# *Fourth* *Visual Properties Driving Visual Preference* workshop

# *Neuroaesthetics*

*"Beauty is, for the greater part, some quality in bodies acting mechanically upon the human mind by the intervention of the senses"* (Burke, 1757)

## 11 June 2018
## University of Liverpool
### Department of Psychological Science
### Eleanor Rathbone Building (boardroom 2nd floor)

**Visual Perception Lab**
**http://www.bertamini.org/lab/**

**In collaboration with IAEA**
**(International Association for Empirical Aesthetics)**
**http://science-of-aesthetics.org**

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**Programme**

| Time | Session |
|---|---|
| 09:15-9.30 | **Welcome** |
| 09:30-9:50 | Preference for symmetry in different categories of objects (**Marco Bertamini, Andrew Jessop, Giulia Rampone, & Alexis Makin**) |
| 9:50-10:10 | Visual preference for abstract curvature and interior design in neurotypical development and high functioning autism (**Letizia Palumbo, Giulia Rampone, Eleanor Clarke, Marco Bertamini, & Oshin Vartanian**) |
| 10:10-10:30 | Preference for curvature in real paintings (**Enric Munar, R. Pepperell, J. Vañó & N. Ruta**) |
| 10:30-10:50 | The key questions a future neuro-aesthetics must answer (**Martin Skov**) |
| 10:50-11:10 | **Discussion over coffee** |
| 11:10-11:30 | Using graffiti to explore embodiment accounts of aesthetic appreciation (**Rebecca Chamberlain, Guido Orgs, Daniel Berio, Frederic Fol Leymarie, Komalta Mirani, Ella Sudit & Veronika Mayer**) |
| 11:30-11:50 | Investigating curvature and sharpness influence on preferences for architectural façades (**Nicole Ruta, Stefano Mastandrea, Olivier Penacchio, Stefania Lamaddalena, & Giuseppe Bove**) |
| 11:50-12:40 | **Keynote:** |
| | The Good, the Bad, and the Ugly of Beauty (**Anjan Chatterjee**) |
| 12:40-13:30 | **Lunch (provided in the boardroom)** |
| 13:30-13:50 | Motion fluency and object preference: Robust perceptual but fragile memory effects (**Steven Tipper**) |
| 13:50-14:10 | Defining Modern art using visual image statistics (**George Mather**) |
| 14:10-14:30 | Perceiving sublimity and beauty in photographs: influences of physical properties (**Young-Jin Hur, Christian Hallam-Evans, Yvette Garten, & Chris McManus**) |
| 14:30-14:50 | The psychology of visual art: Confessions of an ex-designer (**Dhanraj Vishwanath**) |
| 14:50-15:10 | Disambiguation as an aesthetic experience (**Trym Lindell, Janis Zickfeld, & Rolf Reber**) |
| 15:10-15:30 | **Discussion over coffee** |
| 15:30-15:50 | **Keynote:** |
| | Neuroscience of architecture: Top-down and bottom-up approaches (**Oshin Vartanian**) |
| 15:50-16:10 | Using Q-methodology to investigate aesthetic preferences of Interactive Objects (**Jie Gao & Alessandro Soranzo**) |
| 16:10-16:30 | People dislike upside down periodic tables (**Alexis Makin**) |
| 16:30-16:40 | Medieval representation of pictorial space? A study investigating an alternative hypothesis from art history (**Alistair Burleigh, Robert Pepperell & Nicole Ruta**) |
| 16:40-17:00 | Everyday encounters with beauty (**Helmut Leder**) |
| 17:00-17:30 | **Closing discussion** |
| 17:30-19:30 | **Lab visits or *Aperitivo* in town** |
| 19:30 | **Social Dinner (*Crust* on Bold Street)** |

**Tuesday**
10:00-13:00        Lab visits and research discussions

## Organizers

**Marco Bertamini**
Marco Bertamini studied psychology at the University of Padova, Italy, and then at the University of Virginia, USA. He moved to Liverpool in 1999, where he established the Visual Perception Laboratory (sometimes known as Bertamini lab). His interests are broad across visual perception and cognition. For more information visit
 www.bertamini.org/lab/
and
https://scholar.google.co.uk/citations?user=u0mFXekAAAAJ

**Alexis Makin**
Alexis Makin studied Psychology and Neuroscience at the University of Manchester. He is now a Lecturer in psychology at the University of Liverpool. He works on symmetry perception, preferences and how people update mental representations at the right speed. For more information and publications visit:
https://scholar.google.co.uk/citations?user=RArXnR8AAAAJ

**Giulia Rampone**
Giulia studied Neuroscience at University of Trieste, Italy. She moved to Liverpool in October 2012, and has been working in the Bertamini Lab since then. She is now lecturer in the School of Psychology, University of Liverpool. She studies symmetry perception, preference and attention. For more information and publications visit:
https://scholar.google.co.uk/citations?user=fmdes-kAAAAJ

## Directions from Lime Street Station to Department
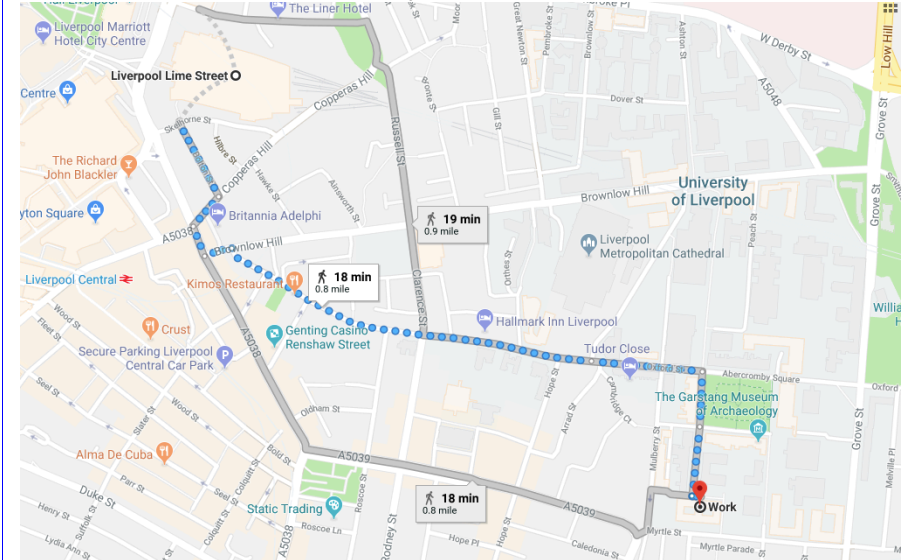


## Directions from Hallmark Hotel to Department
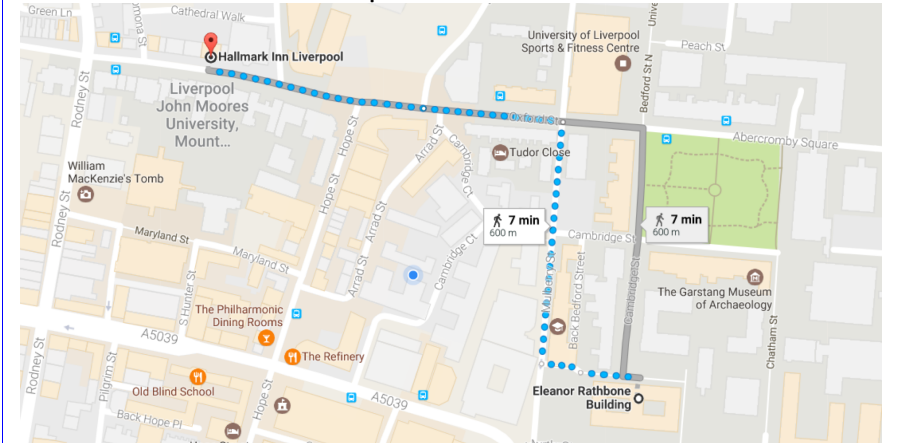


## Restaurant



25 Bold Street
Ropewalks Area, Liverpool (six minutes walk from the Department)
Merseyside, L1 4HR
Tel: 0151 709 1133

## Abstracts

### Preference for symmetry in different categories of objects.

Marco Bertamini, Andrew Jessop, Giulia Rampone, Alexis Makin
*University of Liverpool, Department of Psychological Sciences*

Preference for symmetry in human is strong. This has been studied empirically for over a century, using a variety of stimuli, including faces and abstract patterns. In Experiment 1 we compared preference in a study that mixed categories. We used human faces (from Rhodes et al., 1998, both males and females) smooth and angular abstract shapes, flowers (from Hůla & Flegr, 2016) and outdoor scenes. For each category one set of images had perfect bilateral symmetry, the other had reduced symmetry. Symmetry was not mentioned to the participants and for a given image the two versions with different degree of symmetry were not shown to the same observer. There was a second task of rating the salience of symmetry, and a third task of discrimination between a pair of images on the basis of symmetry. Symmetry was overall a poor predictor of preference. For landscapes the artificially symmetric images were liked less than the original. It seems that symmetry can play different roles, including being used to detect what is not natural. In a second Experiment we used an approach/avoidance talk. Note that in this case preference was not relevant and was never mentioned, but symmetry was a necessary factor to perform the task. Here for both human faces and abstract patterns there were faster approach responses to symmetric stimuli.

### Visual preference for abstract curvature and interior design in neurotypical development and high functioning autism

Letizia Palumbo[1], Giulia Rampone[2], Eleanor Clarke[1], Marco Bertamini[3], & Oshin Vartanian[4]
*[1]Liverpool Hope University, UK; [2]School of Psychology, University of Liverpool, UK; [3]Department of Psychological Sciences, University of Liverpool, UK; [4]Department of Psychology, University of Toronto Scarborough, Canada*

Visual preference for smooth curvature, as opposed to angularity, has been documented for a variety of stimuli and with different tasks. Previous work examined the nature of this phenomenon often without a focus on its applicability and impact. The current work extended the research inquiry to a clinical population to individuate factors that might contribute to the development of friendly-design environments. We examined visual preference for curvature in 13 adults with high functioning autism (HFA) and in 15 matched (for age, gender and IQ) neurotypical individuals (NT). In Experiment 1 we employed abstract shapes with different contours (angular vs. curved), whereas in Experiment 2 sets of colored lines (angular vs. curved) were presented through a circular or square black aperture. Preference for curvature was confirmed with abstract shapes and lines in both NT and HFA. Finally, in Experiment 3 we showed interior design environments varying for appearance (curvilinear vs. rectilinear), ceiling (high vs. low) and space (close vs. open). Participants indicated like or dislike and whether they would enter or exit the room (approach/avoidance). A higher proportion of "likes" was found for curvilinear designs in both groups, although this did not lead to approach. Importantly, both TD and HFA reported a higher proportion of "likes" for curvilinear designs with high ceilings and a higher proportion of approach reactions for curvilinear designs with open spaces. We confirm an aesthetic advantage of curvature extending the outcome to HFA and we discuss the role that additional dimensions might play in ecologically valid settings.

### Preference for Curvature in Real Paintings.

E. Munar, R. Pepperell, J. Vañó & N. Ruta
*University of the Balearic Islands*

Preference for curvature is a well-known cognitive effect. It has been proved with many different types of stimuli. However, as far as we know, there are no experimental results with real paintings. With this aim, Robert Pepperell painted a collection of 48 paintings distributed in three subsets according to the type of contour: curved, sharp-angled and mixed. To wit, there were three versions of the "same" painting. Robert explained in a previous Liverpool meeting how he created them. With the digital versions of these paintings, we carried out a lab experiment in Mallorca and an online study from Cardiff. In the lab experiment, the four tasks were intended to test preference for curvature in the liking and wanting processes. This way, there are three tasks testing the wanting process and one testing the liking process. In the online study, we assessed liking, comfort, approachability, and attractiveness. We will present our provisional results.

### The key questions a future neuro-aesthetics must answer

Martin Skov
*Center for Decision Neuroscience, CBS Danish Research Centre for Magnetic Resonance*

For its first 15 years neuroaesthetics has essentially been an addendum to behavioural aesthetics. Most neuroaesthetics studies have been motivated primarily by behavioral, not neurobiological, questions, and therefore often provide results in the form of (difficult to interpret) blobs associated with some specific kind of behavioural manipulation. In this talk I will argue that the time has come to start asking neurobiological questions instead. More provocatively I will argue that neuroaesthetics should leave behind the psychophysiological paradigm that has dominated empirical aesthetics since Fechner. In traditional empirical aesthetics, the main question is how a change in circumstances under which an object is being experienced affects the degree to which it is liked or not (i.e., object properties, context, personality differences). Neuroaesthetics, in contrast, offers the possibility of investigating what liking is, that is to say the neurobiological mechanisms that dictate such experiences. Neuroscientific evidence already suggests that the processes of assigning value to a sensory input are much more complex than previously imagined. For instance, the human brain embodies not one, but several value signals. These signals are modulated not just by

the information inherent to the sensory signal, but also by interoceptive signals, and task conditions. Furthermore, the functional purpose of valuation is not just to produce an affective experience, but to regulate other neurobiological processes. Neuroaesthetics' main ambition should be to elucidate these processes. In my talk I will present three outstanding questions hopefully to be addressed by future studies: (1) How many value signals are there, and do they play different roles relative to different sensory inputs? (2) What is the physiological effect of valuation events on homeostatic and neuroendocrinological systems? (3) How are valuation processes modulated by task conditions? Together, these three questions promise to transform the way we conceptualize aesthetic valuation.

## Using graffiti to explore embodiment accounts of aesthetic appreciation

Rebecca Chamberlain[1], Guido Orgs[1], Daniel Berio[1], Frederic Fol Leymarie[1], Komalta Mirani[1], Ella Sudit[1] & Veronika Mayer[2]
[1]Goldsmiths, University of London; [2]LMU Munich

Research is beginning to show that embodiment plays an important role in engagement with the arts, by helping the viewer to recover the artist's movements and intentions from the artwork. In line with this idea, motor systems seem to contribute to the observation of dynamic abstract artworks (e.g. Umiltà et al. 2012) and aesthetic appreciation for an artwork is enhanced when artistic movements appear less robotic (Chamberlain et al. in press). Motor simulation accounts of visual aesthetics assume that artworks originating from natural human movement should be more attractive than those originating from non-natural movements. However, to date no study has evaluated how natural movement parameters such as the timing and velocity of drawing movements contribute to perceived plausibility and aesthetic appreciation of the artistic trace. In a series of studies, we present participants in the laboratory with synthetic graffiti tags, which are computationally generated, allowing for systematic manipulation of biologically plausible and non-plausible movements. We then measure the perceived plausibility of various trajectory formation methods and the impact this has on aesthetic evaluation of the dynamic and static artistic trace. Results indicate that observers are sensitive to the plausibility of artificially generated graffiti tags, and that this perceived 'naturalness' shapes aesthetic appreciation. These studies are the first in a line of research evaluating the aesthetic value of graffiti art and its potential for explicating the mechanisms of embodied aesthetic experience.

Umiltà, M. A., Berchio, C., Sestito, M., Freedberg, D. & Gallese, V. Abstract art and cortical motor activation: an EEG study. Front. Hum. Neurosci. 6, (2012).
Chamberlain, R., Mullin, C., Scheerlinck, B. & Wagemans, J. Putting the Art in Artificial: Aesthetic responses to computer-generated art. Psychol. Aesthet. Creat. Arts (in press).

## Investigating curvature and sharpness influence on preferences for architectural façades

Nicole Ruta[1], Stefano Mastandrea[2], Olivier Penacchio[3], Stefania Lamaddalena[4], Giuseppe Bove[2]
1Cardiff School of Art and Design, Cardiff Metropolitan University, Cardiff, UK; 2Department of Education, Roma Tre University, Rome, Italy; 3 School of Psychology and Neuroscience, University of St Andrews, UK; 4 Department of Architecture, Polytechnic of Bari, Italy

This research explores whether the well-known human preference for curved visual objects (Bar and Neta, 2006, 2007) can be extended to the architectural domain, in particular to architectural façades. Can a different amount of curvature in architectural façades drive our preferences or our judgments of their familiarity, complexity, stability and approachability? We produced four different line drawings of a simplified version of the Oratorio dei Filippini by Francesco Borromini, varying its global and local curvature: A) high and B) medium curvature; C) rectilinear and D) sharp. We collected behavioural data of twenty-four female participants who: 1) performed a preference-forced choice task; 2) evaluated each stimulus for five dimensions: liking, familiarity, complexity, stability, approach; 3) classified the façades from the most to the least preferred. Asymmetric multidimensional scaling on the forced choices task showed that the preference order was: A, B, D and C, with the high curvature façade being the most preferred. Multidimensional unfolding showed the same pattern of results, with the majority of participants assigning higher preferences for the A/B curved façades. An ANOVA showed a significant main effect of liking, complexity, stability and approach, but not of familiarity. Stimuli were processed with a dynamical model of the visual cortex (Penacchio, Otazu & Dempere-Marco, 2013) and a model that characterises discomfort in terms of adherence to the statistics of natural images (Penacchio and Wilkins, 2015). The order of stimuli preference was related with both models and matched the behavioural data (Redies, 2007). I will discuss influence of curvature in driving preferences also for architectural stimuli, opening new scenarios for future researches.

## Motion fluency and object preference: Robust perceptual but fragile memory effects

Jonathan Flavell, Bryony G. McKean, Steven Tipper, Alexander Kirkham, Tim Vestner, Harriet Over [speaker: Steven Tipper]
University of York

In 7 experiments, we investigated motion fluency effects on object preference. In each experiment, distinct objects were repeatedly seen moving either fluently (with a smooth and predictable motion) or disfluently (with sudden and unpredictable direction changes) in a task where participants were required to respond to occasional brief changes in object appearance. Results show that 1) fluent objects are preferred over disfluent objects when ratings follow a moving presentation, 2) object-motion associations can be learnt with repeated exposures, 3) sufficiently potent motions can yield preference for fluent objects after a single viewing, and 4) learnt associations do not transfer to situations where ratings follow a stationary presentation. Episodic accounts of memory retrieval predict that emotional states experienced at encoding might be retrieved along with the stimulus properties. Though object-motion associations were learnt, there was no evidence for emotional reinstatement when objects were seen stationary. This indicates that the retrieval process is a critical limiting factor when considering visuomotor fluency effects on behaviour.

## Defining Modern art using visual image statistics

George Mather
School of Psychology, University of Lincoln, Lincoln LN5 7AY, UK

Modern art represented a radical departure in both style, content and philosophy from the Western art of previous eras. Art historians have long debated the question of when the Modern period began. A range of dates have been suggested between the middle of the nineteenth century and the early part of the twentieth century, on the basis of influential reviews, particular exhibitions, individual artworks, and so on. Current theories of visual aesthetics argue that paintings in all periods possesses certain statistical regularities, so one might expect that the advent of Modern art was marked by a shift in the statistical properties of artworks. The results of this study show that two measures of the statistics of Western paintings (fractal dimension and entropy) remained relatively stable for about 500 years, and similar to the values found in photographic images depicting the same subjects. Dramatic changes began in the middle of the nineteenth century, when the statistics of artworks became steadily more variable and departed from values that are typical of representational images. Statistical analysis identifies the year 1884 as the starting point of the Modern art period. Art prior to this date may be largely constrained by the statistical properties of the real scenes they depict, whereas Modern art broke free from these constraints. There was no marked change in aesthetic ratings at this turning point, and this result calls into question the view that image statistics play a major role in aesthetic judgements.

## Perceiving sublimity and beauty in photographs: influences of physical properties

Young-Jin Hur, Christian Hallam-Evans, Yvette Garten, and Chris McManus
Research Department of Clinical, Educational and Health Psychology, University College London

The sublime remains one of the most enduring aesthetic concepts in Western aesthetic discourse, and is often described, notably in Edmund Burke's *A Philosophical Enquiry into the Origin of Our Ideas of the Sublime and Beautiful* of 1759, as an aesthetic delight that evokes emotions of fear and shock. In three studies (total N ≈ 100) each containing 60 pre-selected photographs, we explored the role of physical aspects of images upon perceptions of sublimity and beauty. Participants rated beauty and sublimity by responding on a two-dimensional grid so that both properties were reported simultaneously. We particularly wanted to manipulate size, with the largest images projected onto a laboratory wall and being 200 cms x 150 cms in size. We compared absolute size (large vs. small), viewing distance (far vs. close), visual angle (height (high vs. central) and colour (vs monochrome), and found a number of double dissociations. The design and analysis treated both participants and images as random effects using *lmer()* in *R*. After controlling for by-subject and by-item variations, increase of stimuli size was associated with a significant increase of sublimity rating but not beauty rating. On the other hand, colour in an image influenced the rating of beauty but not sublimity. We are also carrying out analyses of images varying in brightness and contrast to assess effects on sublimity and beauty.

Burke, E. (2009). *A philosophical inquiry into the origins of our ideas of the sublime and beautiful*. Oxon, UK: Routledge Classics. (Original work published 1759).

## Disambiguation as an aesthetic experience

Dhanraj Vishwanath
University of St Andrews

The psychology of visual art and aesthetics is most naturally couched in terms of visual preference. What factors drive preference for artistic images and objects over non-artistic images and objects? Why are some artistic artefacts aesthetically preferred over others? Several interesting psychological theories and ideas that address these questions have emerged over the last two decades, though a unified psychological model is yet to emerge. In this brief presentation I will consider these questions and associated theories/ideas in the context of a confessional of my own intellectual trajectory from architectural design to vision science to (more recently) the psychology of visual art. I conclude by wondering whether answers to the above questions could also emerge by deliberately stepping away from considerations of preference to address the ontological questions: What is an aesthetic artefact? What is an aesthetic experience?

## Disambiguation as an aesthetic experience

Trym Lindell, Janis Zickfeld, & Rolf Reber,
University of Oslo

According to philosopher Alexander Baumgarten who coined the term aesthetics, mental processes can be divided into sensory and cognitive processes. He claimed that sensory processes', but not intellectual processes can elicit aesthetic pleasure. Fluency theory, on the other hand, claims that any experience of ease of mental operations, regardless of whether they are perceptual or intellectual, might elicit positive affect that is attributed to aesthetic pleasure. We were therefore interested in two phenomena. First, are affective responses inherent to sensory processes? When ambiguous visual stimuli are encountered it will be in the perceiving organism's interest to disambiguate the incoming percept. Disambiguation should therefore result in pleasure. Second, are affective responses inherent to intellectual processes? As every mental process, including intellectual ones, are accompanied by experienced ease or difficulty, and solving a task may be a success analogous to disambiguating visual stimuli. Solving intellectual tasks should therefore result in pleasure.

Utilizing facial electromyography, which allows for non-invasive measurement of the temporal development of affective responses with high temporal accuracy, we explored how positive affect and negative affect/cognitive effort develops over time during disambiguation of ambiguous visual stimuli, adding numbers, and solving syllogisms. The results for

visual stimuli suggest that positive affect linearly decreases up until the point of disambiguation which is followed by a rapid increase of positive affect. A similar, but reversed pattern was found in negative affect/cognitive effort. These results were replicated in a second study. By contrast, we did not see similar trends in solving intellectual tasks.

**Architecture, Design and the Brain**
Oshin Vartanian
*University of Toronto*
Over the last few years there has been growing interest in understanding how the brain responds to variations in the design features that characterize architecture. There is applied interest in this line of work because to the extent that we gain a better understanding of how these design features affect our psychological and neural function, we might be in a stronger position to optimize the spaces that we live and work in. I will review some of the key findings from this burgeoning area, and highlight points of convergence as well as problems that require further scrutiny. Importantly, I will argue that the emerging findings fit into and can be understood within the larger framework of neuroaesthetics, and can therefore inform and be informed by it.

**Using Q-methodology to investigate aesthetic preferences of Interactive Objects**
Jie Gao, Alessandro Soranzo
*Sheffield Hallam University*
Beauty plays an important role in everyday life. When we shop, for example, our preferences often rely on aesthetic evaluations. This decision-making process is rooted in our brain, and generally results from the stimulation of multiple senses at once. To investigate how each of our senses contributes to the overall aesthetic experience, Soranzo et al. (2018) studied the aesthetics of the Interactive Objects (IOs); which are objects supplied with electronics that react when handled; e.g. by vibrating, sounding or lighting up. It emerged that people prefer objects exhibiting a "behaviour" over quiescent objects. Furthermore, some interesting different aesthetics "mindsets" were observed: Some people based their aesthetic judgments on the IOs' behaviour only and other also consider a combination of IOs' texture and shape. These individual differences are very interesting, as aesthetic response is a subjective and whimsical experience. To further explore individual differences in multiple stimulation, in this project we employed Q-methodology (Stephenson, 1953) in combination with behavioural methods. The results suggest that people can be clustered into different groups based on their aesthetic mindset. These clustered preference groups have shed more light on individual differences in aesthetics, which paves the foundation for future research.

**People dislike upside down periodic tables**
Alexis D.J. Makin[1], Ellen Poliakoff[2]
*[1]University of Liverpool, [2]University of Manchester*
People like neutral stimuli they have seen before, even if they have no explicit recollection of the previous exposures. We revisited this 'mere exposure effect' by presenting participants with silhouettes of the periodic table, either in original or inverted orientations. We examined scan paths with an eye tracker. Only 6/24 psychology students and staff recognized the periodic table during extensive debriefing (the most identified it as an animal). However, there was a significant preference for the original orientation. This again suggests that mere exposure effects preference without explicit recollection. Furthermore, orientation had a strong effect on scan paths, which were inverted in the inverted condition. This shows that an 'aesthetic stimulus' is not just a simple image or single static representation in the brain, but an (un)familiar perceptual-motor sequence of images and saccades, with a necessary temporal dimension. We think this is an important caveat to understanding how visual properties drive visual preference.

**Medieval representation of pictorial space? A study investigating an alternative hypothesis from art history.**
Alistair Burleigh, Robert Pepperell and Nicole Ruta  [speaker: Robert Pepperell]
*FovoLab, School of art and Design, Cardiff Metropolitan University*
Prior to the discovery of linear perspective, Western artists varied figure size in compositions, often dramatically. The standard 'hierarchical scaling' theory explains these variations as reflecting the figures' status (White, 1973). But the art historian Wulff (1907) offered an alternative, as yet untested, hypothesis: that figure size was determined by 'inverse perspective' used by artists to elicit empathy and direct visual attention. We think that the composition of these Medieval paintings might also reflect the structure of imaginary space.
To test these hypotheses, we selected 10 Medieval paintings and altered each to approximate the rules of linear perspective (using Adobe Photoshop). We subjected the original and altered versions of the paintings to a series of experiments to measure preference, empathy and imagined space. The original version of the paintings did not affect liking, but significantly influenced preferences for artistic composition ($t$ (78) = 8.828, $p$<.001). In a free viewing task, participants fixated for longer the bigger character if viewing the original version (M = 2.96, SE =.267) compared to the altered one (M = 2.78, SE = .256). We also investigated qualitative differences in empathy in participants' descriptions of each painting. Finally, a drawing task revealed a pattern that closely matched the composition of the original Medieval paintings (t (21) = 3.147, $p$ = .005). We conclude that Medieval artists' composition of pictorial space was more sophisticated than standard art histories allow, and representative of imaginary and visual space than previously recognised (Ruta et al. 2016 Pepperell & Haertel, 2014).