1/ Using Phase Synchrony Analysis to Examine the Perception and Imagination of Abstract Art

Roger Batt
Harvard University (Student) / RIKEN Brain Science Institute

Within the past decade, a wealth of innovative studies has shed light on the visual perception of art. Many of these studies have focused on: (1) basic feature analysis; (2) the organization of these features into coherent forms, and (3) the addition of meaning to these forms through associations stored in long-term memory. Despite advances in neuroaesthetics, the significance of abstraction in art has remained relatively unexplored according to these cognitive processes. Our research is, therefore, aimed to provide experimental data on the cognition of abstract and non-abstract visual art.

More specifically, EEG signals are recorded from artists and non-artists during performances of visual perception and imagery of paintings (half abstract and half non-abstract). Phase synchrony analysis of these signals illustrates the cooperation between cortical areas during the performances of visual thinking. The synchrony can be dissected into different frequency bands, illustrating their correlation with specific cognitive tasks. High frequency bands (such as gamma and beta) are associated with the bottom-up process of integrating specific parts of the visual object into a holistic internal representation. Low frequency bands (such as delta and theta) are involved in the top-down process of retrieving prior knowledge to give meaning to the raw visual impression. Previous studies have shown that, when looking at images, artists show a greater increase in the gamma band frequency than non-artists, suggesting that artists are trained to pick up on the salient features of an image[1]. During mental imaging, artists likewise show a greater increase in the theta band oscillations of the frontal cortex, suggesting that they are drawing from more extensive visual-art patterns in their long-term memory.

[1] Bhattacharya, Joydeep. "Shadows of Artistry: Cortical Synchrony During Perception and Imagery of Visual Art." *Cognitive Brain Research* 13 (2002): 179-86.

Our preliminary studies expand upon these findings and likewise suggest a correlation between synchronization and artistic experience. For example, when both artists and non-artists view a work of abstract art, there is a greater degree of high-frequency synchronization than when they view non-abstract art. This synchrony is particularly accentuated between the frontal and right temporo-occipital cortices, suggesting that abstract art encourages the extensive bottom-up processing of basic visual features. Compared to non-artists, however, artists are also believed to show an increase in the delta oscillations of the frontal cortex when looking at abstract art, as they can draw from their prior knowledge to make sense of the abstraction. During performances of mental imagery, non-artists are believed to show greater theta synchronization for non-abstract art, as their long-term memory is better equipped to make sense of real-life images. In artists, on the other hand, theta synchronization is stronger in the right frontal lobe when viewing abstract art, as they actively seek creative and imaginative explanations for the piece. While the studies are yet to be complete (we are scheduled to finish in mid-July), there are numerous fascinating inferences that one can draw from the experimental data. Our research, thus, points to the influence of abstraction in visual art and elucidates the cognitive processes underlying its perception.

2/ An attempt to define a Twenty-first century hybridised Neuroaesthetics via experiential study of the arising praxis of multiplex consciousness

Andrew Denham

This paper speculates that a holistic scientific correlation of the neural processing underlying aesthetic experience requires a paradigmatic shift in philosophical thinking to embrace ubiquitous social behaviour and mental constructs in an era of unprecedented technological convergence, mutable media and simultaneous distributed networks.

The prime objective is to study the psychological resonance of memetic cultural contagion in the “the twenty-first century self … so fully immersed in and defined by the

data that surrounds it, we are entering an era of multiplex consciousness." (Miller, 2004, p.61) The dominant visual metaphor for envisioning the 'mind as a distributed network' (Miller, 2005, p.69-73) tenders the notion of a simultaneous, differentiated, locally specialized and globally distributed objective reality, possibly deemed a manifold aesthetic experience to negotiate / mediate multifarious concomitant information exchange in the transient info-sphere.

The diversity of approaches in the embryonic field of Neuroaesthetics may disavow complex socio-cultural and technologically induced immaterial relations in the ontology of the art object and / or aesthetic experience, and thus may be considered reductionist in its deconstructed origin / thinking. Neidich (2003, p.132) articulates the 'Ontology of the art object as it moves through linear and non linear time' to "[evolve] a prescribed and proscribed genealogy of such art objects as they have migrated through the history of their own form." Neidich (2003, p.132) If we transpose this intellectual premise to generic aesthetic experience in networked society, with all its implicit cultural precedent / genealogy and innate social behaviours, then how is evolutionary cultural actuality altering our epistemological acquisition of knowledge constancies and cognitive development in the networked brain.

This presents the possibility that techno-cultural data inflection and habitual social behaviour exhibits interpolation in the Neuroaesthetics theory proffered by Zeki and Ramachandran, amongst others, as the digital revolution and resultant neurobiological adaptation / evolution in the neural networks of the brain procure a new model of hybridised aesthetic experience. If, as suggested, metaphysical cultural contagion fluidly realigns the aesthetic functionality in the brain, through neural darwinism / neuronal plasticity, to cope with a new level of transience in the emergent info-sphere, then the intention is to attempt to assemble an empirical model to monitor, record, quantify and visualise this evolutionary shift in the collective cultural psyche / neural networks in the brain.

An experiential study to verify this proposed aesthetic hybridity through profiling intrinsic social behaviour and digital transaction, both communal and individual data subjectivity, and omnipresent mental constructs in context specific or context aware scenarios. The building of an intelligent (AI) cognitive agent to visualise 'mental constructs' evidenced in simultaneous and distributed networks. The creative decision-making is taken by an intelligent application (algorithm) to collate empirical data and subsequently envision ubiquitous social behaviour. The intention to map the nascent collective consciousness to unravel the genealogical precedent or immaterial relations deemed fundamental to interpreting individual and group differences in our data subjectivity. An adjusted aesthetic paradigm to visually extrapolate the post-human 'multiplex consciousness' or experiential aesthetics evidenced in our collective socio-cultural psyche and immaterial distributed network information patterns.

***3/* Reading factitious photographs as content-related perceptual multistabilities**

Vasileios Kantas

This thesis offers an understanding of how ambiguity is constructed in quasi-documentary photographs. Through examining selected images by three contemporary artists who use the medium of photography to mix techniques belonging to the contrived image and the snapshot, my research discloses the directorial strategies that provoke a particular 'oscillation' in the spectator's mind that is productive of ambiguity. It is my intention to demonstrate that the viewer's ambivalence between the categories of 'this-has-happened' and 'this-could-not-have-happened', when confronting such imagery, places the viewer within a mode of perceptual multi-stability.

Giving equal importance to the material condition of a photograph's production (the 'photo-effectic' mode) with that of its aesthetic aspect (the 'photo-graphic' mode), this research utilizes case studies in which the imagery examined is analysed from three standpoints. Phenomenology, Speech Act Theory and Catastrophe theory are applied to

enhance our understanding of ambiguity's appearance. The data used for the application of these approaches is drawn from a multidisciplinary literature review of the notion of ambiguity, which places emphasis on the photographic debates around issues such as medium specificity, documentary aesthetics and theatricality. A body of photographic work by the author is presented as one of the case-studies in this research, mirroring the potential handling of the medium and its capacity for provoking equivocal readings.

4/ Synaesthesia and creativity: A research at neurological level

Eurícide Cabañes Martínez
University of Santiago de Compostela

On the research about creativity, we can find an important study framework, coined with the terms "creativity and mistake" or "disorder and creativity". In the paper, following the line Kraepelin (1921) marked in his work, in which he set out the hypotheses that a maniac can cause changes in thought process leading to creativity, we will see the newest studies related to creativity and bipolar disorders (specifically, manic-depressive disorders). We will also see the case Marl Lythgoe (2005) found in his research about creativity: a 40 year old worker, with little creativity, who became a man with an incredible creativity after suffering an apoplexy that caused the blockade of the areas in the brain that guide the inhibitor process. The same way the researchers in the University of Exeter discovered the relationship between Tourette syndrome and creativity, Paul Howard-Jones (HOWARD-JONES, ET AL., 2005) is carrying out studies on creativity at neurological level to determine how the brain works when creativity is produced discovering the activation of specific areas that are activated when the subject is creative.

This research in the field of creativity and mistake seems to show that, in the cases studied, those areas in the brain activated when being creative, and those always activated, are to be the same. It also seems, and this is the most important part, to be the same area where feedback is produced in the cases of synaesthesia.

But there is a basic difference between these cases and those of synaesthesia. The cases studied are “abnormal” cases affecting a low percentage of population. On the contrary, synaesthesia is present in every human being (to a greater or lesser degree).

If mental disorders or brain damages are to be related to creativity, the relationship between synaesthesia and creativity seems to be clear. According to Ramachandran and Hubbar “synaesthesia in creative people multiplies by seven its frequency in general population. One of the common faculties shared by creative people is a gift for metaphor (…) the same way synaesthesia is linked to the formation of arbitrary links between independent sensitive entities, such as colours and numbers, metaphor is related to the conceptual domains not related among them" (RAMACHANDRAN & HUBARD, 2003)

Therefore, we can see how synaesthesia does not only help to obtain more information from our environment, but also to organise it in more complex perceptual and conceptual schemes, without which arts and science would have never been possible.

Neurologically speaking, if interconnections are related to the areas in the brain that process or represent summaries of concepts, the link between synaesthesia and creativity can be explained.

5/ The robustness of symmetry and complexity against familiarization

Pablo P.L. Tinio & Helmut Leder

The basic visual features symmetry and complexity have been a focus of numerous investigations since the early days of empirical aesthetics (e.g., Birkhoff, 1932; Eysenck, 1941). The effects of these features on aesthetic judgment have been shown to be robust. Symmetrical basic patterns (e.g., Jacobsen & Höfel, 2001), faces (e.g., Perrett et al., 1999), human bodies (e.g., Concar, 1995), and abstract designs (e.g., Cardenas & Harris, 2006) are judged more positively than their nonsymmetrical counterparts. Complex basic patterns (e.g., Jacobsen, 2004), building facades (Imamoglu, 2000), and product designs (Cox & Cox, 2002) are also evaluated more positively than their simple versions. In light

of these findings, the question that beckons is whether dynamic factors such as familiarization could challenge this robustness: could familiarization mediate the effects of symmetry and complexity on aesthetic judgment? We previously addressed this question in a series of experiments and found that although the effects of symmetry were generally resistant to massive familiarization, the effects of complexity were indeed influenced (Tinio & Leder, 2009). Specifically, participants familiarized to simple stimuli subsequently judged complex stimuli more positively than participants familiarized to complex stimuli; participants familiarized to complex stimuli subsequently judged simple stimuli more positively than participants familiarized to simple stimuli. In the present research, we build on our earlier work by examining the relationships among symmetry, complexity, and familiarization using more meaningful stimuli. We discuss the results in the context of current debates in aesthetics.

Birkhoff, G. D. (1932). *Aesthetic measure*. Cambridge, MA: Harvard University Press.

Cardenas, R. A., & Harris, L. J. (2006). Symmetrical decorations enhance the attractiveness of faces and abstract designs. *Evolution and Human Behavior*, *27*, 1-18.

Concar, D. (1995). Sex and the symmetrical body. *New Scientist*, *146*, 40-44.

Cox, D., & Cox, A. D. (2002). Beyond first impressions: The effects of repeated exposure on consumer liking of visually complex and simple product designs. *Journal of the Academy of Marketing Science*, *30*, 119-130.

Eysenck, H. J. (1941). The empirical determination of an aesthetic formula. *Psychological Review*, *48*, 83-92.

Imamoglu, C. (2000). Complexity, liking, and familiarity: Architecture and non-architecture Turkish students' assessments of traditional and modern house facades. *Journal of Environmental Psychology*, *20*, 5-16.

Jacobsen, T. (2004). Individual and group modelling of aesthetic judgment strategies. *British Journal of Psychology, 95*, 41-56.

Jacobsen, T., & Höfel, L. (2001). Aesthetics electrified: An analysis of descriptive symmetry and evaluative aesthetic judgment processes using event-related brain potentials. *Empirical Studies in the Arts, 19*, 177-190.

Perrett, D. I., Burt, D. M., Penton-Voak, I. S., Lee, K. J., Rowland, D. A., & Edwards, R. (1999). Symmetry and human facial attractiveness. *Evolution and Human Behavior*, *20*, 295-307.

Tinio, P. P. L., & Leder, H. (2009). Just how stable are stable aesthetic features? Symmetry, complexity, and the jaws of massive familiarization. *Acta Psychologica*, *130*, 241-250.

6/ A Perceptual Hypothesis: The Neuroaesthetics of Dance Made from Embodied Movement

France Mayotte Hunter

Previous neuroaesthetic studies have focused largely on paintings and music, while performing arts such as dance have been less researched. Nevertheless, increasing knowledge of the neural mechanisms, primarily mirror neurons, that discharge in the brain both when performing an activity as well as when observing the same activity performed by another, make the investigation into the neuroaesthetics of dance timely. This paper is based on an 8-month choreographic process with five dancers that was designed to elicit embodied movement material from the unconscious experiences of insomnia. The process culminated in a 15 minute dance performed at The Movement Research Open Performance Series in New York in May, 2009. From this project I will attempt to show that movement derived from neuromuscular memory can, as a result of the authenticity of the movement experience for the dancer, promote a more visceral or "embodied" rather than cerebral experience in the viewer.

The dancers, through various extended structured improvisations, created movement essentially in an "unconscious state" and had little recollection of what they did after. Using video to record these sessions, movement was then selected, re-learned and structured into a cohesive whole. Some of the movement was solo and others required physical interaction between and among the dancers. The process was a lengthy and challenging one; subsequent to a movement experience that was had in an almost trance-

like state, it was difficult to then "re-learn" movement that they had created but had very little memory of.

The piece, called *Ravell'd Sleeve*, transitioned from the physical exploration of restless and interrupted sleep, to a rigorous dreamscape of fear-based issues identified by the group through psycho-automatic writing and discussion. As the participants were all women, these issues tended to be peculiar to women and imagery that arose- yellow rubber gloves, crime scene tape- became the eventual props used in the dance.

Subsequent to the creation of the dance, feedback was elicited from both the dancers and from a variety of audience members from its 12 performances. Consistently the dancers, striving to recreate the original unconscious state in each performance, had only a vague recollection of the experience of having danced the piece and it was only through viewing a video record of the event that they could attempt to integrate conscious changes into the work.

The audience likewise consistently remarked that they felt the dance more in a physical way than on an intellectual level.

It is my hypothesis from my research in the creation of this dance work that, in the simultaneous firing of the mirror neurons in both the dancers and the viewers, the more authentic the experience of executing the movement material as it was derived from embodied memory, the more empathic the experience is for the audience; that the deeply personal nature of the movement coupled with a structure designed to immerse the dancers in repeating the experience rather than dancing about it, made for a deeper connection to the viewer.

7/ Artist as Visual Citizen, Society's Catalyst for Intellectual Evolution

Kerri McGill

The first homo sapiens to transition to higher consciousness may have been the artist. 40% of our brain's neurons are dedicated to the visual brain. It is a particular individual that is predisposed to physically reinterpret the effects of visual qualia into an original

product. This product, visual art, nurtures the growth of complex ideas through neural connections. Society's visual citizen provides the community with a necessity, the neural catalyst.

As others create schedules based on daily needs, the artist stops and fixates on visual stimuli not connected with immediate survival needs and actions. This qualia observation connects with memory, emotion, or hypothetical ideas and induces focused reentry. This contemplation breaks the individual from the "remembered present" through active intellectual investigation.

The artist translates the perceptual memory and related ideas into visual metaphors to be reinterpreted by an audience. Many layers of visual content create ambiguity that calls on all parts of the viewer's brain to interpret meaning. Art does not cater to just the mid-brain (emotional brain) as traditionally believed, or even to specific areas of the brain. Viewing art caters to the process of reentry. It strikes the cerebellum with an emotional jolt. It calls on the cerebral cortex to assess novelty and reassess expectations. The reentry connects new visual info to the viewer's personal intellectual history. A concentrated gaze allows for contemplation of constant stimuli. This constant puts saccades and the brain's need to constantly construct time/space to rest and allow other areas of the brain more activity. The viewer instills a personal timeline, unlike the spoken/written language which structures the release of information in grammar and controlled time sequence.

Since it marked a turning point in evolution and intelligence in early homosapiens, art has never faded as a sign of humanity and communication. The more we study the workings of the brain, the more we know that our thoughts are emotion and metaphor based. The more we learn about our physical realities, the more we may find that the written word may not be enough. We may need a visual aid that touches all parts of the brain at once. Preparation through surrogate experiences, reassessing expectations, and the quieting effect of the visual constant are all ways visual art readjusts neuro-pathways and the

individual's thought process. Visual contemplation of artwork is the catalyst for complexity of ideas and with it strengthens society with innovation.

***8/* Photographic cropping as a paradigm for experimental aesthetics: Assessing the role of individual differences, colour, meaning and expertise**

Chris McManus, Anita Zhou, Sophie I'Anson, Lucy Waterfield
Division of Psychology and Language Sciences, University College London, Gower Street, London WC1E 6BT, UK

Susan Sontag has described a photograph as "a thin slice of space [and] time", the camera's shutter recording the viewer's choice of a particular part of the visual world at a particular moment. Photography has been little used in experimental aesthetics, but this paper will argue that in many ways it provides an ideal experimental paradigm. Not only are photographic images aesthetically rich and complex, but also the majority of participants in experiments are used to using a camera, and they recognise that some photographs are, in some ill-defined way, better than others. For practical reasons, most work in empirical aesthetics has used Fechner's Method of Choice. Photography, though, can be seen as implementing Fechner's Method of Production, but with the advantage that subjects do not require high levels of technical skills in drawing or other artistic techniques, as all they need to do is 'push the button'.

In our studies we simplify the photographic task to make it more empirically tractable, and have concentrated on *cropping*, the process of selecting a smaller portion of a larger image (and in some sense the viewfinder of a camera can be seen as enclosing, framing, or cropping a portion of the viewer's wider visual world). Specifically, participants firstly see a complete 1024 x 768 pixel image on a computer monitor. They then crop that image to a 512 x 384 image (half the linear extent, a quarter of the area), the 'crop window', which acts like a camera viewfinder, being moved by the computer mouse. Instructions are intentionally minimal, participants merely being asked to make

the cropped image look "as good as possible". Subjects find the task intuitive, natural and straightforward (and indeed, they often describe it as fun and interesting).

71 subjects have carried out the task, 11 of whom were experts, taking the MA in photography at the Royal College of Art. Key findings include, that:

i) Subjects are individually consistent in their choice of croppings in a test-retest design;

ii) Subjects differ in how they choose to crop photographs;

iii) Some subjects are better at cropping than others, their cropped photographs being systematically preferred to other subjects' croppings, when assessed by separate groups of subjects;

iv) Cropping position is influenced by colour (monochrome images being cropped in somewhat different positions to colour versions of the same images);

v) Cropping positions are influenced by meaning, black and white 'thresholded' images, whose content is not recognisable, being cropped in different positions to monochrome versions of the same images;

vi) Experts crop photographs in different positions to non-experts;

vii) Experts take longer to crop images, sampling more of the original image, particular in the vertical direction, and spending longer dwelling on particular crops before making their decisions.

Overall we believe that cropping is an ideal experimental paradigm for aesthetics, not least because the process of selection from a large domain of possible images is made explicit.

9/ Response scale choice in neuroimaging and cognitive studies of beauty appreciation

Patricio Bustos, Julia Christensen, Nadine Gut, Albert Flexas, Marcos Nadal, & Enric Munar
Human Evolution and Cognition Group (EvoCog). IFISC (UIB-CSIC). University of the Balearic Islands.

Recently there has been a great growth of the interest on the neural basis of visual beauty appreciation. However, neuroimaging procedures differ from the usual behavioral procedures, particularly, in the use of different scales to measure responses (dichotomous vs. Likert beauty judgements). This raises the question of whether participants' responses in neuroimaging tasks are comparable to those given in classic behavioral and cognitive settings.

The objective of this experiment was to answer this question by exploring whether any of the possible methodological choices produced differences in the way 64 university students (32 men and 32 women) responded to a beauty-rating task. We analyzed their responses on Likert (1 to 9 points) and dichotomous (beauty- non beauty) scales, order (dichotomous first or Likert first) and kind of visual stimuli: artistic (impressionist, postimpressionist, abstract, realist paintings) and none artistic (photographs).

Our results reveal that differences between sexes are only appreciable using a Likert scale, particularly in relation to the time that men and women take to decide about the beauty of realist paintings, and responses to postimpressionist paintings. On the other hand, order has an effect only on reaction times to photographs, impressionist paintings on the Likert scale, and to photographs on the dichotomous scale. However, there is no interaction between order and sex regarding reaction times and responses on either scale. Conversely a high correlation between responses on dichotomous and Likert scales for both sexes is observed. This suggests that order of presentation of the visual stimuli has an influence on the way participants perceive beauty and that it must be taken into account in future research.

We conclude, overall, that there is a great equivalence between Likert and dichotomous rating scales. This suggests that responses given by participants on scales frequently used in neuroimaging experiments, including generally only two or three options, are equivalent to the responses given by participants on scales used in typical behavioral and cognitive experiments, which tend to include a broader range of response possibilities.

10/ Children's Ability to Override Personal Taste and Source Knowledge in Evaluating Works of Art

Angelina Hawley

Boston College

Little is known about the criteria children use to evaluate art. We investigated when children distinguish taste (I like it) from judgment (This is good) and when they evaluate art independently of knowing the work's source. Participants are 4-, 8-, 12- and 16-year-olds and adults. Materials are 30 highly similar pairs of non-representational abstract images, one by an artist, one by a non-human animal (e.g., elephant) or child. Ten pairs are presented without source labels, 10 with correct labels, 10 with switched labels. Participants are asked which they like better and which is the better work of art. It is hypothesized that the ability to distinguish taste from judgment will emerge before the ability to override the false source label, and that only adolescents and adults will override both personal taste as well as false labels to select the images by the actual artists as the better works of art.

11/ Left-right/right-left visual scanning direction in the reception of art.

Mai Damgaard Rasmussen
Aarhus university

Arnheim's classical book concerns the difficulties of viewing art on its own premises and "the inborn capacity to understand through the eyes has been put to sleep and must be

awakened." i He, however, mistakenly analyses the scroll "Court Ladies" from right to left, - a fact, which dramatically alters the aesthetical aspect of the scroll.ii
The question is concerns the possibility of an artistic eye disregarding neuroanatomy and cultures? A pure psychology of visual perception and the possibility of an 'universal language of Art'? In 1950, Mercedes Gaffron introduced 'the Glance curve', a basic perceptual path in perceptual representations. Like Oppé, Gaffron conceive the left side as important: It represented proximity, 'us' whereas the right side appears 'farther away from us, and actions going on there, persons and objects represented there, appears less important. iii Gaffron connected this to 'the left cerebral cortex, which contains the higher brain centers for speech, writing and reading'iv. Contrary Kress classifies the horizontal lines running from left (the Given) to the right (the New), where "broadly speaking, the meaning of the New (right) is therefore 'problematic', 'contestable', the information 'at issue', while the Given is presented as commonsensical, self evident.v The 'New', implies 'the butler did it' side for westerners, - whereas the opposite counts for right warding cultures. Chan & etc have offered evidence that the location where a writing system starts is where speakers attend first in their visual field, where they remember objects best, and where they spatially represent the beginnings of temporal sequences.vi However, Chinese characters can be written either horizontally or vertically, right to left, or left to right, or top to bottom or bottom to top. Traditionally, writing was done vertically, from top to bottom, and arranged in columns going right to left. With the introduction of television, subtitles ran from right to left until the 1960s. After the modernization efforts of PCT, left-to-right writing became usual practice. How could the Chinese still understand and appreciate the art of ancient times? How can we? Levy (1976) noted that the activation of one hemisphere produced an attentional bias to the opposite visual field. For a dextral person, the right hemisphere would be the main processor for visio-spatial tasks giving an attentional bias to the left visual field. Hence, "Right-handed subjects are more likely to conceptualize agents on the left of recipients of actions".vii A. Chatterjee however concludes; "Despite these broad differences in the neuroanatomy of language and space, their segregation is unlikely to be absolute. A language network completely encapsulated from sensations would imply a radically different neural organization in the left and right hemispheres".viii

Arnheim quotes Gaetano Kanizsa “We have been able to become familiar with the things of our environment precisely because they have constituted themselves for us through forces of perceptual organization acting prior to, and independent of, experience, thereby allowing us to experience them.’ix We thus have to keep perceiving.

12/ **The neural bases of the appreciation of beauty: differences and similarities between men and women**

Flexas, A.1, Christensen, J.F.1 , Gut, N.1 , Nadal, M.1 , Bustos, P.1 , de Miguel, P.2 & Munar, E.1
(1) Human Evolution and Cognition. IFISC (UIB-CSIC). Spain
(2) Clínica Rotger de Palma (Balearic Islands. Spain)

Appreciation of beauty (aesthetic judgment) appears to be one of humans' most distinctive traits. Neuroimaging techniques are proving to be instrumental in the understanding of the biological basis of this trait. Results of recent studies suggest that a broad array of brain regions are involved in our appreciation of beauty. However, the use of different techniques makes it difficult to compare across studies. Our objective in the present work was to examine sex-related differences in the neural underpinnings of beauty appreciation by means of functional Magnetic Resonance Imaging (fMRI), and to compare these results with those of an analogous study carried out earlier by means of magnetoencephalography. Here we recorded the BOLD signal of 12 male and 12 female participants while they decided whether diverse visual stimuli were beautiful or not-beautiful. Our results suggest that there are interesting differences in specific brain regions and in lateralization. However, in both men and women, fMRI revealed occipito-temporal activity that could not be registered with magnetoencephalography due to its limitations measuring activity below cortical surface.

13/ Effects of affective priming by facial expressions on aesthetic preference

Rosselló, J.; Nadal, M.; Flexas, A; Vilanova, J. & Barceló, S.
Department of Psychology, Universitat de les Illes Balears

The present study investigates the influence of affective priming on the aesthetic preference of similar abstract pictures. In order to contrast these effects we used an affective facial priming paradigm based on Murphy and Zajonc's (1993) and Wong and Root's (1999). Facial primes were photographs of men and women, expressing happiness, disgust or a neutral state, that were presented for brief (SOA = 20 msec) and extended duration (SOA = 300msec) conditions. The target stimuli acted visually masking the primes (ISI = 0).

Participants were sixty students (32 women and 28 men) from different courses at the University of the Balearic Islands, with an age between 19 and 25. Each participant took part in the two phases of the experiment.

In the affective priming one, trials were divided into two identical blocks in order to study the dynamics of priming. In each block, subjects were presented 96 trials in pseudorandom order. The different trials varied pseudorandomly according to the prime (happy, disgust or neutral faces) and to the SOA (20 or 300 msec). Target stimuli (abstracts pictures) had to be rated by participants using a 5-point Likert liking scale (1 indicating "do not like at all", 3 indicating "neither like nor dislike", 5 indicating "like very much"). The software used (Direct RT) automatically registered both each rating and the reaction time. Priming effects were measured based on differences in liking ratings depending on the previous presentation of either positive, negative or neutral facial expressions.

In the second phase of the experiment we assessed the actual awareness of the primes presented in the brief condition, applying a multimodal method of assessing awareness (Reingold and Merikle, 1990; Baars, 1997), i.e., using jointly (i) both a subjective awareness procedure that included the confidence of their subjective report, and (ii) a

forced-choice task, which constituted the third block of the experiment. The forced-choice task comprised both and affect identification task and an identity identification one.

Results suggest that the affective priming using facial expressions influenced subjects' ratings of how much they liked the artworks, both in the brief and the extended duration conditions. Specifically, higher ratings on the liking scale were associated with happy faces and the lower scores were given after presentation of disgust faces. Interestingly, it seems that the positive effect of the happy faces is stronger than the negative effects of the disgust ones. On the other hand, in the first two blocks, the rating responses of participants were systematically faster in the brief duration trials. We hardly found gender effects, except for the subjective report of awareness of the brief duration primes. Here women reported higher awareness and more confidence than men. We discuss these and other results, such as the dynamic changes in the priming effects on the aesthetic preference, in relation to other experiments on affective priming and to our previous studies on the appreciation of beauty and their relation to affective processes (Cela-Conde *et al*., 2004; Nadal *et al*., 2008, etc.)

14/ Dance aesthetics and dance art therapy: Why does dance make us feel good? The need for a disentanglement of the neural underpinnings of dance aesthetics

Christensen, J.F., Gomila, A., Munar, E., Bustos, P.M., Cela-Conde, C.J.
University of the Balearic Islands, Spain
Human Evolution and Cognition. IFISC (UIB-CSIC)

The contemplation of dance movements is an aesthetic experience *par excellence*. Thus, through history of humanity, dance has been a crucial element in human cultures – not only as a cohesion element, but presumably also due to the rewarding nature of the aesthetic experience of dancing bodies. Considering that it is such an ancient human habit, it isn't surprising, that it is omnipresent also in today's societies. "Modern" applications of dance are, for instance, also as an art therapy due to its' supposedly

beneficent elements for mental health. The list of disorders and conditions in which dance art therapy has been applied till date, is long. Thus, a brief bibliographic search in corresponding databases reveals its' implementation in Depression, Anxiety, Schizophrenia, delinquency, Down syndrome, Autism and many more. *Dance therapy* as a search term results in 375 hits in the meta database Pubmed and in 626 hits in the Web of Knowledge. In the past two decades, dance therapist associations have been created all over the world and an increasing number of schools and universities in Europe and the United States offer trainings for becoming a professional dance therapist. Brief, the interest and demand for dance therapy appears to be in continuous rise. In the meanwhile, today, where highly sophisticated neuroimaging techniques are available and cortical plasticity studies yield promising results, attention is drawn also to the neuronal underpinnings of aesthetic dance experience – and also to dance as an art therapy form. Which could be the neuronal bases for the behavioral and emotional improvements sometimes observed with dance therapy? However, to our knowledge, no firm evidence has ever been reported in this respect for this complementary therapy form. In the present review, we discuss how experimental neuroaesthetics could provide evidence – not only for the exciting field of the aesthetic experience of dance – but also for a better comprehension of the specific neural bases, likely to be stimulated by this complementary therapy form.

Particularly, we discuss the rewarding nature of the aesthetic experience when contemplating or executing dance movements and the possibility of the implication of reward processing brain structures (O'Doherty, Kringelbach et al. 2001). Furthermore, we review literature regarding neuronal sensorimotor and emotional underpinnings as possible explanations for this experience (Calvo-Merino, Jola et al. 2008), alluding especially to the capacity of cognitive and motor imitation (Schögler 2007) and empathy research (de Vignemont and Singer 2006). Additionally, we include recent findings of the possible rewarding nature of moving or dancing in synchrony with others and the subsequent enhancement of positive emotions (Wiltermuth and Heath 2009). Finally, we propose perspectives for future research in the field of experimental neuroaesthetics of dance, especially in clinical conditions.

REFERENCES:
Calvo-Merino, B., C. Jola, et al. (2008). "Towards a sensorimotor aesthetics of performing art." Consciousness and Cognition 17(3): 911-922.
de Vignemont, F. and T. Singer (2006). "The empathic brain: how, when and why?" Trends in Cognitive Sciences 10(10): 435-441.
O'Doherty, J., M. L. Kringelbach, et al. (2001). "Abstract reward and punishment representations in the human orbitofrontal cortex." Nature Neuroscience 4(1): 95-102.
Schögler, B., Trevarthen, C. (2007). To sing and dance together. From infants to jazz. On Being Moved. From Mirror Neurons to Empathy. S. Braaten. Amsterdam/Philadelphia, John Benjamins Publishing Company. 68: 281-302.
Wiltermuth, S. S. and C. Heath (2009). "Synchrony and Cooperation." Psychological Science 20(1): 1-5.

15/ How is it that you can be affected by the spoken word in spite of its semantic contents? In spite of opinions, language and culture?

Anna Lawaetz
University of Copenhagen

The present paper is a scientific investigation of the rhythmic-sonorous element in the linguistic performance and the involved effects and processes in the uncovering of its potential.
From a theaterreseachers point of view I am using the cognitionscience to understand the out come of my analysis. To understand the impact the spoken word can have in specific performativ situations on a broad public and the the specific physical and emotional reaction that occurs.
I have chosen to move across time, languages, culture, and genre in order to approach the more basic musical elements in language. To throw light on the subject I have borrowed analytical methods from other scientific fields such as the sciences of literature,

cognition, and religion, and from rhetoric, ethnology, and psycho-acoustics, and I have utilized specific sound editing programmes.

I base my investigation on three apparently very different theatrical representations, which all have in common that something is performed for somebody with a high degree of sense of musical form.

The Sicilian *Cunto* is a narrative cycle covering 340 days. Until the 1950's it was a living oral culture with symbolical figures dating back to the Middle Ages that could be heard and seen in the squares of Palermo. In the rendering of the stories the storyteller uses a special technique when describing the battle scenes, as he suspends all sense of time through a contrasemantic use of language and depicts the battle in sounds.

In modern stand up comedy strong opinions are aired with an acute sense of rhythm,
the effect of which is, that the audience is elated in spite of the often very offensive remarks. In this genre especially rise in pitch and breaks are important in order to provoke the desired effect, laughter.

Lastly in the Alexandrine we see a tight, rhythmic linguistic framework with an inborn rhythmic-sonorous potential. The continuous use of rhythm is spell-binding, and the sonorous imagery describes the figures' state of mind phonetically and contrasts it to their expressions on the semantic level.

Common for the three objects is a break in rhythm in the spoken language in favour of a "musicalization" that has various effects: trance, laughter, the feeling of an emotional haven.

The cognitive sciences enable us to map the reasons why it is so difficult to put into word those strong feelings of being moved. Besides the emotional responses there are indications that the immune defence mechanisms are activated (Koelsch), and this gives us quite a new understanding of the concept of catharsis mentioned as an aim for the theatre by Aristote. This is not a symbolical process but seems to be a process in the brain that can be activated through accentuated use of the rhythmic element in the language.

This discovery sets the scene for a new approach to theatre and its linguistic element: The theatre as a healing ritual in modern society simply through focusing on the rhythmic-sonorous element in the language, which turns it into music and breaks with the imitation of the rhythm of everyday language thereby activating parts of the brain that are not spontaneously activated in everyday language.

Thus this thesis points to a new application of the use of language in the theatre and to an important potential in the linguistic performance, which can be of an emotionally stimulating as well as healing quality.