## Conference

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Cionce Museum, do honor 26-27th of August 2016. CosmoCaixa (Science Museum), Carrer d'Isaac Newton, 26, 08022, Barcelona



indition 26th August 2016

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http://www.ub.edu/ecvp/vsac

Obra Social "la Caixa"

## LosmoCaixa

Isaac Newton, 26 | Barcelona 08022

CosmoCaixa is the emblem of the "la Caixa" Foundation's Science in Society programme, whose aim is to spread and promote scientific culture, contribute to informal edu cation in the sciences, stimulate scientific vocations and to underlin the value of research as an engine of social progress.

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Services The Museum ShorLaie – CosmoCaixa (Floor 0) Cafeteria-restaurant Arcasa – CosmoCaixa (Floor -1)

Parking Enter at C/ de Quatre Camins, 89 2 hours free if you buy a Museum entry ticket

WIF





### Welcome to the 4th Visual Science of Art Conference in Barcelona

We look forward to your presence and contribution during this event.

VSAC is interested in all kinds of approaches (phenomenological, biological, computational, etc.) that explore the relationship between our visual perceptual mechanisms and the arts. We are also interested in new ideas to add to the experimental foundation of a Science of Art.

We hope you enjoy the event and associated activities.

The organizers

#### **COMMITTEES**

#### Advisory

C. Alejandro Parraga (chair)	Marco Bertamini	Shelley James
Carol Laidler	Marta Expósito Ventura	Slobodan Marković Fila
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Bilge Sayim	Letizia Palumbo	Ute Leonards
Branka Spehar	Marco Bertamini	
Claudia Muth	Marcos Nadal	

#### THE ART & PERCEPTION EXHIBITION

With works of art that challenge our perceptual and aesthetic ideas this exhibition, located in the Agora room of the CosmoCaixa Venue will open with a celebration drink and the opportunity to meet the artists at 12:30hs on Friday the 26<sup>th</sup> of August. It will close at 18:00hs on the 28<sup>th</sup> of August.



#### VENUE

Talks: Auditorium Room, L-2, CosmoCaixa (Science Museum) Posters: Agora Room, L-2, CosmoCaixa (Science Museum). Posters should be portrait DIN A0 (1189 x 841 mm or 46.8 x 33.1 in)

Website: http://www.ub.edu/ecvp/vsac



BUS: 17, 22, 58, 73, 75 and 60

Tube (FGC) Ferrocarriles de la Generalitat de Catalunya. Avinguda del Tibidabo St.

Blue Tram (Tramvia Blau)

 O1- Museum's Parking, entrance from 89 Quatre Camins Rd. Limited parking space

02- GPS: 41.412024, 2.133008

#### **SCHEDULE**

#### Friday 26th of August 2016

12:30 Art & Perception Exhibition Opening

#### Saturday 27th August 2016

8:30 Arrival

9:00 - 11:00 Talk Session One

11:00 – 11:30 Coffee Break

11:30 – 12:30 Keynote Address:

Prof. Anjan Chatterjee

12:30 – 14:00 Lunch and Poster Session

14:00 - 15:30 Talk Session Two

15:30 – 16:00 Coffee Break

16:00 - 17:00 Talk Session Three

17:00 Business Meeting

#### Sunday 28th of August 2016

18:00 Art & Perception Exhibition Closing

#### **TALKS (Auditorium)**

#### 9:00 - 11:00 Aesthetic judgment

**9:00** Semantic Instability in art. How artworks affect us by inducing and complicating the formation of stable meanings. Claudia Muth & Claus-Christian Carbon.

**9:15** *"When we see we perceive what to see": A new art and perceptual problem.* Katia Deiana, Jan Koenderink, Andrea van Doorn & Baingio Pinna.

**9:30** Aesthetics without semantics: a new dataset of natural scenes devoid of semantic content. *Marta Expósito Ventura, Bogdan Raducanu & C. Alejandro Parraga.* 

**9:45** The Intension of the Term Artwork – A Meta-Study on VSAC Contributions. *Gregor Uwe Hayn-Leichsenring, Nathalie Lyssenko & Katharina Schulz.* 

**10:00** The Aesthetics of Authenticity: About authenticity, originality and innovativeness. *Claus-Christian Carbon.* 

**10:15** How does perceptual goodness relate to aesthetic merit? *Alexis David James Makin, Giulia Rampone, Damien Wright & Marco Bertamini.* 

**10:30** Aesthetic appreciation of representational and abstract artworks: The role of art expertise. *Galina V. Paramei, Megan Snellock & David L. Bimler.* 

**10:45** Gaze meets space: mapping natural viewing behavior in the gallery. *Elizabeth N Johnson, Jeff MacInnes, Shariq Iqbal & Marianne Eileen Wardle.* 

#### 11:30 - 12:30 Keynote Address

Realizing Fechner's Fantasy. Anjan Chatterjee.

#### 12:30 - 14:00 Poster Session & Lunch

#### 14:00 - 15:30 Art and Cognition

**14:00** What does an artist's innocent eye mean, psychologically speaking? *Leon Lou.* 

**14:15** Can perceptual judgements elucidate the Mona Lisa smile? *Christopher Tyler.* 

14:30 Sargy Mann: Art, vision and blindness. Robert Pepperell.

**14:45** Synesthetic correspondences between cover art images and music tracks. *Chihiro Hiramatsu, Shinnosuke Ogata & Takeharu Seno.* 

**15:00** What shall we listen to, abstract or figurative music? *Rossana Actis-Grosso, Olga Daneyko, Zaira Cattaneo & Daniele Zavagno.* 

**15:15 Discrimination of blur and disorder in photographic and artistic images.** *George Mather, Megan Miller & Robert Pepperell.* 

#### 16:00 - 17:30 Visual Perception

**16:00** Kandinsky or me? How free is the eye of the beholder in abstract art? Doris Ingeborg Braun & Katja Doerschner.

**16:15** Effects of emotion, complexity and presentation duration on eye movements when viewing environmental scenes and paintings. *Manuela Maria Marin & Helmut Leder.* 

**16:30** High entropy of edge orientations in paintings of Western provenance. *Christoph Redies, Anselm Brachmann & Johan Wagemans.* 

**16:45** Compositional bias in selfies: Both selfies and wefies reveal a left cheek biases in children and adults. *Marco Bertamini, Carole Bode & Nicola Bruno.* 

17:00 Business Meeting

#### ABSTRACTS (TALKS)

#### 9:00 - 11:00 Aesthetic judgment

Semantic Instability in art. How artworks affect us by inducing and complicating the formation of stable meanings. Claudia Muth & Claus-Christian Carbon, University of Bamberg.

Art is often associated with plurality of meaning, semantic openness, or contradiction to habits: e.g., we explore aesthetic qualities of everyday objects when encountering them in exhibitions, we see blots of paint and at the same time the fleeting scene they represent in impressionist paintings, and become fascinated by Mona Lisa's enigmatic smile. A theoretical analysis of such variants of Semantic Instability (SeIns) within the framework of Predictive Coding suggests a differentiation between phenomena of multistability, dichotomy, indeterminacy, and experience of hidden images (Muth & Carbon, 2015). A cluster analysis on the reports of experiences with a set of artworks from the 20th and 21st centuries furthermore revealed the additional variants of integrative blending and contrast to perceptual habits. These preliminary classifications allow for a more systematic look on Selns in the arts and question simple models that equal Selns with multistability. Further studies point to the potential of Selns to heighten interest, even if we never arrive at semantic stability in the course of elaboration (Muth, Hesslinger, & Carbon, 2015). We suggest that artworks affect us in multiple ways depending to a part on the variant of Selns they induce and not just by liking of cognitive mastery.

**"When we see we perceive what to see": A new art and perceptual problem.** Katia Deiana<sup>1</sup>, Jan Koenderink<sup>2</sup>, Andrea van Doorn<sup>3</sup> & Baingio Pinna<sup>4</sup>. University of Sassari<sup>1,2,4</sup>, Utrecht University<sup>3</sup>.

The starting questions preceding and leading every visual phenomenological and psychophysical experiment are "What do you see?" and "What is a visual object?". These questions are immediate consequences of the most famous question of Koffka "Why do things look as they do?" This last issue can be described as follows: when we see, before seeing and perceiving an object, we perceive what and where to see to perceive an object. This sounds paradoxical since, to "perceive" what to

see is necessary to perceive an object and, conversely, to perceive an object is necessary to "perceive" what and where to see. Furthermore, this What-to-See problem becomes even more paradoxical if a single object is considered as it actually is, i.e. as a multiplicity of components distributed in the 3D space. Briefly, we "perceive" what and where to see, namely one aspect among the infinite possible aspects, and only one component within the multiplicity of infinite possible components placed within the same aspect. We studied the What-to-See problem in lab conditions and in the Hermitage Museum. Our findings demonstrate that the paradox is resolved introducing a perceptual process that we propose to call: Reductio ad Unum (reduction to one).

Aesthetics without semantics: a new dataset of natural scenes devoid of semantic content. Marta Expósito Ventura, Bogdan Raducanu & C. Alejandro Parraga. Universitat Autònoma de Barcelona.

Much of the work in visual aesthetics considers judgements of images from a few popular online datasets [1][2]. These datasets are the collective product of amateur/professional photographers who upload their images to win contests or showcase their photographic skills. For this reason, these datasets lack examples of agreed "low aesthetic value" (ugly) images. Moreover, these images are loaded with "semantic content" through objects (human faces, animals, food, etc.) which are linked to personal experiences, culture, etc. This high-level, extra-aesthetic content is extremely difficult to model [3]. To address these issues, we built a new dataset consisting of 12.909 images devoid of semantic content (i.e. without man-made objects, humans or animals) which also includes purposely-made "ugly" images. We asked 80 subjects to rate each image from 1 (very ugly) to 5 (very beautiful) via a crowdsourcing paradigm. Finally, we applied a low-level spatio-chromatic cortical model and statistical learning to capture the combination of low-level features that determine observer performance. Our results show that the use of an enlarged ugly-beautiful continuum improves the learning of aesthetic features.

[1] DPChallenge, www.dpchallenge.com. [2] Inc. NameMedia and contributors, "Photo.net," 1996. [3] Redies C., Frontiers in human neuroscience, 2015.

The Intension of the Term Artwork – A Meta-Study on VSAC Contributions. Gregor Uwe Hayn-Leichsenring, Nathalie Lyssenko & Katharina Schulz. University Hospital Jena.

Although the extension of the term artwork (i.e., the range of objects to which this concept applies) remains vague, the different intensions of this term (i.e., the internal concept that constitutes a formal definition) are well defined. This metaanalysis explores the various concepts of artworks (intensions) that were used in contributions to the VSAC (2012 to 2015). In 61% of the studies, the selection of stimuli (extension) derived from an institutional concept of artworks, in which an object is an artwork if it is presented in an art exhibition or referred to as an artwork by critics. However, the investigations focused on specific attributes that artworks might possess. These attributes derived from intentional concepts (artworks are defined by their purpose, 58%), essentialistic concepts (a materialistic approach according to which artworks possess universal properties, 36%), or other concepts. In only 4% of the studies, selection and investigation followed the same concepts. The application of two concepts within one study leads to systematic problems concerning the interpretation and comparability of the experimental results. Consequently, we encourage researchers to be aware of the various intensions of the term artwork and we propose specific steps to ensure a valid interpretation of research results.

The Aesthetics of Authenticity: About authenticity, originality and innovativeness. Claus-Christian Carbon. University of Bamberg.

What's wrong with high-quality fakes or copies of originals—e.g. a mimetic design, an art forgery, a reprint of an artwork? First of all, such copies are cheap and accessible, and if they are generated on a high quality level, they resemble the original sometimes to a degree that differences are hardly detectable. Still, an essential ingredient seems to be missing: such a copy is not unique any more, it is not original, it is mostly not reflecting the inherent authenticity of the seminal work. In a couple of experiments I will demonstrate how the aesthetic appeal is reduced when people are confronted with fakes. Starting with a study on famous vs. less familiar artworks of five centuries of art history we revealed that not only the work itself is devaluated when originality is not ascertained, but we could also detect a kind of halo effect indicated by a devaluation of the talent of the artist him/herself having created the copy. We could also observe a direct devaluation when artworks were associated with internationally known dictators—an effect which was particularly large when participants realized that they had previously evaluated the same works labelled as being of different origin.

How does perceptual goodness relate to aesthetic merit? Alexis David James Makin, Giulia Rampone, Damien Wright & Marco Bertamini. University of Liverpool.

'Perceptual goodness' means the perceptual strength or salience of a pattern. Helm and Leeuwenberg (1996) developed a holographic weight of evidence model that quantifies the goodness of different visual regularities. The W score from the holographic model predicts response time and accuracy in regularity discrimination tasks. W also the amplitude of the neural response to symmetry. But does W predict preference? The influential fluency account claims that people like patterns that are processed quickly and efficiently. This suggests that people should like high W patterns most. Conversely, other researchers have emphasized the aesthetic value of indeterminacy or perceptual challenge. These accounts allow for the possibility that people should prefer regularities which are not so obvious, with mid level W scores. To test these diverging theories, we measured explicit preferences for a range of abstract regularities used in previous EEG research. We found a strong linear relationship between preference and the W goodness metric. This is consistent with the super-stimuli and fluency models, but not with the indeterminacy/perceptual challenge accounts. The later may capture slower, more cognitive aspect of aesthetic experience, which were not measured by our simple experiment.

Aesthetic appreciation of representational and abstract artworks: The role of art expertise. Galina V. Paramei<sup>1</sup>, Megan Snellock<sup>2</sup> & David L. Bimler<sup>3</sup>. Liverpool Hope University<sup>1,2</sup> & Massey University<sup>3</sup>.

Aesthetic appreciation of artworks implies visual elaboration (Muth, Hesslinger, & Carbon, 2015), including perceptual, semantic and affective dimensions (Marković, 2011). To examine the role of observer's expertise in aesthetic appreciation, we asked 30 experts and 33 non-experts (Arts and Psychology students respectively) to

rate 24 paintings on six evaluative, affective and evaluative-affective semantic differential scales. Twelve paintings were Representational (e.g. Bellow, Dix, Hopper) and 12 Abstract (e.g. Braque, Klee, Marc), all from 1900-1930s Western art. Relative to non-experts, experts rated Abstract artworks as more Interesting, Beautiful, Informative and Sophisticated, distinguishing them less markedly from Representational artworks. Processed by factor analysis, mean expert and nonexpert ratings resulted in a two-factor solution. The first factor, contrasting Abstract and Representational paintings (VAF=93%), appeared more salient for non-experts. The second factor, Warm-Cool, separating vibrantly-coloured paintings from those with blueish/dull colours (VAF=4%), was more salient for experts. While non-experts exaggerated differences between Abstract and Representational paintings, experts appraised these two types of art similarly and accentuated the chromatic palette. We conclude that appreciation of art by experts involves 'cognitive mastery' (Leder et al., 2004), i.e. more complex visual schemata which equip them with more sophisticated strategies for parsing 'visual rightness' ("good" structure) from an image.

Gaze meets space: mapping natural viewing behavior in the gallery. Elizabeth N Johnson, Jeff MacInnes, Shariq Iqbal & Marianne Eileen Wardle. Duke University.

Viewers experience works of art in personal, idiosyncratic ways. Despite the artist's intentions, a viewer's engagement is ultimately influenced by her own interests, emotions, and reactions. At a basic level, this is reflected in unique gaze patterns individuals exhibit as they explore artworks. Yet, eye-tracking experiments investigating this behavior often constrain the experience: participants may be shown scaled-down reproductions of artwork, viewed for a set duration, with head and body movements restricted. While these studies have offered important insights, they are not an accurate representation of how viewers engage with visual art in more natural settings. Here we describe work to overcome those limitations. Using eye-tracking glasses, we recorded gaze patterns as participants freely explored original works of art in a museum setting. We recorded gaze position and point-of-view video simultaneously, allowing participants free range of motion as they engaged with objects in the real-world. We outline the numerous analytic challenges that such an approach presents, as well as a method for mapping dynamic gaze position onto static reference images. These tools offer exciting potential for

exploring naturalistic gaze behavior of visual art, and can be extended to new investigative approaches across a wide range of complex real-world scenarios.

#### 11:30 - 12:30 Keynote Address

#### **Realizing Fechner's Fantasy**

Fechner had three fundamental insights relevant to my talk. He realized that properties of the world were systematically related to properties of the mind. Aesthetics could be an empirical science, or "an aesthetics from below." Finally, in addition to outer psychophysics, he speculated that there had to be an inner psychophysics. These insights give rise to contemporary neuroaesthetics. In this talk, I will offer a framework from which neuroscientists might decompose aesthetic experiences and frame questions experimentally. Fundamental to aesthetic experiences are the interactions between sensori-motor, emotional-valuation, and meaning-knowledge systems. I will discuss findings from cognitive neuroscience that reveal neural structures and networks engaged in our response to beauty and in other aesthetic experiences and how these experiences influence our interactions in the world.



Anjan Chatterjee is the Frank A. and Gwladys H. Elliott Professor and Chair of Neurology at Pennsylvania Hospital. He is a member of the Center for Cognitive Neuroscience, and the Center for Neuroscience and Society at the University of Pennsylvania. His research addresses questions about spatial cognition and language, attention, neuroethics, and neuroaesthetics. Recently he wrote *The Aesthetic Brain: How we evolved to desire beauty and enjoy art.* 

#### 14:00 - 15:30 Art and Cognition

What does an artist's innocent eye mean, psychologically speaking? Leon Lou. Grand Valley State University.

Many artists and art educators believe that drawing and painting require artists to see those aspects of the retinal image inconsequential to mundane functions of human vision. In its original and literal form, the "innocent eye" hypothesis is incompatible with the basic tenets of the modern vision science. Nevertheless, it contains a core idea substantiated by many artists' shared experience. The aim of this paper is to offer a valid psychological construct that captures the essence of the innocent eye hypothesis and remains fully compatible with modern vision science. A review of related empirical studies dating back several decades found little evidence for an explicit version of the innocent eye hypothesis, according to which artists have better access to sense-data, or aspects of retinal images. Instead, the innocent eve must essentially mean a special mode of active vision----the proximal mode of seeing that is concerned with pictorial relationships and plausibly contingent on the development of the Theory of Mind and the capacity to be aware of ones own viewpoint. It is argued that this understanding of the "innocent eye" paves the way for asking several ecologically meaningful questions concerning how visual perception affects the accuracy and other qualities of drawing and painting.

**Can perceptual judgements elucidate the Mona Lisa smile?** Tyler Christopher. City University, London.

There is very little information about the identity of the Mona Lisa, but one welldocumented remark suggests that she may have been a mistress of Cardinal Giuliano de Medici, brother of the Medici Pope and one of the most supportive patrons of Leonardo da Vinci. This would explain the fact that da Vinci retained the painting, because the husband of the most popular candidate, Lisa Gherardini, was known to resort to confiscation to ensure that his artistic commissions were delivered on time, and thus would be highly unlikely to have left the painting with da Vinci. This artistic conundrum was addressed by identifying portraits of the cardinal's mistresses and asking human observers to rate the probability that the Mona Lisa is a portrait of the same person as in each of the portraits. Other identifications that have been proposed were also assessed in the same way. The results give indirect support the hypothesis that Lisa Gherardini was a mistress of the cardinal prior to her marriage to Francisco del Gioconda, and suggests a compelling explanation for her ambiguous smile.

Sargy Mann: Art, vision and blindness. Robert Pepperell. Cardiff Metropolitan University.

Sargy Mann (1937-2015) was a British painter who was deeply fascinated with the nature of visual perception and how to depict it. His early training as a science technician gave him a lifelong appreciation of how art, science and mathematics could enrich and inform each other. His later training as a visual artist was driven by rigorous observation of reality, a process that he believed heightened and profoundly modified how he saw. Always troubled with poor sight, he began to lose vision in his 30s, and eventually became totally blind. Rather than ending his career, his blindness led to a late flowering of his painting, resulting in what many believe to be the best work of his career. This paper will discuss some of Mann's ideas about visual perception, and the many problems involved in depicting it, using examples of his paintings and writings and the analyses he undertook of other artists like Pierre Bonnard and Paul Cezanne. It will show how artists can enhance our understanding of visual perception, and how it can still be a rich source of experience, even in the absence of sight.

Synesthetic correspondences between cover art images and music tracks. Chihiro Hiramatsu, Shinnosuke Ogata & Takeharu Seno. Kyushu University.

Synesthetic correspondences between visual and auditory perception/cognition like the Bouba-Kiki effect is one of many fascinating topics in art and science collaboration. Humans can convert impressions of music into visual images. For example, cover art sometimes very effectively and correctly represents the impression of music. Therefore, we investigated the factors influencing audiovisual synesthetic correspondences by focusing on music and cover art images associated with the music. First, we asked participants to select cover art that matched the music best while listening to music. Then we calculated distances between cover art images and those between music tracks based on the matching pattern. Next, we asked participants to classify cover art images visually and calculated distances between images based on the visual classification. We also calculated distances between images based on low-level image statistics and distances between music tracks based on statistics of music parameters. By correlating distances obtained in each analysis, visual features those exceeding low-level and the musical features of rhythm, tone and timbre were found to be important factors influencing synesthetic correspondences between music and cover art images.

What shall we listen to, abstract or figurative music? Rossana Actis-Grosso, Olga Daneyko, Zaira Cattaneo & Daniele Zavagno. University of Milano-Bicocca.

Common sense and experimental research both suggest that classic music is a better fit for figurative art than jazz, which in turn is a better fit for abstract art. However artistic avant-gardes often deliberately fused and confused the concepts 'figurative' and 'abstract'. This research deals with such concepts by asking two questions: 1) How do people classify visual art that can fit in either category? 2) Can those concepts be extended to classify also music? Participants (n=24) were asked to classify (Session I) 30 paintings (10 clearly figurative, 10 clearly abstract, and 10 ambiguous) and (Session II) 40 excerpts (15sec) of instrumental music (20 classical, 20 jazz) as 'abstract' or 'figurative' and rate them for pleasantness. Abstract and figurative paintings were correctly classified, with the majority (8/10) of ambiguous paintings classified as abstract. Results also show a gender effect for painting's pleasantness: females rated higher ambiguous and abstract paintings. More interestingly, results show an effect of music style on classification (p<0.001), showing that it is possible to classify music as figurative or abstract, independently on the match with visual artworks.

**Discrimination of blur and disorder in photographic and artistic images.** George Mather, Megan Miller & Robert Pepperell. University of Lincoln<sup>1,2</sup> & Cardiff Metropolitan University<sup>3</sup>

The spatial resolution of human vision is worse in the retinal periphery than at the fovea, partly due to larger receptive field sizes which increase neural 'blur'. Spatial blurring affects both spatial resolution and tonal resolution. Koenderink and van Doorn (1999) reported a novel way to reduce spatial resolution in an image while preserving tonal resolution, which may capture human vision more faithfully than

blurring. In a 'locally orderless image' the pixels in a given region of the image are scrambled rather than replaced with their average local value (as in blurring). Locally orderless images retain tonal resolution and result in 'painterly' rendering which conveys tonal values but not precise local detail. To investigate perception of locally orderless images we compared the ability of participants to discriminate blur level with their ability to discriminate disorder level, using an 'odd one out' task. Images were either photographs of landscapes or paintings of the same scenes by Cezanne. Results showed that psychometric functions for blur discrimination were qualitatively similar to those for disorder discrimination. However spatial blur was more readily discriminated than local disorder.

#### 16:00 - 17:30 Visual Perception

Kandinsky or me? How free is the eye of the beholder in abstract art? Doris Ingeborg Braun & Katja Doerschner. Giessen University.

Research on the perception of art has focused often on aesthetic ratings. Here we take a different approach and investigate art perception by assessing (i) how the artist's color palette of a painting influences observers' choice of color for one element in the same painting (ii) if observers prefer their color choices over the original and (iii) how the composition of the painting affects its perceived balance. Participants (i) adjusted, starting with a neutral gray, the color of a single element selected in 24 abstract paintings of Baumeister, Hoffmann, Delauney, Kandinsky and Klee, and indicated (ii) their preference between adjusted and original color. To measure the perceived balance (iii) in a painting we asked participants to indicate the center of gravity for each artwork by adjusting the location and size of a black circle on a corresponding adjacent white rectangle. Results indicate that the color palette of a painting influences color choices in two ways: it either elicits harmonious or contrasting settings. Notably, color settings are frequently not in agreement with the artist's choice - though the latter is usually preferred over one's own settings. Unlike for color settings observers' exhibited a remarkable consistency in their perceived center of gravity.

Effects of emotion, complexity and presentation duration on eye movements when viewing environmental scenes and paintings. Manuela Maria Marin & Helmut Leder. University of Innsbruck.

Eye movements are linked to the pleasantness and complexity of an environmental scene (Bradley et al., 2011), suggesting that motivationally relevant cues prompt information seeking. However, arousal may be another affective dimension influencing eye movements. Furthermore, it is yet unclear whether these effects extend to aesthetic experiences and whether presentation duration leads to different viewing strategies. We thus measured eye movements in a free-viewing task in response to 32 environmental scenes (IAPS pictures) and 32 representational paintings which varied in complexity, pleasantness and arousal (Marin & Leder, 2013). In two blocks, 68 participants (34 females) viewed randomly presented environmental scenes and paintings, which were either presented for 6 or 25 s. When viewing environmental scenes for 25 s, arousal and complexity were the main determinants of fixation duration. Moreover, complex and unpleasant scenes induced longer saccades, particularly in high-arousing scenes. In paintings, however, unpleasant pictures elicited shorter, more numerous fixations. For saccade length, complexity interacted with both arousal and pleasantness. These findings indicate that affective contents and perceptual composition modulate eye movements, and further, that these factors have a differential effect during the perception of environmental scenes and paintings. The data of the 6 s-condition is currently being analyzed.

**High entropy of edge orientations in paintings of Western provenance.** Christoph Redies<sup>1</sup>, Anselm Brachmann<sup>2</sup> & Johan Wagemans<sup>3</sup>. University of Jena School of Medicine<sup>1</sup>, University of Jena<sup>2</sup> & University of Leuven<sup>3</sup>.

Does "visual rightness" of artworks manifest itself in a particular arrangement of edge orientations? To address this question, we analyzed how edge orientations relate to each other in >1600 paintings of Western provenance. We compared pairwise the orientations of each edge with the orientations of all other edges in the image of each painting. Based on the resulting orientation histograms, we measured Shannon entropy, collinearity and overall edge complexity. For comparison, we analyzed photographs of man-made stimuli and natural patterns. Results showed

that, for paintings, Shannon entropy of edge orientations was high and collinearity low, compared to the man-made image categories. This result implies that edge orientations exhibit a low degree of correlation across a painting on average. Moreover, confirming earlier studies, the complexity of paintings was intermediate. Results were similar for paintings depicting different content matter and for different art styles. An SVM classifier trained on the three measures reached accuracies of 79% in distinguishing paintings from all the other image categories. In conclusion, our results indicate that a large set of artworks is characterized by a specific lay-out of edge orientations. [A similar abstract was submitted to the IAEA 2016 conference in Vienna].

Compositional bias in selfies: Both selfies and wefies reveal a left cheek biases in children and adults. Marco Bertamini, Carole Bode & Nicola Bruno. University of Liverpool.

Artists have a bias to select poses showing the left side of the subject's face. The bias reverses when composing self-portrait probably because of the use of a mirror, and is particularly evident in the 16th-18th centuries. We tested whether this pattern exists for spontaneous productions by individuals with no formal training in painting and art history. We tested a sample of 104 British schoolchildren and teenagers (mean age = 13.8 years; 80 females) who used a smart phone to take a self-portrait (selfie) under controlled conditions. We also analysed combinations of self-portraits and portraits (wefies). The bias for showing the left cheek was preset in selfies. In wefies there was a bias for showing two left cheeks rather than two right cheeks. These results with young participants provide evidence in support of a biological basis for these biases in portraits and self-portraits, independently of training and expertise.

#### **ABSTRACTS (POSTERS)**

#### 01- How to Make Partly Invisible Objects. Kokichi Sugihara, Meiji University.

I found a class of anomalous objects, which I named "partly invisible objects." These objects are anomalous in the sense that parts of the objects become invisible when they are reflected in a mirror. This visual phenomenon arises due to optical illusion. A single image of a 3D object does not contain depth information, and hence from a mathematical point of view there are infinitely many objects whose projections coincide with the image. However, human visual systems usually interpret the image as a specific 3D object, ignoring other possible interpretations. In particular they have strong preference for right angles, and are apt to interpret the image as a rectangular object. Employing this human preference, we can construct 3D objects that appear different from actual shapes when they are viewed from one special viewpoint and that hide themselves partly when they are viewed from another special viewpoint. We present an algorithm for designing this class of objects. Indeed it is a special application of a more general principle for designing ambiguous cylinders that appear quite different when they are seen from two special viewpoints. The algorithm might be used as a new tool for generating artistic visual effect.

**02- High entropy of edge orientations characterizes artworks from different cultural backgrounds.** Anselm Brachmann<sup>1</sup> & Christoph Redies<sup>2</sup>, University of Jena School of Medicine<sup>1</sup> & University of Jena<sup>2</sup>.

In a companion presentation at this meeting (Redies, Brachmann & Wagemans), we studied whether "visual rightness" of an artwork manifests itself in a particular arrangement of edge orientations. We compared edge orientations pairwise in each of >1600 paintings of Western provenance and found that, on average, Shannon entropy of the edge orientation histograms was high, i.e. edge orientations exhibited a low degree of correlation, in each of the paintings. At the same time, collinearity of edge pairs was low in comparison to images of other man-made objects or scenes. Here, we extend this investigation to artworks from diverse cultural backgrounds and techniques (Islamic manuscript illuminations, Chinese brush paintings, Japanese

woodcut prints, calligraphy and Western graphic art). Similar to the results for Western paintings, entropy of edge orientation was high and collinearity low in these sets of artworks, while complexity was more variable. We conclude that high entropy of edge orientation is a widespread finding in artworks from different cultural backgrounds. Our results are compatible with the notion that a large body of visual artworks are characterized by specific statistical image properties across human cultures. [A similar abstract was submitted to the IAEA 2016 conference in Vienna].

**03-** New areas within the image and image thinking: The artist's perspective. Patrick Ceyssens, University Hasselt.

As a visual artist and teacher in a university college for media, arts, and design, I offer a new perspective for a visual science of art. Together with my colleagues, we believe that images can only be read as a complex structure of indirect image components, junctions between layers of meaning, mental connections, and their interrelationships, to end up in new areas within the image. This talk will focus on three levels. Firstly, we introduce a dynamic interplay between viewer and image, in which the concentration of the image meets the attention of the viewer and multiple image registers start interacting. Second, we liberate the image from language. In an art-historical approach, an image can only be grasped through language, but this interpretation strips the image of its explosive potential of meaning. In our visual approach of art, we no longer take the detour of language. The image thinks for us. Third, by reinterpreting and regenerating images over and over again, we arrive in a new, undisclosed artistic area with unprecedented opportunities: transfusions, interspaces, new sensations,... I will demonstrate how my art work sheds a different light on our perception of images and, consequently, our perception of the world.

**04- Beyond humans? Emulating a morally and ethically unaware android.** Ramiro Martin Joly-Mascheroni, City University, London.

Sometimes we observe actions in others that we do not intend to imitate. If they still trigger the urge in the observer to perform the same action, we refer to them as 'contagious'. Examples of such contagious actions are laughter and yawning, which

we also refer to as 'embodiment- inducing actions'. We know how it feels to perform these actions ourselves, and our perceptual systems are so fine-tuned to them that we 'embody' the action; we feel it in our body. In the field of Robotics and Artificial Intelligence, there is increasing interest in exploring the acceptability of and reactions to inanimate objects, such as androids and robots, and the potential use of these agents. Scientific studies found that humans spontaneously mimic emotional facial expressions of avatars. Through Art, Aesthetics, Artificial Intelligence and Technology, we are looking at Social Interaction and the Multi-sensory Integration of events around us. Scientific research such as in Neuroscience, Evolutionary Psychology and Philosophy, is focusing on artificial agents and human interaction. This era of intense technological advances suggests we should explore those brain mechanisms underlying how we perceive actions, and how we often attribute human characteristic virtues and imperfections to non-human agents and machines.

**05- Aesthetic stimuli stay in memory.** Bettina Rolke & Elisabeth Hein, University of Tuebingen.

We investigated whether the aesthetic value of pictures influences their cognitive processing and affects the way they are stored in memory. According to the perceptual fluency hypothesis of aesthetic experience, aesthetic stimuli are processed more easily and faster than unaesthetic ones and thus might have a facilitated access into memory. In a first step, we assessed the aesthetic values of chair pictures by means of a questionnaire. Based on these values, the chairs were categorized into aesthetic ones, neutral ones, and unaesthetic ones. In the learning phase of the memory task we presented the pictures shortly (80 ms) and masked them afterwards. In the following recognition memory phase, participants had to indicate whether they saw a picture before or not and how confident they were with their decision. Recognition memory of aesthetic chairs was higher than those of neutral chairs or unaesthetic ones. In addition, participants were more confident in recognizing aesthetic chairs than recognizing those of the other two categories. The results are in line with the perceptual fluency hypothesis, as an accelerated processing of aesthetic pictures could have generated a more stable memory representation and therefore better recognition performance for aesthetic chairs compared to neutral or unaesthetic ones.

**06-** Mors certa kitsch incerta: How does mortality salience affect kitsch judgements? Stefan A. Ortlieb, Fabian Gebauer & Claus-Christian Carbon, University of Bamberg.

Terror management theory states that art is valued for its ability to provide deathtranscending meaning. Previous research shows that reminders of mortality amplify people's positive and negative aesthetic judgements: Artworks which affirm the beholder's worldview were rated more positively, whereas artworks which defy meaningful interpretation were rated more negatively. How do these findings relate to kitsch? As a derogatory term "kitsch" is used to contrast significant artistic achievements. Yet kitsch also offers a clear-cut and consoling message which allows for immediate understanding. Hence, from a terror management perspective it is unclear how mortality concerns will affect kitsch judgements. Two studies were conducted based on the mortality salience paradigm to explore this issue: In both studies participants were either instructed to reflect on their own mortality or they were asked to imagine a situation of impending dental pain or disability prior to rating images of decorative and devotional objects in terms of liking, acceptability, and kitschiness. Subsequently, ratings were compared with evaluations by participants who rated the same set of images in a neutral setting. Both studies revealed a consistent pattern: Neither liking nor acceptability varied across experimental conditions. Kitsch ratings, however, were diminished whenever mortality was salient.

07- A 3D printed reconstructing of a paintings original size: showing the original size of Saul and David, by Rembrandt Willemijn Elkhuizen, Delft University of Technology.

In 2015 the Mauritshuis (The Netherlands) hosted a special exhibition to celebrate the results of the spectacular restoration treatment of Saul and David- since then reattributed to Rembrandt himself. This exhibition titled Rembrandt? The Case of Saul and David presented the results of eight years of research into a single painting Saul and David.In the 19th century the painting was cut into several pieces and trimmed. Later the painting was reassembled. Using advanced 3D scanning and 3D printing technologies a 3D printed reconstruction was made of the original format of the painting. During the restoration process, after the varnish and old retouches were removed, the colour and surface texture of the painting was scanned, using a high-resolution 3D scanner. These scans were digitally restored, in conjunction with the restoration of the painting itself. Finally the restored pieces of the painting were printed in their assumed original configuration. The painting and 3D print were on shown together at the exhibition. The 3D reconstruction was evaluated by fine art experts, on its material appearance, and the role of 3D reproductions in museums. This paper presents the reconstruction process as well as the evaluation of the reproduction.

**08-** Aesthetic preferences for unfamiliar faces are modulated by a combination of dynamic social cues Pik Ki Ho, Trinity College Dublin, The University of Dublin.

Facial expression, eye gaze, pupil size and head orientation are important social cues which indicate the emotional states and intentions of others. These cues can also modulate perceived attractiveness. However, it is unclear how they interact to determine preferences in faces. We conducted 3 experiments, using ratings of facial attractiveness, to explore these interactions. In Experiment 1 we manipulated pupil size and gaze direction of faces and found that a preference for direct gaze was modulated by pupil size - faces with dilated rather than constricted pupils were perceived to be more attractive but only when gaze was directed at the observer. In Experiment 2, we investigated the effect of gaze shift and facial expression on perceived attractiveness. We found a significant interaction between these cues in that faces were rated to be the most attractive when they changed from neutral to smiling coupled with a gaze shift towards the viewer. In the final experiment, we investigated the role of head orientation, eye gaze and expression. Again we found that the effect of head orientation varied between happy and angry expressions. Our results suggest that cues to social engagement combine to enhance perceived attractiveness in unfamiliar faces.

**09-** New areas within the image and image thinking: The scientist's perspective. Johan Wagemans<sup>1</sup>, Yane Beckers<sup>2</sup> & Patrick Ceyssens<sup>3</sup>, University of Leuven (KU Leuven)<sup>1,2</sup> & University College Hasselt<sup>3</sup>.

Inspired by the visual artworks by Patrick Ceyssens and his theoretical views on "images as the new thinking", we wanted to study how the audience perceives and appreciates his work. At an exhibition with a dozen of artworks with combined media, we collected questionnaire data from 108 visitors and conducted in-depth interviews with 28 visitors. The guestionnaires asked for 14 separate ratings and a general appreciation score on a 5-point scale for 3 representative artworks, as well as some demographic information (e.g., expertise level). Participants also selected 2 images in response to the exhibition's title work. In general, the responses varied as a function of expertise level and familiarity with the artist's repertoire. In addition to 'beautiful' and 'original', which strongly contributed to the appreciation of the 3 artworks by both groups, for experts 'abstract' and 'emotional' and for novices 'witty/to the point' seemed to contribute as well. Regarding the selected images, novices appeared to respond on the basis of overall or partial similarity with the artwork, while experts more freely associated on the basis of structural image components or image composition. We will discuss these and other results in terms of complexity of images and of image thinking.

**10- Attractiveness of human body and fluency of gender categorization.** Slobodan Marković & Tara Bulut, University of Belgrade.

In the present study we investigated the relationship between judgment of the human body attractiveness and the fluency of gender categorization. Eighteen participants of both genders were asked to categorize the silhouettes of human body as either male or female (first part of the study) and to judge the same silhouettes on attractiveness scale (second part of the study). Five male silhouettes and five female silhouettes were used as stimuli. Masculinity levels of male silhouettes were specified by shoulder-to-hip ratio, and Femininity levels of female silhouettes were specified by waist-to-hip ratio. Significant negative correlation between categorization time (CT) and attractiveness. This finding is in line with the Processing fluency theory which predicts that fluent (fast) processing induces

positive affect, i.e. generates aesthetic pleasure. ANOVA and post hoc analyses showed that categorization becomes faster and attractiveness is increasing with the increase of Masculinity/Femininity level. This finding is in line with the Supernormality hypothesis which predicts that human body attractiveness should increase with amplification of masculinity or femininity.

**11-** Capturing the intangible: M5oX—A multi-dimensional toolbox for measuring dynamics of aesthetic experience. Marius Hans Raab, Claudia Muth & Claus-Christian Carbon, University of Bamberg.

Faced with the temporal dynamics of aesthetic experience, in visual arts as well as in other artistic forms (e.g. film and music), conventional psychological measures (like interviews and questionnaires) reach their limits; essentially, such measures disrupt the experience and they only allow very limited data points. We present, compare and discuss a collection of five approaches that assist more ecological valid testing to increase the understanding of cognitive and emotional processes being relevant for aesthetic experience. Posturography (Raab, Shengelia & Carbon, 2012) records experience-related changes in body sway. Electrodermal activity (EDA) measures the sympathetic nervous activity (for music: Weth, Raab & Carbon, in prep.). The Continuous Evaluation Procedure (CEP) allows retracing changes in experiential dimensions with high temporal resolution (Muth, Raab & Carbon, 2015). The commercial software FaceReader (Noldus Systems) is able to detect the presence and strength of six basic emotions in a beholder's facial expression in real time (for music: Weth, Raab & Carbon, 2015). Finally, commercial gaming hardware Kinect (Microsoft) enables the recording and processing of body gestures in real time (Raab, Muth & Carbon, 2013). Most of these approaches are very cost-effective and can therefore be applied and critically evaluated even under very limited lab resources.

**12-** The mystery of orientations in abstract paintings – an experimental study of preference. Johannes Zanker, Rachel Harding & Cerys Simpson, Royal Holloway University of London.

The Dutch arts 'De Stijl' movement in the early 20th century was pivotal for advancing the composition of abstract paintings. In developing a 'universal' pictorial

language free of representational motifs, a legendary debate ensued between Piet Mondrian and Theo van Doesburg about the preferred orientation of lines: whilst Mondrian favoured horizontal and vertical ('cardinal') lines to reflect natural balance, van Doesburg introduced oblique lines ('diagonals') signifying dynamics. We tested this question experimentally, by using 8 paintings with predominant cardinal and 8 painting rich in diagonal orientations from 6 painters (Albers, Malevic, Klee, Moholy-Nagy, Mondrian, van Doesburg), and comparing perceptual ranking and preferential looking methods to assess preference. Two pairs of cardinal and diagonal painting were presented simultaneously in one of 28 stimulus sets, balancing the total number of individual painting, and the time spent on each of these paintings (dwell time) was measured with a desktop eye tracker (Tobii TX300). In a second experiment the same 20 observers were asked to rank the same stimulus sets according to 'liking'. We found that rankings for these paintings correlated with dwell time, and that diagonal paintings were preferred over cardinal paintings, challenging Mondrian's proposition that cardinal orientations mediate aesthetic priority.

**13-** Photographing art: An experimental and naturalistic investigation into the effects of photo-taking on memory. Caitlin Mullin<sup>1</sup> & Johan Wagemans<sup>2</sup>, MIT<sup>1</sup> & University of Leuven (KU Leuven)<sup>2</sup>.

Our culture increasingly communicates through images. This shift towards creating an external representation of events may change the way we perceive and remember those experiences. While composing a photograph calls for focused attention, recent work finds a Photo-Taking-Impairment Effect (PTIE). However, given that photographers usually attempt to capture something of beauty or interest, we wondered whether an experimental task would be suitable to capture the true effect of photo-taking. Here we attempt to replicate the original PTIE and evaluate whether it stands up under more naturalistic circumstances. In the replication study, participants were recruited for a museum tour and instructed to photograph certain artworks while simply observe others, followed by a surprise memory test. In the naturalistic study, participants were independent patrons of the museum and were approached as they exited to take part. Results revealed a replication of the PTIE, however when comparing photo-takers to non-photo-takers in the naturalistic study, we found no significant difference between groups. Therefore, it seems that the motivation to capture beautiful or interesting images might overwrite the impairment of photo-taking on memory. Photography, with the appropriate goals, and subject matter in mind does not appear to be harmful to the memory of our experiences.

**14-** Individual Differences in Artistic Capture of Peripheral Appearance. Tilde Van Uytven<sup>1</sup>, Erik Myin<sup>2</sup> & Bilge Sayim<sup>3</sup>, Royal Academy of Fine Arts, University of Antwerp<sup>1,2</sup> & University of Bern<sup>3</sup>.

The appearance of objects viewed in the periphery strongly differs from their appearance in central vision. However, precise characterizations of peripheral appearance are still lacking. Here, we investigated peripheral vision with a gazecontingent drawing paradigm to shed light on appearance characteristics in the peripheral visual field. We presented art students with images consisting of a range of geometric shapes. Eye tracking ensured that the presented image was only viewed in the periphery. Participants were asked to capture peripheral appearance as accurately as possible by making drawings that looked as similar as possibly in central vision as the presented image in the periphery. As expected, the resulting images strongly differed from the presented images. Differences were more pronounced in cluttered image regions (i.e. crowding), and increased with eccentricity. Importantly, there were strong inter-individual differences, again increasing with clutter and eccentricity. While salient features were maintained by most participants, the location, shape, extent and number of the features varied strongly. Our results show what is – and what is not – consistently extracted from the visual periphery, and illustrate the variance of peripheral appearance in different observers. We discuss how drawing the periphery is a useful tool in art education.

**15- Facial fixations: how visual exploration varies across artistic depictions of faces.** Jeff MacInnes<sup>1</sup>, Marianne Eileen Wardle<sup>2</sup> & Elizabeth N Johnson<sup>3</sup>, Duke University<sup>1,3</sup> & Duke University, Nasher Museum of Art at Duke University<sup>2</sup>.

Research since the 1950s has aimed at characterizing how humans view other faces. Eye-tracking studies have revealed stereotyped gaze paths in which the viewer fixates on central features of the face, including the eyes, nose, and mouth, while spending considerably less time on peripheral regions. This finding is common with representational depictions of faces (such as photographs); however, much less in known about how faces are processed when the depiction is more abstract. For centuries, visual artists have been exploiting the bias for finding faces even when hidden in ambiguity. We examined eye-tracking patterns elicited by a spectrum of artistic depictions of faces, including the still life portraits of Giuseppe Arcimboldo (b. 1526), and the mixed media collages of Wangechi Mutu (b. 1972). We compared these stimuli against naturalistic photographs of faces, as well as non-face control artworks matched to include similar features. We show that more abstract depictions of faces exhibit a significant difference in visual exploration depending on whether the image is upright or inverted. This same effect is not found with naturalistic photographs or control stimuli, and suggests that face processing evokes unique patterns of eye-movement distinct from the local features of the stimulus itself.

**16- On the perception and production of drawings and graffiti tags.** Frederic Fol Leymarie<sup>1</sup>, Prashant Aparajeya<sup>2</sup>, Daniel Berio<sup>3</sup> & Ilona Kovács<sup>4</sup>, Goldsmiths, University of London<sup>1,2,3</sup> & Institute of Psychology, Péter Pázmány Catholic University<sup>4</sup>.

We report on our progress in the last year in applying and refining computational models to study the perception and generation of certain types of visual art. We focus on line drawings, sketches as well as on graffiti writing and calligraphy. On one hand we consider recent studies and results in cognitive science which point in similar directions in emphasising the likely importance of "medialness" [Kovács, 2010] as a core feature used by humans in perceiving shapes in static or dynamic situations [Fol Leymarie & Aparajeya, in press]. On the other hand we rely on physiologically plausible models of handwriting gestures that permit the generation of curves which are aesthetically and kinetically similar to the ones made by an expert graffiti artist [Berio & Fol Leymarie, 2015]. We illustrate the use of medialness in computations performed with finished artworks as well as artworks in the process of being created or modified, evolved. We illustrate methods for extracting gestural model parameters from static images and video, which help study the generative process of graffiti writing. This is shown in particular with a humanoid robot which gives us an embodied platform to better understand how the human artist behaves.

**17- On the role of perceptual challenge in aesthetic stimuli.** Sabine Albrecht, Claudia Muth & Claus Christian Carbon, University of Bamberg.

The transformation of a disfluent stimulus into something meaningful has a rewarding quality, leading to a higher appreciation of the stimulus (Muth & Carbon, 2013)—even if content of negative valence is detected (Chetverikov & Filippova, 2014). As an important facet of aesthetic appreciation, interest is qualified by anticipation of such transformations plus an increased level of perceptual challenge (e.g., Berlyne, 1971). In our study, Mooney faces with positive or negative emotional expressions were either hidden in black-and-white contexts (challenging condition) or embedded in grey-and-white contexts (easy condition). As predicted, after spotting the face (via mouse-click) interest was higher for the hidden faces in the challenging than in the easy condition, regardless of the valence of the facial expression. Moreover, only in the challenging condition hidden faces with a positive expression were found to be more interesting than hidden faces with a negative expression, indicating that the appeal of positive expression was attributed towards interest. This was confirmed by similar results in a supplemental rating of the Mooney faces without context and spotting task. Our findings underline the role of challenge, insight, and stimulus valence within the process of aesthetic judgment formation.

**18- Effects of prior walking context on the vection induced by different types of global optic flow.** Takeharu Seno<sup>1</sup>, Stephen Palmisano<sup>2</sup> & Shinji Nakamura<sup>3</sup>, Kyushu University<sup>1</sup>, Kyushu University, University of Wollongong<sup>2</sup> & Nihon Fukushi University<sup>3</sup>.

Visually-induced-illusions of self-motion (vection) are widely used in entertainment (e.g., film, dynamic art and video-gaming). Our research suggests that walking while wearing iron clogs inhibits the subsequent induction of vection by radial optic flow (Seno et al., 2013). However, adding simulated viewpoint oscillation to such patterns of optic flow appears to significantly increase vection (see review, Palmisano et al., 2011). Do these two factors interact and if so what implications do they have for entertainment and art? In this study, we examined the effects of prior walking context on the vection induced by the radial flow with or without added simulated viewpoint oscillation. Before presenting the vection stimulus, our 19 participants

walked or sat for five minutes while wearing either iron or wooden clogs. The results showed that vection strength was inhibited by walking with iron clogs (relative to with wooden clogs or being seated) and always facilitated by adding oscillation. There was no significant interaction of the two factors. While these findings suggest that prior context should not alter the entertainment benefits of adding simulated viewpoint oscillation (e.g. to video games), one should still be vigilant for potential motion sickness.

**19- Making demo-movies of various vection stimuli.** Emi Setoguchi & Takeharu Seno, Kyushu University.

Visually-induced-illusions of self-motion is named vection and widely used in entertainment (e.g., film, dynamic art and video-gaming). Vection has been studied for about 40 years in behavioral and cognitive Psychology. Especially, stimulus attributes for effective or inefficient vection induction have been extensively studied. For example, larger stimulus size and peripheral visual field rather than central could induce stronger vection (Brandt et al., 1973; Nakamura, 2006), multiple colors could induce stronger vection than the black and white (Bonato & Bubka, 2006), color red in optic flow stimulus inhibited vection (Seno et al., 2011)(although Seya et al., 2015 reported the opposite case), attention could modulate vection strength (Seno et al., 2011) and the oscillatory and jittering display of optic flow facilitated vection (review, Palmisano et al., 2011). In this study, we challenged to make demo-movies of those vection stimuli as many as possible. There has been no such challenge in Psychology so far. We made various demo-movies that were based on over 30 Psychological published articles (some of them are described above). We think our movies can contribute to Science and also Art & Entertainment. Now we are trying to make movies that are most beautiful, interesting and fully scientific.

**20-** Classification of Expertise in Photoediting based on Eye Movements. Tandra Ghose, Kartikeya Karnatak, Thomas Morris & Yannik Schelske, University of Kaiserslautern, Germany.

Can expert knowledge be modeled by machine-learning algorithms based on eyemovement data (EM) in the domain of photoediting? To investigate this question we recorded EM from 4 experts and 4 novices during two photoediting tasks,: set the 1contrast or2-color of a given image to the most aesthetically pleasing one. The stimuli were images acquired from expert photographers that were degraded either in 1-contrast or 2-color along the blue-yellow axis. Clustering of adjusted-contrast and adjusted-color showed two distinct groups corresponding to the experts and novices. For the experts the adjusted-value was closer to that of the original-image. A support-vector machine was trained to classify EM-based features (luminance at fixation, luminance-variance in small (3x3px) or large (51x51px) region around fixation, color at fixation, color-variance in small/large region) into experts or novices. Classification-accuracy was significantly higher for the contrast (60 %) than in color (52 %) adjustment task. Luminance-features were significantly more discriminative during contrast than during color-adjustment, and vice-versa for color-features. Luminance-features were more discriminative (60% accuracy) than color-features (54 %). Based on EM-based classification of observer expertise we conclude that EM encode task-relevant information (increased discriminability of color-/luminance-features in color/luminance-based tasks respectively).

**21- Visual preference and approach response for smooth curvature.** Letizia Palumbo & Marco Bertamini, Liverpool Hope University, University of Liverpool.

Visual preference for smooth curvature, as opposite to sharp angularity, has been reported for a variety of visual stimuli (Bar & Neta, 2006, 2007; Bertamini et al., 2015; Leder & Carbon, 2005; Silvia & Barona, 2010; Vartanian et al., 2013). However, the origin of this phenomenon is still debated (Gómez-Puerto et al., 2015). Three studies are presented using explicit and implicit tasks (Palumbo et al. 2015, Palumbo & Bertamini, 2016). The first study shows that cognitive operations instantiated by stimulus time exposure and type of response during explicit tasks does not modulate visual preference for curvature (Palumbo & Bertamini, 2016). In Palumbo et al. (2015) the use of implicit tasks revealed an automatic association of curved shapes with positive (or "safe") concepts and angular shapes with negative (or "dangerous") concepts (Implicit Association Task - IAT). However, angular shapes did not elicit any avoidance reaction, whereas curved shapes triggered approach (Stimulus Response Compatibility Task - SRCT). Recently, this pattern of result has been replicated with an emotional regulation paradigm (Bamford et al., 2015). We propose that preference and approach response for curvature might result from the visual-

perceptual properties of curvature, possibly in combination with sensorimotor processes and context.

**22- Why do artists depict hands smaller than their actual size?** Nicole Ruta, Alistair Burleigh & Robert Pepperell, Cardiff Metropolitan University.

Often hands in painted portraits, especially of women, appear excessively small. We hypothesised that artists are influenced by cognitive and perceptual processes to underestimate hand size compared to head size (Bianchi et al., 2008; Pepperell & Haertel, 2014), and that this may be historically determined by the development of linear perspective. To test this we analysed 120 portraits of males and females made before and after linear perspective (30 of each gender pre- and 30 of each postperspective) by measuring a relationship index (RI) between head and hand size. We measured the same index in photographs and from anthropometric data (Peebles & Norris, 2008; Greener, 1990). The mean RI for both paintings (Pre: M=6.0, SD=1.06; Post: M=5.6, SD=1.19) and photographs (M=4.7, SD= .4) were significantly smaller than the anthropometric value (p < .001), while hand size in paintings was overall significantly smaller compared to photographs. In paintings we found a significant main effect of gender (F(1, 56)= 29.03, p < .001) that interacted with art period: male hands were depicted significantly bigger post-perspective, while female hands size did not change over time. We suggest that hands in paintings are depicted significantly smaller as a result of artists' perception of visual space.

23- A Tri-Level Explanation to Reconcile Competing Accounts of Picture Perception from the Visual Arts and Cognitive Neuroscience. Peter Coppin, Ontario College of Art and Design University, University of Toronto.

The visual arts and perceptual psychology each uses different theories to explain human picture perception capabilities. On one hand, a visual art student is typically taught that picture perception capabilities are conventionalized, akin to a language. On the other hand, in cognitive neuroscience, experiments to test how humans perceive natural environments often use pictures as proxies for environments, seemingly reflecting a view that treats picture perception as akin to "innate." A rare debate about these two views transpired in the 1970s when psychologist J.J. Gibson challenged the conventionalized account of art theorist Ernst Gombrich (with philosopher Nelson Goodman). The debate was not resolved; the schism continues. However, if perceptual systems inform actions in response to dynamic environmental changes, capabilities to both anticipate distal changes (via learning, consistent with the conventionalized account) and act in response to proximal changes (consistent with Gibson's account), would be required. Inspired by Marr's Tri-Level Hypothesis, this talk will aim to reconcile the two views via a three-level model: a computational level, a representational level, and a physical (neural) level. Implications will be discussed in relation to Arthur Danto's aesthetics, the plasticity of vision, and claims about "universal" properties of (visual) language.

24- The influence of graphic long-term memories and attentional priming on drawing accuracy. Neil Harrison & Simon Davies, Liverpool Hope University.

A crucial part of accurately drawing portraits is the correct spatial placement of the features. Non-experts typically place the eyes higher on the head than they are actually located. One theory is that such errors by non-artists are partly caused by the activation of graphic long-term memories (gLTMs) of the object to be depicted, and hence their depictions are less informed by bottom-up perceptual processes. A further source of error is thought to involve deficiencies in attentional allocation to the to-be-depicted model. First, we tested the influence of gLTMs by asking participants to draw faces and objects from memory and to directly copy them from photographs. Results showed associations in spatial errors between observation and memory-based drawings, supporting the theory that gLTMs may influence drawing more than the actual appearance of the to-be-drawn object. Then we tested the influence of attentional processes by priming participants to allocate attention to a specific part of the face. Results showed that participants made reduced spatial errors in their drawings when primed to attend to the top half of the head, compared to the bottom half of the head, supporting the view that attentional allocation may also play an important role in drawing accuracy.

**25- How artists depict equidistance in perspective paintings and engravings.** Casper Erkelens, Utrecht University.

From the fifteenth century on many artists have employed linear perspective to depict three-dimensional objects and scenes on paper and canvas. Linear

perspective provides rules and constructions for making faithful pictures of threedimensional scenes on two-dimensional surfaces. In appraisals of the perspective skill of painters, emphasis has been on accurate use of vanishing points. The current study investigated the skill of painters to depict equidistant intervals. Scenes were selected that contained rows of five equidistant intervals at the least. Depicted rows of equidistant columns, tiles, tapestries or trees were analyzed in 26 paintings and 4 engravings. Positions of intermediate borders of intervals were computed from positions of outer borders and vanishing point. Comparison of depicted and computed borders shows that from the Middle Ages until the 21th century, artists either depicted equidistance in physical space or in a visual space of very limited depth. Among the painters and engravers who depicted equidistance in a highly non-veridical visual space are renowned experts of linear perspective.

**26- It Matters Whom You Paint – Gender Differences in Art Portraits.** Jana Katharina Schulz & Gregor Uwe Hayn-Leichsenring, University Hospital Jena.

We investigated the differences between content and composition of art portrait paintings. To this aim, we conducted a study, in which 20 participants rated a random selection of 100 images of oil portrait paintings (16th to 20th century; 51 depicting women) according to four different categories, two of them concerning the depicted person (attractiveness of the person; evoked emotion in the viewer), and two concerning the image (beauty and harmony of the image composition). For one group of paintings, ratings on attractiveness and beauty were similar, while for the other group, attractiveness ratings were lower than beauty ratings. Strikingly, paintings of women were more likely to be of the first type. Possibly, artists tend to choose attractive women for their paintings, while images themselves are created to be similarly beautiful for portraits of women and men. Next, we analyzed the complete subjective dataset according to gender of the depicted person. In portraits depicting women, the evoked emotion of the viewer and the impression of harmony in the image show significantly higher correlations with the attractiveness of the depicted person than in portraits depicting men. Therefore, the gender of the depicted person is relevant for subjective evaluation of an art portrait.

**27- Examining the Mere Exposure Effect in Dementia patients using recreational tasks.** Fatima M Felisberti, Kinga Zyto, Shahnaz Akhtar & Oded Be-Tal, Kingston University London.

The Mere Exposure Effect (MEE) refers to an increase in likeness judgements for novel stimuli after repetitive exposure (Zajonc, 1968). In this study we explored the MEE in Dementia patients (Dp; mild to moderate severity) and age-matched control participants (Cp) (n = 74). Likeness ratings for three categories of stimuli (music, colour, paintings) were obtained in three (weekly) sessions incorporated into the recreational activities of five care homes across London (UK). The stimuli used were PANTONE colour postcards, short music clips composed by Oded Ben-Tal (voice vs no-voice), and Picasso's paintings (displayed on a laptop). The findings showed no effect of exposure in the ratings for paintings or colour postcards, but ratings for paintings were significantly higher in Cp than Dp. On the other hand, a significant interaction between music and exposure was observed: the ratings for music with voices decreased whereas the rating for instrumental music increased with exposure, both in Cp and in Dp (who also gave music higher ratings than Cp). The findings suggest that instrumental music could be used during recreational activities with Dp to improve their sense of well-being.

**28-** Colour Preferences Differ According to Object Context and Gender. Domicele Jonauskaite, Christine Mohr, Jean-Philippe Antonietti, Laetitia Chèvre & Nele Dael, University of Lausanne, Switzerland.

Humans like some colours and dislike others, but which particular colours and why remains to be understood. Empirical studies on colour preferences generally targeted most preferred colours, but rarely least preferred (disliked) colours. In addition, findings are often based on general colour preferences leaving open the question whether results generalise to specific objects. Here, 88 participants selected the colours they preferred most and least for three context conditions (general, interior walls, t-shirt) using a high-precision colour picker. Although the chosen colours varied widely between individuals and contexts, consistent patterns also emerged. Furthermore, when allowed to select more than one colour in a subsequent study (N = 50), participants showed the same preference tendency as for single favourite colours: red and green-blue were the most preferred while

yellow, orange and purple were the least preferred colours in general. We also report gender differences. The high intra- and inter-individual variability in this and previous reports furthers our understanding that colour preferences are determined by subjective experiences and are context-specific.

**29-** The effect of art appreciation education on aesthetic impression of paintings. Masahiro Wakabayashi<sup>1</sup>, Tomoyuki Naito<sup>2</sup>, Noriko Fuku<sup>3</sup> & Hiromichi Sato<sup>4</sup>, Osaka University<sup>1,2,4</sup> & Kyoto University of Art and Design<sup>3</sup>.

In this study, we investigated the effect of the art appreciation education on the aesthetic impression of visual arts. Two different groups participated in an aesthetic evaluation experiment of paintings. One is experts who received art appreciation education at university (N = 11). The other is novices who did not received it (N = 23). All participants evaluated 60 paintings presented on LCD monitor using 23 adjective pairs with a 7-point semantic differential. As a result of exploratory factor analysis, four latent factors for aesthetic impression were extracted, corresponding to Activity, Evaluation, Eccentricity, and, Potency. We found that factor scores of novice group were more widely distributed than that of expert, suggesting experts exhibited less fluctuation in evaluation within the group than novice. Furthermore, there were tight correlations in factor scores between the two groups in Activity, Eccentricity, and Potency, while there was no significant correlation in Evaluation factor. The results suggested that the art appreciation education had significant effects on aesthetic evaluation judgement without changing perceptual aspects of aesthetic impression.

**30- Sketching the 'Strange-Face-in-the-Mirror' Illusion.** Ute Leonards & Catherine Lamont-Robinson, University of Bristol.

Gazing at one's own face in a mirror at low illumination levels evokes illusory perceptions of one's reflection, known as "strange-face in the mirror illusion" (Caputo, 2010). Reports of illusions range from distortions of one's face over faces of relatives and archetypal faces to faces of animals or monstrous beings. Here, we present a new way to capture the extent of the subjective and dynamic nature of these perceptual illusions, namely through drawing. We asked participants (n=85) to sketch from memory their own face before gazing into the mirror and then sketch

their most striking illusion afterwards. An independent participant group then rated how different these pairs of face sketches appeared (on a 10-point Likert scale) as compared to two sketches of an object drawn by the same person before and after mirror gazing. Not only did this study enable us to visualize the mirror illusion in healthy individuals and relate them to their verbal reports, but we quantified the strength of the illusion and correlated it to the more classical measures of illusion frequency and duration as well as to personality traits, mood, and cultural background. Results allow new insights into the mechanisms underlying this illusion.

**31-** Forming Hypotheses in Categorization Research by means of the Process of the Perception of and Interpreting Works of Art. Levente Gulyás<sup>1</sup>, Anna Losonczi DLA<sup>2</sup>, Anett Ragó<sup>3</sup>, Klára Sarbak<sup>4</sup>, Attila Kurucz<sup>5</sup>, Júlia Losonczi<sup>6</sup>, Miklós Oroszlány<sup>7</sup>, András Gyökér<sup>8</sup>, Sonit Bafna<sup>9</sup> & Andrea Dúll<sup>10</sup>, Ginkgo-Green Architects, Budapest<sup>1,2,4,5,6,7,8</sup>, Hungarian Academy of Sciences<sup>2</sup>, Department of Cognitive Psychology, Eötvös Loránd University, Budapest<sup>3</sup>, School of Architecture, Georgia Institute of Technology, Atlanta<sup>9</sup> & Department of Economic and Environmental Psychology, Eötvös Loránd University, Budapest<sup>10</sup>.

We are a group of architects and psychologists exploring how architectural space can influence people's behavior. Our research examines the cognitive process that develops in the course of moving through spaces, with a focus on the concept of categorization. During the research process we get closer to understanding the operation of various concepts, to be followed by transforming a certain element of the behavior of the phenomenon investigated into a compositional element in the process of artistic creation. We are able then to learn more of its usability and impact, re-examining it once again from the researcher's perspective. Our goal is to exhibit shapes, positions, and gestures that deliberately stimulate the visitors' system of perception. By means of experiencing the artwork, a number of categorization processes are activated, the visitor becoming aware of their presence and operation as a result of continuous stimulation. Elevating the psychological concept explored to the compositional level in the work of art exhibited enables the visitor to experience empirically, as a result of interpreting the work of art and as a way of extending the knowledge of the abstract concept, how our mind sets up the membership of different forms in different categories.

**32- On which parts of the beautiful painting do I look longer and more carefully?** Piotr Francuz, The John Paul II Catholic University of Lublin, Institute of Psychology.

Analysis of oculomotor data provides interesting results for understanding why we like some paintings more than others. While viewing, the subjects unevenly focused their gaze to different parts of the painting. So, its aesthetic appreciation is also based only on the content of these parts. Forty-four subjects (experts in visual arts and novices, half of them men and half women) viewed figurative masterpieces (selected from 418) and evaluated them in terms of beauty (on a 5-point scale). During viewing, eye movements were recorded. The eye fixation positions of all subjects on each painting were clustered by an Expectation-Maximization algorithm. The time duration of all points in each cluster were subjected to Multivariate Multiple Imputation and then Multilevel Modeling to determine to what extent they explain the aesthetic assessment of the whole painting. A similar analysis was conducted for the diameter of the pupil. It was found that for each painting there are clusters in which a longer fixation duration and/or the greater diameter of the pupil explains a higher aesthetic appreciation of the image. These diagnostic clusters often contain some kind of mystery or promise. The results are discussed in the light of the theory of interpretation of a painting.

## **33- Fractals: Converting 3D formula to artworks.** Kazim Hilmi Or, Eye Surgeon Private Office.

Fractals are formula in algebra which describe endless 3 D forms in space, which are repeating themselves in every step about 1,5 %. Some examples of fractals are found also in nature, in natural forms. Projecting rectangular prism slices of fractals to 2D and painting it with colours is a new type of art. Before the area of computers and software programs, it was very difficult and time consuming to draw fractals. Nowadays there are many software programs having the function to change a lot of variables in fractals. So, using the conventional rules of art, there fractal artwork can be created in endless forms and colour combinations. Theory and practice of creating fractal art will be shown at a software program.

**34-** Is she looking at you? The effect of distance (and memory) on Mona Lisa's gaze. Daniele Zavagno, Christine Stivanin, Olga Daneyko & Natale Stucchi, University of Milano-Bicocca.

La Gioconda, aka Mona Lisa (ML), is a most iconic painting, such that many have seen a reproduction of it at least once in their lifetime. Pages have been written about the elusive quality of its smile. Here we considered its eyes instead: if asked out of the blue in which direction ML is looking, many would assert that she is looking straight at the viewer. The fact is that ML is not looking at you, if you look at her up close; however when observed at a distance she indubitably appears to be looking at you. We tested this fact in an experiment with two groups of subjects: G1=100 people from Milano-Bicocca who saw a 1:1 reproduction of the painting at a relatively close distance (70-100cm), and G2=160 people from the Louvre who saw the original at a relatively greater distance (300 cm or more). Both groups were interviewed with the painting out of sight; 56% of G1 declared that ML was not looking at them, while 56% of G2 asserted the contrary. Results from a second experiment are also reported showing the importance of the face as a Gestalt in the impression of the direction of ML's gaze.

**35- The influence of illumination on perception of works by Jan Schoonhoven.** Maarten W.A. Wijntjes<sup>1</sup>, Susan F. te Pas<sup>2</sup>, Marga P. Schoemaker<sup>3</sup>, Sylvia C. Pont<sup>4</sup>, F. Zhang<sup>5</sup>, T. Kartashova<sup>6</sup> & C. van Middelkoop<sup>7</sup>, Delft University of Technology<sup>1</sup>, Perceptual Intelligence Lab, TU Delft, Helmholtz Institute, Faculty of Social and Behavioural Sciences, Utrecht University<sup>2</sup>, Museum Prinsenhof, Delft<sup>3</sup> & Perceptual Intelligence Lab, Faculty of Industrial Design Engineering, Delft University of Technology<sup>4</sup>.

A central theme in the development of pictorial representation is the use of light and shade. Through smooth tonal variations, observers are deluded in seeing a three dimensional shape on an otherwise flat medium. Another central theme in art history is that of ornament: repetitive patterns decorating walls, vases, frames and so on. The Dutch artist Jan Schoonhoven combined both universal themes in his white reliefs. Instead of tonal variations in the paint, Schoonhoven used white paint covering repetitive three dimensional patterns. Thus, the shading (and thus shape) depend not only on the work, but also on the environmental lighting. **36-** The impact of drawing instruction on perceptual abilities in training artists. Rebecca Chamberlain, KU Leuven.

Research has shown that artistic skill is associated with enhanced perceptual abilities. However, existing correlational findings cannot determine whether artistic training leads to perceptual enhancement. The current study aimed to identify a causal link between drawing training and the development of perceptual abilities. A battery of tasks were administered to 37 non-art students at baseline and to 38 art students who were enrolled in an intensive foundational drawing course on three occasions. The battery consisted of: Mental rotation, embedded-figures, bistable figures, visual illusions, Navon shapes, blurred photos, limited-line tracings, and creative and observational drawing tasks. Art students outperformed non-art students on drawing tasks, mental rotation, embedded figures and bistable figure reversal. There were no group differences for the blurred pictures, global and local Navon tasks, and illusions. Art students showed improvements in tasks in which they showed superior performance to controls at baseline (mental rotation, embedded figures, bistable figures). Assessing the relationship between change in drawing ability and changes in perceptual performance will determine whether longitudinal changes are caused by drawing instruction in particular. Low inter-task correlations and differential rates of change across tasks suggest that drawing training confers wide-ranging but differential impacts on perceptual processing in the emerging artist.

**37-** Self-portraits, side biases, and lateralized expressiveness: New evidence from the updated SelfieCity database. Nicola Bruno<sup>1</sup>, Vera Ferrari<sup>2</sup> & Lev Manovich<sup>3</sup>, Università di Parma<sup>1,2</sup> & CUNY<sup>3</sup>.

Selfie takers prefer poses showing their left cheek (Bruno & Bertamini, 2013; Bruno, Bertamini & Protti, 2015; Lindell, 2015). This phenomenon may have a psychobiological basis: assuming that (i) the expression of emotions is rightlateralized; and that, consequently, (ii) most of us are more expressive on the left side of the face, there may be a spontaneous preference for poses favoring the left cheek. We tested this hypothesis using the updated SelfieCity database (3840 selfies posted on Instagram from New York, Sao Paulo, Berlin, Moscow, Bangkok, and London), which includes computer-based automatic assessments of face rotation and of the intensity of positive and negative emotions. In accord with previous analyses (on an earlier, smaller dataset), we confirm that selfies show a significant left cheek bias. In addition, we report that selfies showing more of the left cheek are coded as more expressive than selfies showing more of the right, and that this difference is mostly driven by stronger expression of negative emotions on the left cheek. Implications for studies of self portraiture in the psychology of art and for cognitive and affective neuroscience are discussed.

## **38- Angular versus Rounded shapes: aesthetic preferences and non-arbitrary correspondences.** Olesya Blazhenkova & Melisa Maya Kumar, Sabanci University.

Present study explored several aspects of the processing of angular versus rounded abstract shapes. In particular, the current research jointly examined angular and rounded shape correspondences, aesthetic preferences towards angular and rounded shapes, as well as individual differences in emotional processing. Using both verbal labels and real sensory stimuli, this research systematically investigated non-arbitrary mapping between angular/rounded shapes and attributes from all basic sensory modalities (vision, audition, gustation, olfaction, and tactation) and non-sensory attributes (emotion, gender, and name). Participants associated rounded shapes with sweet taste, quiet and relaxed sound, vanilla smell, green color, smooth texture, relieved emotion, female gender, and wide-vowel names. Angular shapes were associated with sour taste, loud and dynamic sound, spicy and citrus smell, red color, rough texture, excited and surprise emotion, male gender, and narrow-vowel names. This effect was robust across all conditions and shape pairs. A preference task, using the same angular/rounded shapes, revealed mixed findings. Our research brings together the multisensory research on shape correspondences and research on aesthetics, as well as research on emotional processing. The current findings may inspire applications in various disciplines such as experimental aesthetics, marketing, and individual differences.

**39-** Photogenic Cranes – An Analysis of Bird Photography. Claudia Menzel & Gregor Uwe Hayn-Leichsenring, University Hospital Jena & Institute of Anatomy, University Hospital Jena, Germany.

Birdwatching is as popular as ever. Moreover, the colorfulness and huge variety of birds make them an exceedingly popular object of photography. Photographs of birds are particularly hard to take due to the timidity, small size and speediness of these animals. This difficulty provides an additional incentive for wildlife photographers. The question arises: What kind of factors make a bird photograph beautiful? Here, we investigated 300 photographs derived from a Facebook group on bird photography. We asked ten participants to rate (1) the appeal of the birds and (2) the beauty of the photographs, on continuous-looking scales. We analyzed the data based on the orders of birds. Results revealed that participants (1) found ramphastidae (toucans) most appealing as birds while (2) they preferred photographs of strigiformes (owls) and gruiformes (crane-likes) over photographs of other orders. In particular, crane photographs were rated as highly beautiful, although cranes are not considered as appealing birds per se. Additionally, bird photographs of lower complexity and higher anisotropy, as well as depictions of flying and/or moving birds are generally preferred. Overall, our study shows that besides the depicted bird other factors like statistical image properties and positioning are relevant for creating a beautiful bird photograph.

**40- Fascination of autumn foliage illuminated by LED lighting.** Shino Okuda, Doshisha Women's College of Liberal Arts.

Several kinds of illumination events related to autumn color are held at temples in Kyoto, Japan. Recently, LED lighting has become popular in such events, because their usage can reduce energy consumption and provide various light color environments. This study aims to clarify the LED lighting conditions for creating a fascinating appearance of autumn foliage. We conducted a subjective experiment on the appearance of two kinds of Japanese maple: green leaves and red leaves. Twenty female participants observed each Japanese maple tree under eighteen kinds of LED lighting conditions with different light colors. They evaluated the "naturalness in color", "vividness in color" and "preference" according to a 7 steps numerical scale, and also answered the impression with a semantic differential

method using eighteen pairs of adjectives. The results show that the preference is higher as the vividness in color is higher for both types of Japanese maple. Vividness in color of green leaves is highly correlated to Duv (the distance from the blackbody curve for the color temperature on the uv plane) whereas vividness is highly correlated to FCI (Feeling of Contrast Index), suggesting that FCI is a critical factor for creating a fascinating autumn color illuminated by LED lighting.

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