1st Scientific Meeting on
Psychology, Art, and Neuroaesthetics (PAN)
University of Bergamo 9-10 June 2023

Between anxiety and curiosity: a psychophysiological investigation of music-induced aesthetic appreciation

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Pursuing new knowledge in the entropic environment is pivotal for survival. However, dealing with uncertainty is a costly challenge for the agent surrounded by the stochastic sensory world, giving rise to different (and seemingly contradictory) epistemic emotions, such as curiosity (i.e., a drive for knowledge acquisition) and anxiety (i.e., a conservative emotion towards novelty). We recently proposed that aesthetic appreciation may have the role of associating pleasant feedback with the update of predictive representations. According to this idea, aesthetic appreciation and its associated rewarding feeling could generate a second-order expectation of fruitful updating of representations, driving people to seek new knowledge over anxiety.
However, the relation between aesthetic pleasure, curiosity, and anxiety has been still underexamined in the literature. Here, we explored the relationship between these epistemic emotions in a series of three experiments. In Experiment 1, we examined whether music-induced aesthetic experience would influence curiosity in a gambling task. In Experiments 2a and 2b, we explored the relationship between music-induced aesthetic appreciation and anxiety state by assessing both behavioural and electrophysiological (i.e., skin conductance response) measures. Overall, aesthetic appreciation promoted curiosity-driven behavior while it was negatively associated with anxiety. These results are consistent with the idea that aesthetic pleasure could act as a "valve", prompting the individual to perceive curiosity (i.e., to consider novelty as a valuable opportunity to acquire new knowledge) rather anxiety (i.e., to consider novelty as a risk to be avoided).

Further steps toward an enactivist psychological theory of picture perception

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What are the neural bases of picture perception? In this talk I want to investigate this topic from an enactivist perspective. I want to start my analysis from Gabriele Ferretti's account of picture perception [1]. I will try to engage with Ferretti's theoretical position, confronting it with two classic enactivist assumptions: a conception of the basic unity of cognition as a holistic whole of environment, body and brain; the critique of the "mental sandwich model of the mind" [2] and thus the enactivist belief in the existence of an intersection between perception, cognition, and action. Drawing on these two assumptions I want to suggest that the biological bases of picture perception consist in a form of sensory-motor interaction. This process of sensory-motor interaction is not the final top-down outcome of a representational recognition process internal to the brain, but rather a bottom-up process involving the body. This form of interaction is influenced and refined in its unfolding both by the activity of the motor system and by abstract cognition, cognition which is not separate from the activity of the beholder but in service of the global process of interaction. In the last section of the talk, I try to suggest an example of how this interaction might work, through the application of Alva Noë's (2002) "enactive approach to perception" to the recognition of the pictorial content [3].

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Keynote: Neuroaesthetics of music – A research agenda coming of age

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The concept of beauty has a long history in philosophy. It is commonly used to refer to positive evaluative appraisals that are uniquely human. This talk is summary and integration of what psychology and neuroscience have taught us about beauty in the last 30 years, and is structured around five basic ideas: beauty is not a quality of objects, but a quality of our experience of objects; beauty is important to humans: it influences our behavior, emotions and decisions; the experience of beauty arises from brain mechanisms that anticipate and generate states of pleasure; our expectations, previous experience and the context modulate the beauty experience; we share with many other animals many of the perceptual, cognitive and neural basis of the experience of beauty.

Aesthetic Experiences Throughout Life

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Aesthetic experiences are often regarded as vague and ill-defined phenomena. It is still unclear how frequent they are, and to what extent they encompass affective and cognitive components. We devised a survey, including quantitative and qualitative measures, whereby we investigated the occurrence and components of aesthetic experiences. Participants were asked to describe as many aesthetic experiences as they could recall, in terms of frequency, intensity, trigger type, as well as temporal, cognitive, and emotional factors. Preliminary results showed that 85% of participants reported having more than 10 aesthetic experiences, and 60% recalled more than 5. Most experiences had medium to high reported intensity and were frequently elicited by visual stimuli. Emotional activation and behavioral indicators of arousal, such as laughing, were reported for 61% of aesthetic experiences. Intensity variations throughout an experience were frequent and correlated with emotional fluctuations. Cognitive components, such as explicit meaning attribution, were rarely associated with the experiences. Taken together, these findings complement previous research by providing insight into the occurrence and nature of aesthetic experiences, as well as their intensity and variation across time.

Musical emotion evaluation in adolescents with borderline personality disorder traits

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One of the most significant functions of music is the expression and induction of emotions. Musical emotion understanding emerges from the interaction between the listener and the musical piece. The relationship between music and the subjective emotional experience felt by the listener is not clear-cut, such that both extrinsic and intrinsic sources of emotion in music have been described. Furthermore, previous research reported differences between musical emotion perception, which is the emotional quality expressed by music, and musical emotion aroused, namely, the individual's emotional response to music. We suggest that an additional type of musical emotion could be described, namely, the composer's emotion attribution, which consists in the emotional state experienced by the composer while he/she was creating the musical piece.
The aim of the present study was to investigate the differences between the three types of musical emotion in adolescents, namely, a) emotion perceived, b) emotion felt by the listener, and c) emotion attributed to the composer. Furthermore, we aimed to explore the effect of emotion dysregulation on musical emotion evaluation by comparing musical emotional ratings of adolescents with borderline personality disorder to that of a healthy control group. To do so, participants listened to 10 music pieces varying in terms of basic emotional quality and rated each musical emotion type (i.e., perception, arousal, composer's attribution). Moreover, measures of physiological arousal (i.e., skin conductance level and finger pulse) were collected while listening to each musical excerpt. Results on the differences between different types of musical emotion evaluation and the moderation of emotion dysregulation of the listener will be discussed.

Aesthetic experience in museum vs. laboratory: psychophysiological and behavioral evidence

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The educational tools that museums can provide to accompany people on their visits can be crucial factors in determining the quality of the museum experience. Nowadays museums use more and more digital materials (e.g., virtual tours) to attract visitors, therefore it is worthwhile investigating if digital reproductions of artworks are as effective as museum originals in producing a satisfying aesthetic experience.

In a previous work, we compared the impact of informative texts on the cognitive and emotional experience of naïve visitors in a modern-art museum, through multiple psychophysiological (heart rate, skin conductance, eye movements, pupil diameter) and behavioral parameters (viewing time and questionnaires). Here, we repeat the same paradigm in a laboratory setting, presenting the same paintings on the computer screen. Specifically, our research seeks to uncover the effectiveness of written labels in influencing physical and mental states of observers in non-ecological contexts. Additionally, before/after the exposure to paintings, participants had to evaluate valence and arousal of photographs with positive/neutral/negative contents to test for beneficial carry-over effects of art exposure.

Our results show that original artworks in museums are viewed longer compared to their digital reproductions, even though subjective judgments (e.g., appreciation, interest) seem to be comparable. In both settings, descriptive labels increase viewing time, decrease negative feelings, improve comprehension of the paintings, and produce pupillary dilation, although psychophysiological and behavioral effects are smaller in the artificial context. Overall, these effects might be explained by changes in observers' emotional state after art exposure.

Our findings provide further insights into the comparison of in-person vs. virtual art experience, suggesting that the contextual environment affects paintings' fruition, although some beneficial effects of informative material can be also acquainted throughout digital media in non-ecological contexts.

Reading in the City: mobile eye-tracking and evaluations of text in everyday street settings

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Reading is often considered as a mundane aspect of everyday life. Despite this, little is known about the natural reading experiences in daily activities. Addressing this gap, this talk presents two field studies (N = 39 and 26, respectively), where we describe how people explore urban environments and distribute their visual attention towards text elements in highly ecological settings, i.e., urban city streets, using mobile eye-tracking glasses. Furthermore, the attention towards the text elements (i.e., shop signs) as well as their memorability, assessed via follow-up recognition test, were analysed in relation to their aesthetic quality, which supposedly are key for attracting visual attention and memorability.
Our results indicated that, in these urban streets, text elements were looked at most, and viewing behaviour was strongly centred toward shop signs across both street contexts; yet aesthetic values were not correlated either with the most viewed signs or the looking time for the signs. Aesthetic ratings did nevertheless have an effect on memorability, with higher rated signs being better recognised. The results will be discussed in terms of aesthetic reading experiences and implications for future field studies.

The negative bias toward AI in aesthetic appreciation: implicit and explicit comparison between human and AI authorship

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Background: Creativity, intended as an exclusive human activity, has been questioned by the growing implementation of machine learning and artificial neural networks in the field of Artificial intelligence (AI), recently used for art production. In addition, recent studies showed that human aesthetic appreciation can be modulated by several factors ranging from expectations to context.

Aims: in two experiments, we investigated whether prior knowledge about authorship modulates aesthetic appreciation of both abstract paintings (Experiment 1) and poetry (Experiment 2). Specifically, we compared judgments of pre-assigned Human- vs. AI-authorship between two groups based on presentation order.

Procedure: The data collection took place in art-contexts, i.e., at the "ArtVerona" fair and at MAXXi museum in Rome. In both experiments, participants observed two artworks presented consecutively and were informed of the authorship just before watching them and expressed judgments about aesthetic appreciation and economic value for each artwork. We also asked for an explicit comparison between the two artworks. The order of artwork's presentation and the pre-assigned authorship were counterbalanced.

Results: in both experiments, we observed a presentation order effect showing that (a) when the pre-assigned Human-painting was shown first, aesthetic judgment on the subsequent pre-assigned AI-painting was lower; (b) when the pre-assigned AI-painting was shown first, economic judgment on the subsequent pre-assigned Human-painting was higher. Finally, results of the explicit comparison confirmed a greater aesthetic appreciation for the Human-assigned artworks.

Conclusions: Our results contribute to the understanding of the phenomenon of the aesthetic appreciation of AI-associated artworks as compared to Human by using a paradigm that allows us to investigate the role of the explicit and implicit comparison between the two authorship-assignments as plausibly underlying mechanisms of the negative bias toward the AI-associated artworks.

Boundary extension as a tool to study sense of depth from pictures and aesthetic value

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Boundary extension (BE) is a tendency to remember close-up scenes as if they extended beyond the occluding boundaries. Typically, the stimuli are photographs. We created a controlled set of images (N= 104) for which the central object was always at a fixed distance (5 m). We tested online a total of 36 participants. Each photo was presented twice (the first briefly) and between the two presentations a dynamic mask was displayed. Each photo was presented in three different conditions: "same": the second presentation was the same as the first; "farther": the second photography was further than the first, so objects appeared smaller; "closer": the second image was closer than the first, so objects appeared bigger. During the second presentation participants evaluated if that second image was the same, farther, or closer, and then expressed their confidence in their answer. For the same images we had ratings of distance of the object, sense of 3D, beauty of the object and beauty of the scene. These did not correlate with the strength of BE. However, the sense of 3D was correlated with beauty.

In a separate study using the same methodology we used images of artworks from just before the Renaissance period (N=40), or from Renaissance (N=40). These were selected to show the changes in how depth and perspective was reproduced. Some were paintings but a majority were frescos. Preliminary analyses were not able to confirm the presence of BE for these images. This may be related to the fact that pictorial images may not produce a strong sense of aperture through which a scene is perceived. An alternative explanation could be that paintings, being conceptualised as artworks, were categorised as objects, thus having different characteristics than photographs of real scenes.

Aesthetic Pleasure in Ageing: An EEG/fNiRS P300 Study *[cancelled]*

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Introduction: The progressive extension of human survival generates the need for new frontiers of study in which residual capacities can be facilitated in the presence of physiological cognitive difficulties due to age. The most important changes in cognition with aging are declines in performance on cognitive tasks that require one to quickly process or transform information to make a decision, including measures of speed of processing [1]. The ERP P300 oddball paradigm component has been associated with cognitive and speed information processing, P300 latency and amplitude index are different aspects of brain maturation [2]. Neuroaesthetics is the field of research in which the neural substrates of human aesthetic appreciation and the biological foundations of aesthetic experiences are investigated [3], [4]. Experimental neuroaesthetics setting produces data that are quantitative and vetted statistically [5]]. The aim of the present EEG-fNiRS P300 study is to correlate cognitive and psychophysiological outcomes in order to develop conceptual understanding of how aesthetic experience can contribute in cognitive facilitation, to set the stage for criteria for personalizing daily living environments [6] and to foster the ambitious project of an inclusive ageing society.

Materials and Methods: Eighteen subjects with 65 years of age were enrolled at the Neurophysiopathology Unit of Bari - Policlinico General Hospital, divided into two groups (Normal Ageing n. 10 vs MCi n, 6) according to their MMSE score [7]. EEG/fNiRS co-recording: 1 - initial two-minute resting state recording 2 - visual task of the P300 oddball paradigm: n. 165 visual stimuli, divided into 115 single-color frequent images and 50 target images; target images were represented by 25 static and 25 dynamic aesthetic stimuli. The motor task demanded, at the occurrence of aesthetics target stimulus (static or dynamic images), consisted of pressing, as quickly as possible, the PC space bar key. In the offline setup, all subjects were asked to rate the aesthetic experience, i.e., the liking index of the images shown on a Likert scale of 1 to 10.

Results: Preliminary results show differences in latency and morphology within the two groups (Normal Ageing vs MCi) in cortico-cortical cognitive processing following motor task related to a visual cognitive stimulus. Figures A and B show the latencies of the cognitive electroneurophysiological P300 response of the two study groups under the different conditions: in both groups, an increased latency of the P300 response emerges in relation to stimuli judged as aesthetically less pleasing; the same pattern is evident in relation to static vs dynamic stimuli. No additional statistical significance from the preliminary data.

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Psychophysiological and behavioral responses to informative labels in modern art museums

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Didactic materials in art exhibitions seem crucial to improve the cultural and aesthetic experience, particularly of non-expert visitors, thus becoming a strategic goal for museums. However, there has not been much research regarding the impact of written labels on the quality of visitors' aesthetic experience.

Here, we aim to assess the cognitive and emotional experience of art by combining psychophysiological (skin conductance, heart rate, pupillary response, eye movements) and behavioral (viewing time, questionnaires) measurements in a structured experimental protocol in the very context of a modern art museum. We specifically tested the impact of basic and more informative written labels on the fruition of XX-XXi century paintings, for which the general public expresses a lot of difficulty and perplexity in understanding and appreciating the content.

We found that, after detailed descriptions, art-naïve observers spend more time inspecting artworks, their eyes wander more looking for the described elements, their skin conductance and pupil size increase, and overall, they find the content less complex and more arousing. Overall, our findings show that people do receive important benefits from reading detailed information about artworks.

The outcome of this study could be of interest to museum operators, which can receive useful insight to offer more educational, informative, and interesting experiences to attract a wider non-expert public.

Portraying the best side? An analysis of Rembrandt's paintings and etchings

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According to a comprehensive survey of 1474 portraits painted in Western Europe, artists have predominantly painted posers with their left-cheek facing the viewer [1]. This effect is stronger in females: 68% of females presented their left cheek, compared to 56% of males. This phenomenon could be explained by the affective hemispheric laterality, and the fact that the left side is more emotionally expressive, combined with gender biases with respect to portraying emotions. The opposite pattern in self-portraits may be explained by the use of a mirror (Bruno et al., 2017).

In Rembrandt's paintings (N = 546), the gender difference is particularly strong [2]. A majority of males present their right-cheek (183/125 for males and 51/108 for females). This pattern is present even when the analysis is restricted to portraits (N = 468) (158/103 for males and 31/98 for females), and also within the large set of self-portraits (N = 64, with 49 right-cheeked self-portraits and 9 left-cheeked).

We also explored Rembrandt's etchings (N = 146 portraits, which are mirror-reversed, compared to paintings). The gender asymmetry was reduced, possibly because of the process of printing, and in the case of self-portraits (N = 24) the bias was reversed. Overall, it seems Rembrandt made explicit choices to represent males and females differently, and, at least in part, the technique (i.e., etching) affected the resulting pattern.

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Understanding Readymades: The importance of Metaphysical Contagion in Art

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Why Readymades are artworks? Their constituent parts are usually bought rather than made, and often a duplicate is as valuable as the original. This violates traditional art rules such as: the artist must be personally involved in the whole physical creation of the artwork, and a copy will never be as valuable as the original. With such characteristics it is hard to believe that Readymades are actual artworks. However, one possible explanation might be metaphysical/symbolic contagion — the conceptual information artists provide about an object changes its status from artifact to artwork [1]. This was assessed in the present study. For Study 1 (N = 600), when an artist either claimed that a Readymade was art, or that there was a certificate of authenticity about it, viewers were more likely to rate the Readymade as art. Study 2 (N = 400) replicated Study 1 findings and also showed that when viewers learned that the artist left a certificate of authenticity, they were willing to pay more for the Readymade. For Study 3 (N = 392) the Readymade's original title was replaced by a descriptive title, erasing the effects found in Study 1 and Study 2. Thus, showing that a Readymade's title is also a central metaphysical contagion factor. These findings support the hypothesis that metaphysical contagion is central for a Readymade to be perceived and valued as art.

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Left biases in portraiture, emotional expression, and emotion perception: new data support an action-perception mutuality account

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Studies on art, perception, and emotions have reported biases related to the left hemiface, the left hemifield, and the right hemisphere in relation to various aspects of emotions expression, perception, and valence. However, how this may be linked to a lateralized mechanisms for emotional processing remains controversial. Using an improved affective-space methodology, we assessed the intensity of emotions expressed on the right and left hemiface, presented either in both hemifields (chimeric faces) or on either hemifield (occluded faces). In both happy and angry faces, we find that participants report stronger emotional expression in left-hemiface chimeras as well as in occluded faces showing only the left hemiface. Furthermore, comparing hemiface-occluded with full faces suggested that the left hemiface tends to dominate the global expression on the full face. However, comparing occluded faces between presentations hemifields also documented slightly higher perceptual sensitivity on the left hemifield in comparison to the right. These results confirm that the right hemisphere plays a key role in emotional processing. We propose that reported biases related to the left hemiface may have emerged within the right hemisphere from the mutual interplay of perception and action in emotional processing during interpersonal perception. Due to the right-hemispheric prevalence in spatial attention, most individuals tend to be more perceptually sensitive in the left-hemifield than in the right (as also documented by phenomena such as pseudoneglect). Thus, emotions displayed in the right hemiface, which tends to appear in the left hemifield of observers (assuming fixation around the face center), are perceived as more intense. In dyadic social interactions, this asymmetry selected for stronger emotional expression on the left hemiface, which compensates for lower perceptual sensitivity, as well as for higher perceptual sensitivity on the left hemifield, which compensates for lower intensity in emotional expression.

Beyond Mere Pleasure: How Does Beauty and Pleasure Reduce Pain and Stress?

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The role of the arts to improve physical and mental health has gained more and more attention in recent years [1]. But how can the arts help people feel better? looking at a pleasant image reduces subjective pain and stress experience [2]. But a pleasant picture is not necessarily art, so what can art add beyond mere pleasure? Considering the sensory and affective component of pain and stress [3], as well as the affectively and cognitively engaging nature of visual art [4], [5], we argue that viewing art can be an even more beneficial tool to reduce pain and stress.

In our series of experiments, we investigated how the aesthetic quality of images has the potential to alter pain and stress perception. First, we wanted to establish that art can reduce pain and stress. In Study 1, we found that self-selected movingly beautiful artworks reduce pain and stress induced by the cold pressor test more efficiently than self-selected non-beautiful artworks. We investigated these findings further by disentangling the underlying correlates of subjective components of pain and stress perception, as well as physiological (electrocardiogram, electrodermal activity) and endocrine (salivary alpha-amylase and cortisol) measures (Study 2). Finally, we directly addressed if this goes beyond mere pleasure by testing whether artworks can be more effective in pain and stress reduction than content-matched pleasant images (Study 3).

Our results are discussed in relation to philosophical concepts of art and pleasure, as well as in how art can be a powerful, accessible, cost-effective, and nonpharmacological tool to reduce both pain and stress in everyday life.

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Stopping for Knowledge and Moving for Knowledge: Aesthetic Experiences in the Motor Domain

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A promising and fast-growing stream of research in empirical aesthetics and neuroaesthetics is highlighting the relationship between aesthetic pleasure and learning [1]–[3]. According to this stream of research, we tend to grant our aesthetic preference to those stimuli that maximize our learning—where learning is in turn often conceived in terms of the updating of a multi-layered probabilistic model of the world embodied by our brain [4], [5]. So far, however, this learning theory of aesthetic pleasure has been applied mainly to perceptual learning, that is the kind of learning triggered by exteroceptive stimulation (a novel, a picture, a piece of music, etc.). Not much has been said so far, on the other hand, on motor learning, that is the kind of learning that is concerned primarily with proprioceptive stimulation (information coming from our limbs and muscles).

In this talk, we expand this learning theory of aesthetic pleasure to the motor domain. In doing so, we make two crucial predictions: 1. The contemplation of preferred exteroceptive stimuli induces a state of motor inhibition, as the system allocates more resources to perceptual learning (the "Stopping for Knowledge" hypothesis); 2. The execution of actions of the right level of complexity induces pleasure, as the system allocates more resources to motor learning (the "Moving for Knowledge" hypothesis). To corroborate the first prediction, we present the results of two experiments that show that preferred landscape images elicit motor inhibition, as indexed by both slower reaction times and a significant modulation of motor-evoked electrophysiological responses. To corroborate the second prediction, we present preliminary results of a third experiment showing that actions that maximize motor learning are indeed rated as more pleasing.

Taken together, this evidence considerably expands the scope of the learning theory of aesthetic pleasure and paves the way to a unified explanation of the pleasure elicited by exteroceptive stimuli (visual stimuli, musical pieces, literary works, etc.) and actions (dance, sports, performative arts, etc.).

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The artist's brain: a machine learning study to detect morphometric differences between visual artists and non-artists

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This study aimed to investigate whether there are structural differences in the brains of professional visual artists compared to non-artists, and whether these differences can be used to accurately classify individuals as being an artist or not. Previous research using functional MRi has suggested that general creativity involves a balance between the default mode network and executive control network, and this is particularly true for professional artists. However, it is not known whether there are structural differences between the brains of artists and non-artists.

In this study, a machine learning method called Multi-Kernel learning (MKl) was applied to grey matter images of 12 artists and 12 non-artists matched for age and gender. The results showed that the predictive model was able to correctly classify artists from non-artists with an accuracy of 79.17% (AUC 88%), and had the ability to predict new cases with an accuracy of 81.82%.

The brain regions most important for this classification were the Heschl area, amygdala, cingulate, thalamus, and parts of the parietal and occipital lobes as well as the temporal pole. These regions may be related to the enhanced emotional and visuo-spatial abilities that professional artists possess compared to non-artists. Additionally, the reliability of this circuit was assessed using two different classifiers, which confirmed the findings. There was also a trend towards significance between the circuit and a measure of vividness of imagery, further supporting the idea that these brain regions may be related to the imagery abilities involved in the artistic process.

Art, Science, and Technology: Two Case Studies in the Fields of Crypto Art and Emotion AI

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In recent years, art has leveraged innovative digital tools, both for the creative processes (through, for example, AI or virtual and augmented reality) and for the certification of artworks through the technologies of Web3, such as Blockchain and NFT. As a result, a new intersectionality between seemingly distant worlds is emerging rapidly, and different ways of experiencing art are becoming possible. The artist and the audience are establishing a new connection through decentralisation, and the experiences are becoming immersive and interactive.

In this scenario, and thanks to the collaboration with ReasonedArt, the first Italian startup in the field of CryptoArt (i.e., NFT-certified digital art), it has been possible to research on two projects in which art and technology collaborate closely.

The first project (Amygdala n.) is a real-time and generative artwork that uses the analysis of the emotions of tweets as input and associates each emotion with a colour. The output of Amygdala n. consists of "algorithmic" images and sounds that have been projected onto the Maffei Palace in Verona and allowed the users to become a "spectator-author" of the work itself.

The second project is about measuring the emotional involvement generated by art and is the result of the partnership between Reasoned Art and Emotiva, a startup dealing with Emotion AI. The project involved the creation of the "Stendhal index," a new metric that aims to assess the intensity of a user's emotional response and their involvement in front of an artwork.

Through these two examples, our goal is to stimulate the discussion around topics such as the hybridization of art, science, and technology and the innovative ways of creating, perceiving, and enjoying art.

Poetry in Pandemic: A Multimodal Neuroaesthetic Study on the Emotional Reaction to the Divina Commedia Poem

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Poetry elicits emotions, and emotion is a fundamental component of human ontogeny. Although neuroaesthetics is a rapidly developing field of research, few studies focus on poetry, and none address its different modalities of fruition (MOF) of universal cultural heritage works, such as the Divina Commedia (DC) poem. Moreover, alexithymia (AX) resulted in being a psychological risk factor during the COVID-19 pandemic. The present study aims to investigate the emotional response to poetry excerpts from different cantica (Inferno, Purgatorio, Paradiso) of DC with the dual objective of assessing the impact of both the structure of the poem and MOF and that of the characteristics of the acting voice in experts and non-experts, also considering AX. Online emotion facial coding biosignal (BS) techniques, self-reported and psychometric measures were applied to 131 literary (LS) and scientific (SS) university students. BS results show that LS globally manifest more JOY than SS in both reading and listening MOF and more FEAR towards Inferno. Furthermore, LS and SS present different results regarding NEUTRAL emotion about acting voice. AX influences listening in NEUTRAL and SURPRISE expressions. DC's structure affects DISGUST and SADNESS during listening, regardless of participant characteristics. PLEASANTNESS varies according to DC's structure and the acting voice, as well as AROUSAL, which is also correlated with AX. Results are discussed in light of recent findings in affective neuroscience and neuroaesthetics, suggesting the critical role of poetry and listening in supporting human emotional processing.

The role of the global properties of a natural scene in the judgement of restorativeness and aesthetic preference

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The purpose of the study is to investigate the relation between some basic global properties of a scene, perceived restorativeness (i.e., the sense of replenish lost resources), and aesthetic preferences. Literature has shown that humans tend to aesthetically prefer images that generate a high sense of restorativeness [1]–[4]. It has also been shown that natural environments are perceived as more restorative than urban environments and that the former are actually able to promote the recovery of physical and psychological resources [5]–[8].

The link between perceived restorativeness and aesthetic preference can be explained by the fact that humans tend to prefer environments that show that they possess useful and beneficial resources for survival and development (Purcell et al., 2001; Staats, Kieviet e Hartig, 2003). Some authors also argue that humans are able to distinguish efficiently, at a first glance, whether an environment is natural or not because they identify some basic global properties in the scene that can signal important structural and functional features of the scene [9]–[12].

Considering the above, it is intended to test, by presenting a sample of subjects to a pairwise comparison of images, whether the presence in natural scenes of certain visually perceived basic global properties (i.e., Openness, Expansion, Main Depth, Temperature, Transience, Concealment, and Navigability) is able, at least partially, to elicit a sense of restorativeness and aesthetic preference. The global properties and aesthetic preference are measured by means of eight unidimensional scalings, and the perception of restorativeness using PRS [13]. LMM and SEM are performed for data analysis.

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Visual Attractors and Composition in fine arts

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One of the most important principles in art composition is the rule of the Main Diagonal (from the left to the right). As a result, the objects in the right half of the picture have more "perceptive weights" than the ones in the left half [1].

At the same time, a good composition can be destroyed if some specific visual forms (strong "visual attractors") will be appeared in the picture.

We have obtained evidence of the possibility in our experiments with the registration of the first 3-4 eye fixations at the complicated visual scenes and pictures of some famous painters [2]. We have found that each observer has a hierarchy of visual attractors which forces his eyes to move towards these points regardless of their location in the picture. The most important visual attractors were "water reflections" and "distorted figures" (e.g., "fluid watches" in S. Daly's "Memory Constancy"). The less important attractors were figures of people and animals, inscriptions, and patterned textures.

Recently we have repeated our investigation in the case of real pictures and their mirror reflection (a rotation relative vertical axis). We measured points of eye fixation at 6 original and 6 mirror versions of Salvador Daly's pictures. The obtained results show that in the case of mirror versions, the points of eye fixation are located rather chaotically, and the rule of main diagonal does not work. Therefore, artists and visual designers need to consider the role of strong visual attractors in composition construction. Moreover, we can use our method of first eye movement detection to test the composition in visual advertising.

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Showing Time: Continuous Pictorial Narrative and the Adam and Eve Story. In Memory of Alberto Argenton

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This poster presents a book with the same title and by the same authors, which has just been published by Springer. The book concerns a research, originally designed and initiated by Alberto Argenton, on pictorial continuous narrative, understood as a composition comprising at least two scenes, enclosed in the 'same space', which represent episodes or events, consisting of actions and/or happenings related to a specific character or characters repeated in the scenes or in some of the scenes that constitute the composition itself. The research was developed assuming as its main theoretical reference the psychology of art of a Gestalt matrix and adopting a phenomenological approach and the interobservational method. The research was meant to answer a specific question: how does the artist solve the problem of telling a story and its unfolding — the episodes that compose it, which have a sequential and therefore temporal progression — using a static medium that both perceptually and representationally is distinguished only by spatial sign-elements?
For this purpose, 1000 images of pictorial works of continuous narrative, which can be ascribed to 123 thematic repertoires, were collected, and one of the thematic repertoires, concerning the story of Adam and Eve and consisting of 100 works, was studied in depth. The poster describes the research — from the hypotheses formulated to the main results achieved — specifying the phases into which it was organized: cataloguing, analysis, and classification of the 1000 works in the general repertoire and analyses of the 100 works in the chosen thematic repertoire, with reference to narrative context, number of scenes depicted, narrative progression, spatial disposition of scenes, and perceptual-compositional arrangement of the works, considering, in this last case, four types of representational strategies, namely, segmentation of episodes, space/time separating cues, identification of repeated protagonists, and vectors of direction.
Furthermore, the 122 thematic repertoires, which have not yet been studied in depth but are made available to the scientific community, are presented.

Keynote: What has science taught us about beauty?

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University of the Balearic Islands.

The concept of beauty has a long history in philosophy. It is commonly used to refer to positive evaluative appraisals that are uniquely human. This talk is summary and integration of what psychology and neuroscience have taught us about beauty in the last 30 years, and is structured around five basic ideas: beauty is not a quality of objects, but a quality of our experience of objects; beauty is important to humans: it influences our behavior, emotions and decisions; the experience of beauty arises from brain mechanisms that anticipate and generate states of pleasure; our expectations, previous experience and the context modulate the beauty experience; we share with many other animals many of the perceptual, cognitive and neural basis of the experience of beauty.

Affordance, aesthetics, and sustainability: an investigation on the role of materials in everyday objects' perception.

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The study of beauty and its perception are related with several aspects of human cognition, including emotion, action, and interpretation of art. Interestingly, neural foundations afferent to aesthetic perception of beauty constitute perceptual phenomena that share a variety of formal and processual features with the activation of affordances related to object perception [1]. By linking cognitive and neuroaesthetic research on affordances and beauty together with the study of decision-making processes related to sustainability, the main hypothesis of our project is that beauty can play the role of environmental nudge, thus inducing people toward the use of sustainable materials.

As a first step to pursue this goal, our first pilot study aims to explore the role of materials. Notably, most empirical work in cognitive science has focused on the shape and size of objects (e.g., Ellis & Tucker, 2000 [2]), neglecting the analysis of other visual properties, such as texture, investigated instead by designers of everyday objects [3]. In our work, we investigate the influence of more or less sustainable materials in activating the affordances of everyday objects with varying degrees of familiarity and pleasantness. Re-adapting a well-established paradigm [4], objects shown have the same shape but are made out of different material (namely, plastic vs. wood), and the possible role of participants' specific environmental sensitivity is tested through the Pro-Environmental Behaviours Scale (Italian version [5]).

We expect significantly different results for participants with high environmental sensitivity, for whom the canonicity of the object conflicts with its sustainability. Additionally, the beauty of the object should transversely promote the activation of affordance. The following step will concern the study of an aesthetic experience with common objects and the role that beauty might play toward sustainability in our everyday life.

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The role of visual exploration and personal traits in the responses to artworks at TATE liverpool

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It is established that art appreciation is fostered by the way spectators pay attention to the artworks, and the extent to which this occurs may depend on individual characteristics. At present, supporting empirical evidence that clarifies the relationship between individual characteristics, visual engagement, and aesthetic responses, especially in the real gallery setting, is sparse. In the present study, we investigated the role of visual exploration of artworks in relation to personal traits and aesthetic responses at TATE Liverpool.

Specifically, the study tested whether visual exploration mediated the influence of individual differences in personality and cognitive style on aesthetic responses. Fifty-six visitors to the gallery viewed seven artworks while their eye movements were recorded. Participants rated their aesthetic response to the artwork and wrote their thoughts and impressions about each artwork. Written reports were analyzed in terms of word count and frequency of use of aesthetic descriptors.

Participants completed individual difference measures, including Openness to Experience (OTE) and Need for Cognitive Closure (NFC) before viewing artworks. The results showed that (1) the duration of looking at artworks (dwell time) mediated the relationship between OTE, NFC, and word count as well as the frequency of use of aesthetic descriptors, and (2) the spatial distribution of fixations mediated the relationship between both OTE and NFC and the number of words used in response to viewing artworks.

The results indicate that visual exploration plays a functional role in the experience of artworks in a real gallery setting, and that visual exploration is a mechanism through which OTE and NFC influence aesthetic responses. Future research will investigate the nature and the time course of visual engagement with artworks and its impact on aesthetic experience. More broadly, this study contributes to understanding the role of individual differences in eye movement behavior in real-world settings.

Bodily Sensation Maps to capture valence and arousal of artistic images: developing a new methodology.

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Cognitive-corporal theories and the 4E approach to the mind — embodied, embedded, enactive, and extended [1]— emphasize that emotions are not only cognitive but also deeply rooted in the body. According to this theoretical framework, researchers should investigate people's self-awareness or interoception to assess individuals' internal state of the body and to identify their emotional experiences. This holds true for emotions triggered by art.

Bodily Sensation Maps (BSMs) are a reliable self-reported measure of the embodied experience in response to emotional stimuli, and it has been shown that different emotions are associated with distinctive consistent patterns of physical bodily activity. BSMs are created by explicitly requesting participants to self-report their physical activity by identifying and marking it on two blank body silhouettes: one to indicate perceived activated body parts and the other deactivated ones. Previous research used BSMs to capture reactions to narrative texts and different types of images [2], including artistic ones [3], [4].

We will present an online case study investigating the cognitive and emotional implications of semantic aspects of artistic images and discuss the implications for studies in museum settings. We will discuss how this holistic methodology can be used to generate and visualize BSMs as a biomarker to capture the complexity of artistic experiences, from their sense-making process to their capacity for affordances. Our research provides a new researcher-friendly R code to analyze and visualize BSMs, aiming to contribute to the field of empirical aesthetics as well as other disciplinary fields.

Overall, this approach highlights the importance of considering the role of interoception in art experiences, providing a more nuanced and comprehensive understanding of the cognitive and emotional implications of engaging with art.

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Physiological correlates of "being moved" by art and emotional images

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Several studies have reported the empirical underlyings of mixed emotions and their physiological profiles; however, few studies have undertaken composite constructs such as the feeling of "being moved". Rooted in the distancing-embracing model reported by Menninghaus et al. (2017) [1], purporting that the state of being moved results from a pattern of distancing over fictional/impersonal visual stimuli. This allows for a following round of processing, enabling viewers to positively embrace the experiencing of negative emotions and creates a moving sensation which, rather than peak pleasure, mixes positive and negative emotions to compose a pleasurable experience [2].

Here we aim to disentangle the visual sensory experience of "being moved" in line with aesthetic and non-aesthetic images. To understand the distinct visual and temporal signifiers of being moved, we conduct a study of two conditions. In the first experimental condition, we pair images from the Nencki Affective Picture System (NAPS) dataset of varying valence and arousal to assess participants' feelings through a non-aesthetic prompt of positive vs. negative stimuli. Results are compared against a condition displaying renowned aesthetic paintings rated as emotionally stimulating according to the VAPS database ([3].

The contrast of these two conditions represents a crossover between behavioral and physiological measures applied to dissect the understudied origins of the state of being moved. We use behavioral surveys in tandem with physiological facial EMG and skin conductance measures to pinpoint temporal markers of the emotional progression and the severity of response. The pattern of emotional response between these conditions to isolate the effects of the aesthetic experience on the sensation of being moved.

Our preliminary results indicate positive in valence and mildly arousing images have the greatest moving effects, corroborating prior research [4] findings that this combination is most likely to produce a mixed emotion, moving sensation rather than purely one emotion or similar feelings like awe or admiration.

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A meta-analysis investigating neural correlates of negative emotion in art and non-artistic stimuli

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Background: Aesthetic experience engages neural networks specific to the qualities and evaluation of an artwork. Critically, emotion may be a core construct of aesthetic experience with empathy, a particular social ability, being employed to feel into an artwork, which is essentially a human artifact. Concerning the visual aesthetic experience (VAE), meta-analyses have focused on the neural correlates of positive VAE; however, neuroscientific literature has explored negative VAE. Therefore, we have been carrying out a meta-analysis exploring the neural correlates of negative emotion within the VAE and the visual experience of non-artistic stimuli (VE) to clarify differences and commonalities between the two.

Methods: Two literature searches were carried out on PubMed. The VAE search string returned 2872 results post duplicates, while the VE search string returned 7834 results post duplicates. After screening abstracts for inclusion criteria, the VAE search resulted in 56 articles, and the VE search resulted in 249 articles. Articles in their entirety are currently being screened to meet inclusion criteria, and screening will be completed by approximately May 1st, 2023. Following a final repository, AIE analyses will be performed on the neural coordinates found within the VAE and VE searches.

Results: We expect negative VAE and negative VE to have both distinct and overlapping neural correlates.

Take-Home message: The negative emotional experience of artistic and non-artistic stimuli may recruit different yet similar brain areas.

Validating the Vienna Art interest Art Knowledge (VAIAK) Questionnaire

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In this poster I will present the cumulative work [1]–[3] done to develop and validate the Vienna Art interest Art Knowledge (VAIAK) Questionnaire. The questionnaire was developed to address two problems in the field: a lack of conceptual clarity of what art expertise is, and a lack of coherent measurement for assessing expertise. The VAIAK addresses this by focusing on the measurement of two commonly studied sub-domains of expertise: art interest and art knowledge. It consists of two separate scales, one that measures art interest (11 items) and one that measures art knowledge (6 multiple-choice and 20 open answer items, 26 items in total). In the paper I will present evidence that supports the psychometric model of the VAIAK (by way of CFA), present validation evidence in terms of concurrent and discriminant validity, internal structure (reliability), discrimination ability (between experts & non experts), configural measurement invariance, test-retest reliability, and most recently an item-focused perspective using IRT as well as qualitative analyses. This research has increased insight into the workings of the scale and led to a modified version the VAIAK-R. Beyond specifically discussing the VAIAK, I aim to show more generally how continuous validation efforts of any scale could look like and what theoretical as well as methodological insight such research.

[1]   E. Specker, M. Forster, H. Brinkmann, J. Boddy, M. Pelowski, R. Rosenberg, & H. Leder, "The Vienna Art Interest and Art Knowledge Questionnaire (VAIAK): A unified and validated measure of art interest and art knowledge". Psychol. Aesthetics, Creat. Arts, 2020, doi: 10.1037/ACA0000205.
[2]   E. Specker, "Further validating the VAIAK: Defining a psychometric model, configural measurement invariance, reliability, and practical guidelines.," Psychol. Aesthetics, Creat. Arts, Sep. 2021, doi: 10.1037/ACA0000427.
[3]   E. Specker, K. N. Cotter, and K. Y. Kim, "The Next Step for the VAIAK: An Item-Focused Analysis," Psychol. Aesthetics, Creat. Arts, 2023, doi: 10.1037/ACA0000559.

Why do we need real physical artworks?

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In this talk I will present the cumulative work ([1], [2]; Specker et al., under review) I have done in investigating the genuineness effect: the difference in aesthetic experience between a physical work of art and its (digital) reproduction. In our meta-analysis [3] we found a meta-analytic effect of g = .32 [.16, .47], however, most (N = 8) studies included a context confound, and when this was entered as a moderator the genuineness effect seemed to disappear.

In the following work, we test two explanations for this: first, the facsimile accommodation hypothesis [2] and second, the anchoring effect (Specker et al., under review). In both cases, we failed to find evidence for these alternative explanations. Does this mean there is no genuineness effect? Maybe.

But in this talk, I want to reflect on how this set of studies can inform the field. Here I focus on two aspects: 1) a third potential explanation: the argument that research may have focused on the wrong dependent variables, and 2) a reconsideration of how we typically analyse our data and the correspondence between these statistical models and our theoretical ones.

[1]   E. Specker, A. Fekete, M. D. Trupp, and H. Leder, "Is a 'real' artwork better than a reproduction? A meta-analysis of the genuineness effect.," Psychol. Aesthetics, Creat. Arts, 2021, doi: 10.1037/ACA0000399.
[2]   E. Specker and H. Leder, "Testing the facsimile accommodation hypothesis," Acta Psychol. (Amst)., vol. 222, Feb. 2022, doi: 10.1016/J.ACTPSY.2021.103482.
[3]   E. Specker, J. Arató, & H. Leder, "How are real artworks and reproductions judged? The role of anchoring in empirical investigations of the genuineness effect". Journal of Experimental Social Psychology, (Stage 1 MS accepted).

The unexplored link between aesthetic perception and creativity: a theory-driven meta-analysis of fMRi studies in the visual domain

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Aesthetic appreciation (related to art-viewing) and creative production (related to art-making) are inherently linked in visual arts, but their relationship has never been explored explicitly in cognitive neuroscience, nor the nature of such connection. Yet, existing literature allows generating two alternative hypotheses on what common cognitive processes could possibly ground these two experiences: motor simulation or inhibitory control. We adopted a meta-analytical approach to formally compare these alternative hypotheses, exploring the neural correlates of the aesthetic and creative experience, and their possible overlaps.

We thus performed two separate meta-analyses of fMRi studies on the aesthetic experience of visual art (22 experiments) and on visual creativity (12 experiments); we then computed a conjunction analysis with a twofold purpose. First, it aimed to investigate whether shared neurofunctional underpinnings may support both the aesthetic and creative experience in the visual domain. Second, we examined whether any shared brain activation may reflect either motor simulation or inhibitory processes. We ran the meta-analyses in GingerAle, using the Activation likelihood Estimation Method.

The conjunction analysis revealed a common involvement of the pre-SMA in both classes of studies, a brain region, if anything, more concerned with top-down inhibitory motor and volitional cognitive control rather than bottom-up motor simulation. These mechanisms could lead to learn (during art perception) or generate (during creative production) something new. In the art-viewing domain, this finding was primarily driven by figurative rather than abstract art. However, these results are constrained by methodological limitations in the available literature on visual art, and by the limited number of studies available.

In conclusion, while not solving the issue of what model best captures similarities and differences between art appreciation and creation, this meta-analysis paves the way for future investigations that could expand the existing findings.

Creativity across Cultures: A Comparison between Ugandan and Italian Students

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The purpose of this research is to compare the creative performance of students belonging to 2 different cultures, Italian and Ugandan. The participants are 462 children between the ages of 6 and 14 (231 in each group). The children are distributed across the age groups, between the 1st and 7th years of primary school. This study used a quantitative methodology and an intercultural perspective to explore the socio-cultural variables involved in defining and expressing creative action.

To evaluate creative performance, Williams's TCD (Test of Creativity and Divergent Thinking, 1996) is used along with a questionnaire to identify socio-anagraphical characteristics. An analysis of variance (ANOVA) revealed no statistically significant difference between the averaged total scores of the two groups on creativity and divergent thinking tests. However, Ugandan and Italian students have statistically significant differences in the flexibility (FS) category, with Italian students earning higher scores than the Ugandan students, and also in fluency (FI), where the Ugandan children achieved higher scores than the Italian ones.

Laterality of social touch: Kissing and embracing in the history of painting

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Naturalistic observation and laboratory studies revealed that romantic kissing shows a population-level bias for turning the head towards the right. A side bias was observed also for embracing behaviour, with a preference for using the right arm as the leading arm and for turning the head towards the left. These tendencies have been explained as due to innate motor biases, but they would also be modulated by emotions, mediated in turn by hemispheric asymmetries.

As with other salient asymmetrical behaviours that have been largely depicted in the history of visual arts (e.g., cheek-turning in portraits, cradling side in Madonnas with Child), we wondered whether kissing or embracing biases were captured by painters in their work. To this aim, we visually inspected a database of almost 200,000 artworks spanning five millennia of art history, selecting a surprisingly little set of 721 kisses and embraces overall.

With notable exceptions, this low figure is possibly explained by the fact that kissing and embracing are behaviours that involve the reciprocal masking of the interacting faces and bodies by visual occlusion, thus maximizing crowding and minimizing the opportunity for frontal portraiture. Only 105 paintings were categorized as clearly lateralized kisses or hugs according to strict criteria: 62 were romantic kisses showing a rightward head rotation bias (22 left vs. 40 right; $p=0.007$), and 43 were embraces showing a leftward asymmetry (26 left vs. 17 right; $p=0.048$).

It therefore seems that in the history of painting, artists have spontaneously preferred to depict romantic kisses and embraces by staging the "natural" tendencies observed for the head rotation in romantic kissing and in embracing.

The effect of implicit racial bias on aesthetic response to paintings depicting White and Black sitters

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Our previous research in face perception has established a possible link between eye movements, individuation experience, and implicit racial bias of other-race faces. However, it remains unclear to what extent implicit racial bias and individuation experience with other communities might influence spectatorship of paintings that depict other-race sitters. Here we examined how aesthetic experience gained during spectatorship of paintings that represent White and Black sitters might be modulated by viewer's individuation experience and implicit racial bias.

Sixty-six participants viewed ten artworks at their own pace at the Walker Art Gallery Liverpool, while their eye movements were recorded. Participants completed a set of rating scales measuring their aesthetic response to the artwork, as well as the implicit association test (IAT), a questionnaire on individuation experience towards White and Blacks, and an art interest questionnaire after viewing artworks. The results showed that participants found paintings depicting Black sitters more interesting, emotionally moving, and pleasurable than those depicting White sitters.

More importantly, while the aesthetic response to the artworks depicting White sitters was not predicted by implicit racial bias and individuation experience, the aesthetic response to the artworks depicting Black sitters was negatively predicted by increased positive bias towards Black people. This effect was modulated by an interaction between individuation experience and implicit bias, predominantly with observers who reported high individuation experience with Black people.

Our findings reveal the complexity of perceptual and socio-cognitive influences on the spectatorship of painting representing other communities. The results are discussed in terms of the functional role of viewer's experiences and attitudes when adopting an aesthetic mode of attention in real-world settings.

The beauty of a bounce: Relationship between visual pleasantness, physical plausibility, and animacy in bouncing scenarios

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The present research systematically explored the relationship between perceived naturalness, perceived animacy, and visual pleasantness in bouncing events. Across two experiments, observers saw a small black disk moving back and forth repeatedly along the vertical axis of the screen. The following parameters were manipulated: (a) the simulated coefficient of restitution C (0.7, 0.85, 1, 1.15, 1.3), (b) the value of simulated gravitational acceleration a (9.81, 2.45, 0.61, 0.15 m/s2), (c) the duration of the delay at the impact (0, 30, 60 ms), and (d) the motion pattern (uniform acceleration/deceleration or constant speed).

There were three tasks, performed in three blocks in a counterbalanced order. Observers used a VAS (Visual Analogue Scale) to judge (1) how much the animation looked like the bounce of a physical inanimate object, (2) how much the animation looked like the jumping of a living being endowed with its own force, and (3) how much the animation was pleasant and beautiful to see.

We found that (i) C is negatively correlated with perceived naturalness and positively correlated with perceived animacy; (ii) perceived naturalness is enhanced by uniform acceleration/deceleration, whereas perceived animacy is only slightly affected by the motion pattern; (iii) although a positive correlation between visual pleasantness and perceived animacy emerged, the two concepts are mostly independent from each other. Indeed, visual pleasantness was strongly affected by the motion pattern (i.e., uniform acceleration/deceleration was judged as more pleasant than uniform velocity), and it was also partially affected by temporal delay, despite the fact that these parameters had little or no influence on perceived animacy.

The results indicate that in a basic physical scenario, like that represented by a simple bouncing disk, visual pleasantness is driven by a combination of animacy and mechanical constraints.