condition and in 5 subjects in the abstract condition. Beta activations were observed to be more prominent also in the figurative condition, as significantly higher Beta activity was seen in 10 subjects in comparison to only 3 subjects exhibiting Beta activity in the abstract condition. The Alpha frequencies were on the other hand observed to be significantly more prominent in the abstract condition, as Alpha activation was observed to be significantly higher for abstract paintings in 12 participants and only in 4 subjects for figurative paintings. Significant differences were found to be less prominent and equally distributed in Gamma and Delta activations when comparing the two conditions.

Figurative	6 subjects	14 subjects	4 subjects	10 subjects	4 subjects
Abstract	7 subjects	5 subjects	12 subjects	3 subjects	5 subjects
	Delta	**Theta**	**Alpha**	**Beta**	**Gamma**

Table 1 - Statistically significant differences observed in individual subjects when comparing abstract and figurative experimental conditions in the five frequency bands

Band power analysis additionally showed that if activation in a specific frequency band was observed to be significantly stronger in one experimental condition, it remained constant across the different electrodes for that person (i.e. significantly larger activation was observed only in abstract or figurative paintings, but never in both, across all electrodes in a subject). Finally, the band power analysis revealed that frequency activations were distributed throughout the scalp, however with slightly more prominent activation in Temporal, Central, Parietal and Occipital areas (i.e. T7, C3, Cz, C4, T8, P7, P3, Pz, P4, P8, O1, Oz, O2).

Even though there is a lack of consensus in the EEG community about how to interpret activations of different frequency bands, several existing trends could be discussed in relation to the results obtained in this study. Alpha activity has traditionally been considered as an indicator of inhibited cognitive activity (see for e.g. Kilimesh (1999)). However, even though alpha activity is often thought to represent an idle non-processing state, in more recent years many authors suggest that alpha activation can be associated to conscious inactivation, relaxation (e.g. Swingle, 2008 and Dietrich & Kanso, 2010) and divergent thinking (Fink et al., 2006 and Dietrich & Kanso, 2010). Since our results show a tendency towards more prominent alpha activation in abstract paintings than figurative paintings, it could be plausible to postulate that less cognitive processing is necessary when viewing abstract art. This finding can be further supported with the tendency of increased Theta activity in figurative paintings. Several studies have associated increased Theta activation with maintenance of information in working memory (Kilimesh et al., 1999), retrieval of information (Sauseng et al., 2004) and recall of information stored in long-term memory (Li, et al., 2009). Based on this, we could postulate that figurative art viewing potentially involves more demanding information retrieval and memory-related cognitive processes than abstract art. Beta activity, on the other hand, is often associated with increased alertness and more active thinking (Dietrich & Kanso, 2010). Since our results indicate that Beta activity was more prominent in figurative paintings than abstract, it could furthermore be hypothesized that processing of figurative art requires more mental engagement when compared to abstract art. Based on this it could seem to be counter-intuitive the fact that abstract art - with a lesser demand in cognitive load with respect to figurative art - could be generally considered to be anxiety-provoking by virtue of its alleged ambiguity, independently of its aesthetic effects on particular subjects.

To see if there was a difference between subjective aesthetic experience ratings in abstract and figurative experimental conditions, the frequency of appearance of each rating (with possible ratings of *pleasant*, *unpleasant* and *none*, with the total number of self-report ratings in the experiment being 1160.) was calculated. Calculations revealed that participants have rated their aesthetic experience very similarly in both experimental conditions, with “pleasant” ratings assigned 323 times to the figurative paintings and 251 times to abstract paintings, “unpleasant” ratings given 205 times to figurative paintings and 234 to abstract paintings, and with “none” rating indicated 52 times for figurative and 95 times for abstract paintings. The scarcity of ratings assigned to the “none” category indicates that participants did not have much difficulty in deciding whether their aesthetic experience during the viewing of the painting was either positive or negative. These results support our preliminary assumption for selecting the art works based on the preferences of an anonymous volunteer representative of the target audience for the sample.

	Pleasant	**Unpleasant**	**None**
Figurative	323 times (27.85%)	205 times (17.67%)	52 times (4.48%)
Abstract	251times (21.64%)	234 times (20.17%)	95 times (8.19%)

Table 2 - Frequency of subjective rating assignment, percentages calculated relative to total number of ratings for both experimental conditions

Put together, the EEG measurements and the subjective ratings of the questionnaire, seem to indicate that even though the two conditions elicit distinct cognitive processing modes, it doesn't seem to be warranted to claim that this fact can *per se* elicit a pleasant or unpleasant effects on the subject, but rather seems to support that it will be the particular qualities and features of the specific artwork (be abstract or figurative) that may have positive or negative effects according to individual preferences, personal history and context.

The results of this exploratory study give a good indication that future work could be concentrated in investigating the Theta and Beta activations as a marker for reactions to figurative paintings and Alpha activation as a marker for reactions to abstract paintings. Further mappings could be refined by triangulating with specific questionnaires and eye-tracking data that considers specific features such as colors, brightness, contrast, shapes, and composition for instance.

Works Cited

Dietrich, A., & Kanso, R. (2010). A Review of EEG, ERP, and Neuroimaging Studies of Creativity and Insight. *Psychological Bulletin*, 822–848.

Fink, A., Grabner, R. H., Benedek, M., & Neubauer, A. C. (2006). Divergent thinking training is related to frontal electroencephalogram alpha synchronization. *European Journal of Neuroscience*, 2241–2246.

Klimesch, W. (1999). EEG alpha and theta oscillations reflect cognitive and memory performance: a review and analysis. . *Brain Research*, 169-195.

Klimesch, W., Doppelmayr, M., Schwaiger, J., Auinger, P., & Winkler, T. (1999). Paradoxical alpha synchronization in a memory task. *Cognitive Brain Research*, 493-501.

Li, Y., Umeno, K., Hori, E., Takakura, H., Urakawa, S., Ono, T., et al. (2009). Global synchronization in the theta band during mental imagery of navigation in humans. *Neuroscience Research*, 44 - 52.

Sauseng, P., Klimesch, W., Doppelmayr, M., Hanslmayr, S., Schabus, M., & Gruber, W. (2004). Theta coupling in the human electroencephalogram during a working memory task. *Neuroscience letters*, 123 - 126.

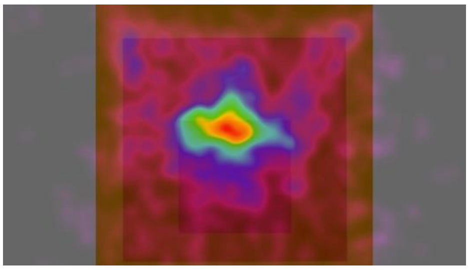
Swingle, P. G. (2008). *Biofeedback for the brain: How neurotherapy effectively treats depression, ADHD, autism, and more.* New Brunswick, NY: Rutgers University Press.

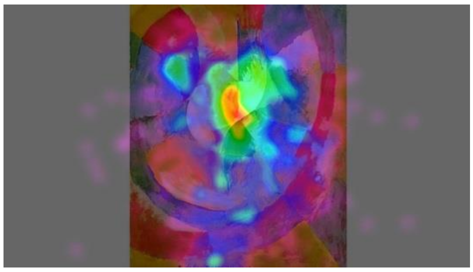
Appendix

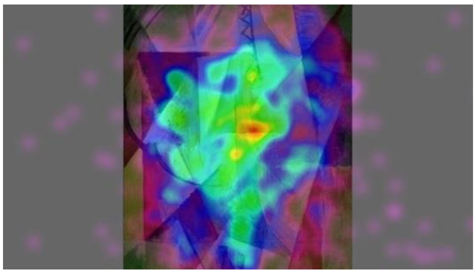
1. Appendix 1: List of Paintings Used as the Primary Experimental Stimuli

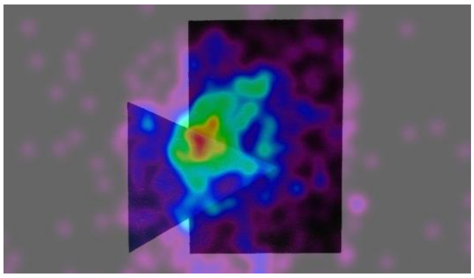
ID	Category	Title of the Painting, Author, Year
1	Abstract	Dottori - Explosion of Red on Green (1910)
2	Abstract	Frost - Khaki and Lemon (1956)
3	Abstract	Hartung - (1982)
4	Abstract	Innes - Three Identified Forms (1993)
5	Abstract	Lalic - History Painting (1995)
6	Abstract	Nagy - VII (1922)
7	Abstract	Pollock -Number 23 (1948)
8	Abstract	Richter - Abstract Painting 2 (1990)
9	Abstract	Williams - Dry Creek Bed (1977)
10	Abstract	Turner - Moses writing the book of Genesis (1843)
11	Abstract	Baldwin & Ramsden - Portrait of Lenin (1980)
12	Abstract	Coventry - Balck Crack Pipes (1999)
13	Abstract	Davies - Small touching squares painting (1998)
14	Abstract	Heron - Azalea Garden (1956)
15	Abstract	Klee - Walpurgis Night (1935)
16	Abstract	Maekawa - Two Junctions (1962)
17	Abstract	Malinowski - Trigonal (1991)
18	Abstract	Olitski - Instant Loveland (1968)
19	Abstract	Riley - Cantus Firmus (1972)
20	Abstract	Rothko - Red on Maroon (1959)
21	Figurative	An allegory of man (1596)
22	Figurative	Blake - Portrait of David Hockney in Hollywood Spanish Interior (1965)
23	Figurative	Bowler - The doubt - Can these dry bones live (1855)
24	Figurative	Egley - Ominbus life in London (1859)
25	Figurative	Granges - Saltonstall Family (1636)
26	Figurative	Picasso - seated woman in a chemise (1923)
27	Figurative	Romney - Emma Heart as Circle (1782)
28	Figurative	Scott - The Eve of the deluge
29	Figurative	Turner - The deluge (1805)
30	Figurative	Warhol - Electric Chair (1964)
31	Figurative	Bettes - A man in a black cap (1545)
32	Figurative	Dubuffet - Monsieur Plume with Creases in his Trousers (1947)
33	Figurative	Lely - Boy playing a jew's harp (1648)
34	Figurative	Nevinson - La Mitrailleuse (1915)
35	Figurative	Reynolds - Puck or Robin Goodfellow (nd- 18th)
36	Figurative	Schad - Agosta, the pigeon-chested man and Rasha, teh black dove (1929)
37	Figurative	Stephens - The porposal (1850)
38	Figurative	Sutherland - Crucifixion (1946)
39	Figurative	Whistler - Nocturne - Blue and gold - old Battersea Bridge (1872)
40	Figurative	Yeames - Robsart (1877)

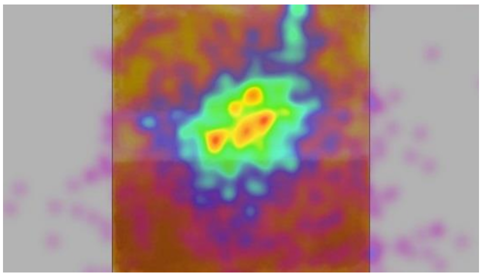
2. Appendix 2: Attention Maps from the 10 Paintings used in the Hospital

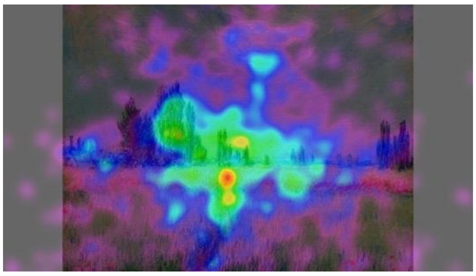
1. 

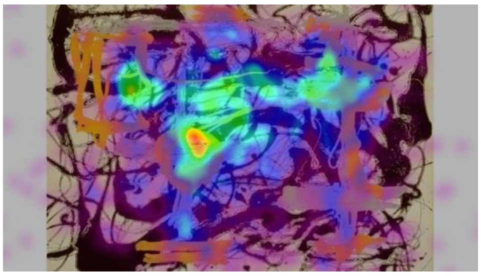
2. 

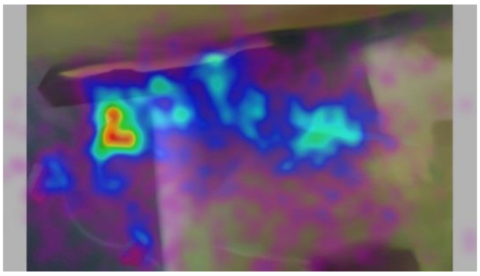
3. 

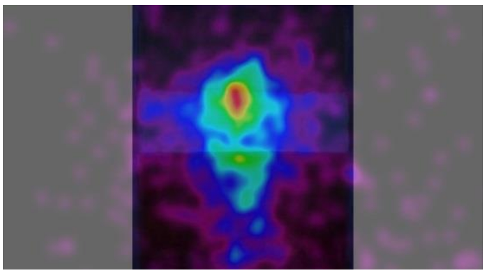
4. 

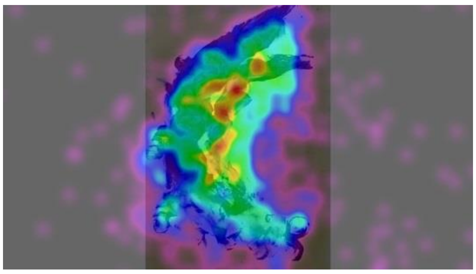
5. 

6. 

7. 

8. 

9. 

10. 

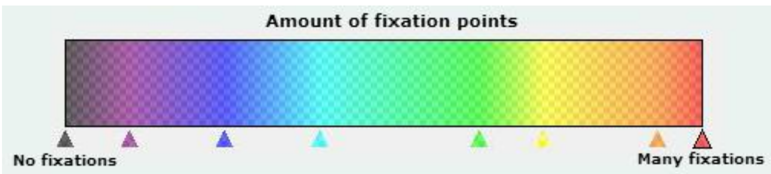


Table 3 - Cumulative attention maps for 10 paintings from the hospital (presented in the order of appearance in the study) and a gradient for interpreting the amount of fixations.