



# Ten years of a model of aesthetic appreciation and aesthetic judgments: The aesthetic episode – Developments and challenges in empirical aesthetics

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About a decade ago, psychology of the arts started to gain momentum owing to a number of drives: technological progress improved the conditions under which art could be studied in the laboratory, neuroscience discovered the arts as an area of interest, and new theories offered a more comprehensive look at aesthetic experiences. Ten years ago, Leder, Belke, Oeberst, and Augustin (2004) proposed a descriptive information-processing model of the components that integrate an aesthetic episode. This theory offered explanations for modern art's large number of individualized styles, innovativeness, and for the diverse aesthetic experiences it can stimulate. In addition, it described how information is processed over the time course of an aesthetic episode, within and over perceptual, cognitive and emotional components. Here, we review the current state of the model, and its relation to the major topics in empirical aesthetics today, including the nature of aesthetic emotions, the role of context, and the neural and evolutionary foundations of art and aesthetics.

## Historical background

Ten years ago, the *British Journal of Psychology* published a paper describing a new model of aesthetic experience of art (Leder, Belke, Oeberst, & Augustin, 2004). The model provided an integrative framework for empirical research and theoretical development. It grew out from the conviction that 'Art, as any other activity of the mind, is subject to psychology, accessible to understanding, and needed for any comprehensive survey of mental functioning' (Arnheim, 1966, p. 2), and it built on a long tradition of psychological research. Gustav Theodor Fechner (1801–1887) developed the original theoretical and methodological infrastructure required for an experimental approach to art and aesthetics. In his *Vorschule der Ästhetik* Fechner (1876) wrote 'Structurally, works of art demonstrate concepts at both higher and lower levels, which can be interrelated, and as a result diversity can result not just from greater variety in the underlying sensory contents, but also from a greater number of higher-level relationships; that is, as it were, from both the breadth and the height of the structure' (p. 70).<sup>1</sup> It was no accident that

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<sup>1</sup> Original version 'In Kunstwerken, wo ein ganzer Aufbau höherer Beziehungen über niederen mit einem Abschlüsse in der Idee des Kunstwerkes statt findet, wächst die Mannichfaltigkeit mit der Höhe dieses Aufbaues nicht nur vermöge Vermehrung der Verschiedenheiten des unterliegenden sinnlichen Materials, sondern auch der Stufen der darüber aufsteigenden Beziehungen, kurz ausgedrückt nicht bloß nach der Breite sondern auch nach der Höhe' (p. 70). Translation by Leder with support of Christina Pleines (published in Leder, 2014).

Fechner turned to the study of art and aesthetics. He hoped he could attract attention to the nascent psychology by showing that it could contribute to topics debated lively in the society of his time. Fechner exhibited his versatility by providing diverse studies that used his newly developed psychophysical methods to address such issues as personal taste or authenticity in art.

Questions related to aesthetics were prominently studied within the young empirical science of psychology, at the intersection of philosophy and empirical sciences of perception. They constituted the object of lively discussion among the early Gestalt theorists, with Theodor Lipps (1851–1914) as a main proponent – and target for debate – and Karl Stumpf (1848–1936) in Berlin, or Karl Bühler (1879–1963) in Bonn, and later in Vienna. After this promising beginning, the study of aesthetics and art did not see much progress. With the hegemony of behaviourism, psychology no longer saw such topics as central to its programme: ‘The behaviorist era is best seen as a disaster for the discipline of psychology and an unmitigated disaster for psychological aesthetics’ (Martindale, 2007, p. 123). One of the consequences of this was that the field lacked a unified theoretical framework until the 1970s, when Daniel Berlyne (1920–1975) introduced his psychobiological aesthetics. His framework was based on the concept of arousal as a drive for curiosity and exploration, but also associated with interest and hedonic pleasure derived from art (Berlyne, 1974). In parallel, Kreitler and Kreitler (1972) developed a theoretical approach that integrated the psychodynamic and cognitive perspectives. The accumulation of experimental evidence and the growth of technical and methodological sophistication during the 1980s and 1990s (e.g., the use of eye tracking and the development of experimental software) increased the rigour and versatility of the experimental designs. Examples of such research, which was mainly concerned with perception, include the role of composition and expertise on perception, measured by eye movements (Locher & Nodine, 1987) or evaluations (Martindale, Moore, & West, 1988), the way art experiences consolidate in long-term memory (Cupchik & Gebotys, 1988), the role of titles accompanying artworks (Millis, 2001; Russell, 2003), prototypicality (Hekkert & van Wieringen, 1990) and familiarity in art (Leder, 2001), as well as inter-individual differences in response to geometric abstract patterns (Jacobsen & Höfel, 2002).

Two developments contributed to the thriving of empirical aesthetics during the early years of the 21st century. First, technological progress improved the conditions under which art could be studied in the laboratory. It was now possible to present and to manipulate high-quality stimuli on computer screens for well-controlled durations. Also, it became possible to concurrently analyse behavioural, physiological and eye-movement data. Moreover, advances in neuroscience and neuroimaging techniques led to the conceptual and experimental exploration of the neural underpinnings of aesthetic appreciation of traditional and modern art, as well as abstract patterns (Cela-Conde *et al.*, 2004; Chatterjee, 2003; Jacobsen, Schubotz, Höfel, & von Cramon, 2006; Kawabata & Zeki, 2004; Vartanian & Goel, 2004).

### **A model of aesthetic appreciation and aesthetic judgments**

Although the aforementioned developments and studies were quite independent from each other, they contributed decisively to make the time ideal for an integration that brought the scattered evidence into a global picture. Similar efforts had already been made in other domains of visual science, such as Bruce and Young’s face recognition model (1986; see Schweinberger & Burton, 2011), or Jacobs and Grainger’s (1994) model of eye

movements during reading. It was 10 years ago, thus, that Leder *et al.* (2004) developed a model of aesthetic appreciation and aesthetic judgments. The model aimed to provide an integrated description of the psychological processes involved in the aesthetic appreciation of art. In doing so, it also raised fundamental conceptual questions about the relation between art and aesthetics, the features that make an experience aesthetic, and the relation between contemporary art and more traditional forms of art. Given the importance of these issues for psychological research, and that Leder *et al.* (2004) did not explicitly deal with them, we examine them in turn here.

First, the terms ‘art’ and ‘aesthetics’ are often used in close connection, sometimes even interchangeably, in the psychological literature. This association seems natural, given that as a branch of philosophy, aesthetics is concerned with the conceptual and theoretical foundations of both art and aesthetic experience (Levinson, 2003). However, art and aesthetics overlap, but they are not identical. As Danto (1997) eloquently expressed, ‘the connection between art and aesthetics is a matter of historical contingency, and not part of the essence of art’ (p. 25). Artworks, especially modern ones, are appreciated for other reasons besides their aesthetic qualities or beauty; and many other objects besides artworks are experienced in terms of their aesthetic qualities. In this sense, the psychology of art aims to characterize the psychological mechanisms involved in the appreciation of art, such as grasping an artwork’s symbolism, identifying its compositional resources, or relating it to its historical context. The psychology of aesthetics, on the other hand, aims to identify and describe the psychological mechanisms that allow humans to experience and appreciate a broad variety of objects and phenomena, including utensils, commodities, designs, other people, or nature, in aesthetic terms (*beautiful, attractive, ugly, sublime, picturesque*, and so on). Both fields overlap, however, when concerned with the role of aesthetic experience in the appreciation of art. This intersection was precisely the target of Leder *et al.*’s (2004) model: it aimed to describe the psychological mechanisms involved in *the aesthetic appreciation of art*.

Second, what makes an experience aesthetic? Shusterman’s (1997) and Bergeron and Lopes’ (2012) historical and conceptual analysis suggests that there are three major aspects that confer the aesthetic quality to an experience: (1) An aesthetic experience has an evaluative dimension, in the sense that it involves the valuation of an object; (2) it has a phenomenological or affective dimension, in that it is subjectively felt and savoured and it draws our attention; (3) it has a semantic dimension, in that an aesthetic experience is a meaningful experience, it is not mere sensation. Chatterjee and Vartanian’s (2014) review of neuropsychological and neuroimaging studies fits seamlessly with this approach. In their ‘aesthetic triad’ proposal, aesthetic experiences arise from the interaction among sensory-motor, emotion-valuation and meaning-knowledge neural systems. In this sense, thus, Leder *et al.*’s (2004) model can be seen as an attempt to determine the psychological mechanisms and the contextual conditions that enable people’s engagement with artworks to be evaluable, affectively absorbing, and individually and socially meaningful experiences. Nevertheless, as Bergeron and Lopes (2012) suggest, there is no reason to believe that all three dimensions are required in every instance of aesthetic experience. It is conceivable that some aesthetic experiences owe fundamentally to the perceptual qualities of the object, while others are mainly related to its affective, or mainly meaningful aspects. Moreover, Leder *et al.* (2004) did not conceive aesthetic experiences as starting after the perceptual processes, or even with them. According to Leder *et al.*’s (2004) model, the aesthetic experience begins before the actual perception: with the social discourse that configures expectations, anticipations, and an aesthetic orientation

(Cupchik, Vartanian, Crawley, & Mikulis, 2009), and in the context, which shapes those expectations and orientation, and creates an environment that can contribute to heightening the artistic status of an object (Brieber, Nadal, Leder, & Rosenberg, 2014).

Third, the model focused on – but was not restricted to – modern art. Because modern or contemporary art commonly has such a marked conceptual component, its full appreciation does not rely solely on perceptual aspects. Modern art is often emotionally and conceptually challenging, puzzling, ambiguous, and it questions our beliefs about reality and art itself (Minissale, 2013). Thus, it is especially interesting from a psychological perspective for two reasons. First, owing to its richness and variety, understanding people's responses to modern art poses a stimulating challenge to psychology. Second, it also constitutes an ideal testing ground for theories of emotion, cognition or perception. The model's focus on modern art, however, did not mean that it did not aim to explain other more traditional forms of art. In fact, there are many aspects of modern art that can be informed by studying traditional forms of art, including the interaction between style and content, the role of knowledge and expertise, perceptual and attentional processes.

Leder *et al.*'s (2004) model included a sequence of processing stages within the perceiver, flanked by constituting conditions. The model was designed as an information-processing box-model, and summarized a variety of findings related to the way perception, knowledge, familiarity, expertise, style and content, among other factors, influence the aesthetic experience of art. In detail, the model comprises five main processing stages, perception, implicit memory integration, explicit classification, cognitive mastering and evaluation, as well as a continuously ongoing emotional evaluation.

In the following section we discuss what was gained with the model at the time it was published, focusing on three main issues that drove its development: the time course of the aesthetic episode, the role of content and style in the appreciation of art, and the inter-relation of cognitive and affective processes. An exhaustive analysis of the research on the psychological processes related to each of the model's components in the past 10 years cannot be achieved in the space of this paper. We cannot hope, for instance, to discuss much of the research on the way in which the formal structure of different types of artworks relates to perceptual mechanisms in human vision (e.g., Locher, Smith, & Smith, 1999), which, in any case, was recently reviewed by Palmer, Schloss, and Sammartino (2013). Thereafter, in the Section 'Challenges today: hot topics, and pending assignments', we turn to the model's shortcomings at the time it was published, and we explore four challenges faced today by empirical aesthetics: understanding the emotional component of the aesthetic episode, the role of context, the neural underpinnings of the experience of art and aesthetics, and their evolutionary origin. Finally, in the Section 'Looking forward into the future: the next 10 years', we look ahead and reflect on the possibilities for empirical aesthetics during the next 10 years.

### **Contributions of Leder *et al.*'s (2004) model of aesthetic experiences**

Looking back, there are two general features that made the model appealing to researchers in empirical aesthetics: its explanatory richness and its modular structure. With regards to the former, the model provided the field of psychological aesthetics with an integrative view of cognitive and affective processes involved in aesthetic appreciation that had largely been studied separately. It was designed to accommodate a large body of research on the cognitive foundations of aesthetic experience. As most art experts would claim that interpretation and understanding are crucial to the experience of art (Dutton,

2009; Gehlen, 1960), for instance, Kreitler and Kreitler's (1972) emphasis on the role of meaning was captured in the model as the distinctive stage of cognitive mastering. The model's integrative nature had three implications. First, it shifted the research focus away from single-factor explanations, which suggested that aesthetic experience was determined, to a large extent, by complexity (Eysenck, 1941), arousal (Berlyne, 1971), or prototypicality (Martindale *et al.*, 1988), to name a few examples. Second, the model emphasized that the key to understanding aesthetic appreciation resides in the interaction among cognitive and affective processes; in the way they modulate and constrain each other (e.g., Tinio & Leder, 2009). Third, it showed that the enormous variety of aesthetic experiences and ways in which art can be appreciated, derives from the diversity of sources of information that come into play, and the diversity of ways in which this information can be used, combined, associated, and so on. Thus, the model was committed to the double proposition that aesthetic experience is the result of multiple perceptual, cognitive and affective processes, and that the panoply of possible aesthetic experiences owes to the virtually unbounded number of ways in which the components can interact, and to variations in the relevance of their role in each particular experience.

This variety is also reflected in the model's postulated dual outcome. On the one hand, the evaluation and cognitive mastering stages lead to an aesthetic judgment. Thus, it is closely linked to knowledge about the appropriate criteria for judgment, to ideas about what an artwork is or should be, about art movements, and so on. On the other hand, the affective state, resulting from the continuous evaluation and its interaction with cognitive processes, leads to the pleasure derived from beauty or insight, surprise, and a broad range of emotions that can be experienced in relation to art, from rage and sadness to joy and awe. Furthermore, artworks can sometimes elicit contradictory emotions, such as when an appalling content is depicted in a pleasing way. The model captures a further degree of richness by allowing a relative independence between aesthetic judgments and aesthetic emotions. It is possible to be emotionally moved by artworks we understand poorly, and it is possible to feel indifferent towards artworks we understand well and judge highly.

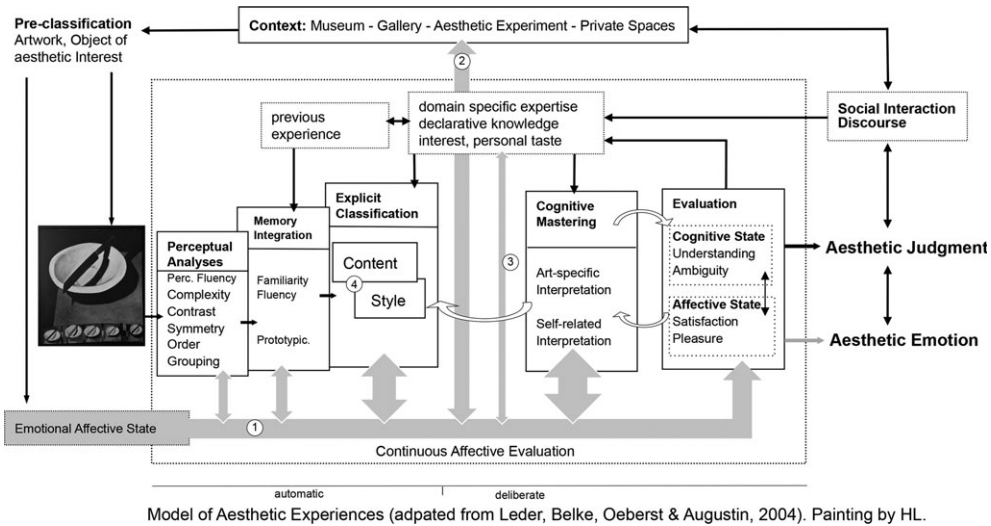
However, the model's most salient feature is probably its modular design of consecutive stages of information processing. In fact, some of the most stimulating research that emerged from the model addresses questions derived from this structure: (1) the nature and effects of the processing stages and their temporal order; (2) the dichotomy between content as style, as a crucial aspect of art; and (3) the interplay between cognition and emotion. In this section we explore each of these in turn. Figure 1 illustrates the way this research suggests modifications to the original model.

### ***Time course and temporal order***

The processing of the perceptual variables proceeds quickly, without effort and is somehow time sensitive. Thus, when presentation time of aesthetic stimuli is strongly restricted, effects of these variables can be analysed. (Leder *et al.*, 2004, p. 495)

The temporal sequence of the processing stages can be studied at least at two levels. From a micro-approach, the model was initially described as a sequence of processes extended in time, with some feedback loops and embedded in a context, and often, a social situation. Some studies have been concerned with fast, automatic early processes. For example, following a micro-genetic approach (Bachmann, 2000), Augustin, Leder, Hutzler, and Carbon (2008) used very short stimuli presentations and masking to





Model of Aesthetic Experiences (adapted from Leder, Belke, Oeberst & Augustin, 2004). Painting by HL.

**Figure 1.** Adaptation of the 2004 model of aesthetic experiences. In this version we have added numbers that refer to indices attached to studies reported in the main text. This figure retains the main elements, processing stages and variables, but has been carefully updated. Major changes are the emotional processes – in grey, that have been updated according to new evidence ((1) e.g., Cupchik *et al.*, 2009; Leder *et al.*, 2013; (2) Brieber *et al.*, 2014; (3) Gerger, Leder, and Kremer, 2014). The emotional state is no longer an external state. The time course of the early processing stages is temporarily overlapping ((4) Augustin *et al.*, 2008)) and some additional aspects have been added (e.g., perceptual fluency, private spaces as context).

disentangle different time courses in which even experiences that feel instantaneous can be decomposed. The study revealed that the flow of information through the processing stages is indeed quite fast. Using paintings of classical modern art (van Gogh, Kirchner etc.), which presented in pairs had to be rated for similarity, they found that content is processed even with presentations of 10 ms, while the processing of style can be observed with presentations of 50 ms. Thus, given that both of these processes are located in the third level of explicit classification, they not only occur fast, but they are also deferred. This is now reflected in the updated model presented in Figure 1.

Electrophysiological techniques are ideally suited to examine the time course of the neural correlates of mental processes. By studying event-related brain potentials, Jacobsen and Höfel (2002) were able to draw a picture of the time course of aesthetic judgment, in this case of geometric patterns that varied in symmetry and complexity, which consisted of two main stages. The first stage, occurring around 300 ms after stimulus onset, consists of an initial impression formation. This process was associated with anterior frontomedian activity, especially when participants dislike the stimuli. The second stage, beginning close to 600 ms after the presentation of the stimulus, involves a deeper aesthetic evaluation, which Jacobsen and Höfel (2002) related with broad right hemisphere activity.

However, the temporal development of psychological processes is also relevant to understand the emotional responses involved in the experience of art. Salimpoor and Zatorre (2013) suggested that the ongoing interaction between pattern recognition and the unfolding expectations over time plays a critical role in the emotional aspect of the aesthetic appreciation of music. Salimpoor, Benovoy, Larcher, Dagher, and Zatorre (2011)

examined the release of dopamine in different brain regions while people listened to musical pieces that they either did or did not deeply enjoy. Their study revealed a temporal and functional dissociation: The caudate nucleus was more active during the anticipation of peak emotional experiences, whereas the actual experiences were associated with dopaminergic activity in the nucleus accumbens. This showed that the emotional experience of music is mediated by two anatomically and temporally distinct pathways that play two different, but complementary, roles in anticipating and generating pleasurable feelings.

A second level, the macro-approach, is concerned with the overall time aesthetic episodes last, and the relation between this duration and the episode itself. The average time people spend in front of artworks according to measures by Smith and Smith (2001) in the Metropolitan Museum of Art is 27 s, with a median of 17 s ( $SD = 33.7$ ). Tröndle, Wintzerith, Wäspe, and Tschacher (2012) found shorter times in their museum study. They found that people spend a median of 11 s (with a range of between 3 s and almost 13 min) in front of each artwork. In contrast, Brieber *et al.* (2014) found that participants in the museum spent a median of 38.8 s ( $SD = 15.46$ ) actually viewing each artwork. These substantial discrepancies are probably the result of differences in the methods used to measure the time people engaged with art, and of differences among the exhibitions – especially the number of artworks on display.

In any case, if the perceptual aspect of the aesthetic episode takes a fraction of a second, Smith and Smith (2001), Tröndle *et al.* (2012) and Brieber *et al.*'s (2014) results suggest that there is much more to an aesthetic episode than mere perception, in a bottom-up sense. It could even be argued that what makes a experience aesthetic is its long extension in time, which allows for several cycles of feedback and feedforward influence among processes related to perception, cognition and emotion. This does not just mean that aesthetic episodes can last longer, but that the nature of an aesthetic episode is, precisely, an extended time devoted to perception-cognition-emotion interactions. When artworks are perceived not only for seconds, but for minutes (Leder, Carbon, & Ripsas, 2006), and even longer episodes (Rosenberg, 2010), specific experiences might occur. Thus, over the last decade it became clear that this model describes aesthetic episodes in which not only shorter and longer processes need to be studied, but also whole episodes, in which processes take place over different time scales and interact in complex ways. This way the model also raised new questions regarding order and carry-over effects (Brieber *et al.*, 2014; Flexas *et al.*, 2013; Tröndle *et al.*, 2012).

### **Content versus style – What is specific to art?**

Probably one of the strongest claims made by the model refers to the distinction between the processing of content and style. Belke, Leder, and Augustin (2006) showed that art appreciation is enhanced when people are made aware of the technique required to produce an artwork, its stylistic features, and compositional elements. What is a psychological explanation for this? In the 19th century, Lipps (1906) argued that '*Einfühlung*' (translated as empathy) was the process underlying the understanding of art. Lipps had a very broad understanding of the concept, proposing that *Einfühlung* constitutes a fundamental process of gaining conscious access to any object of perception, including other people and even artificial objects, such as columns in architecture.

The art historian Werner Haftmann (1959) conceived abstract art as a 'visual world language' that could be universally understood, given that it 'promotes an unprejudiced

act of experiencing the pure values of lines and colours as such' (Brinkmann, Commare, Leder, & Rosenberg, 2014, p. 256). However, Brinkmann *et al.* compared the exploration of abstract and similar representational paintings and found no evidence that the reception of abstract art, in terms of eye-movement patterns, was more consistent than reception of a control set of representative artworks.

Lipps' (1906) claim is not easy to test empirically. Nevertheless, paintings are produced by applying paint on the canvas – often in idiosyncratic ways – mostly via brushstrokes that are often visible. There is some evidence that brushstrokes elicit responses in the perceiver, which correspond in direction to motor activation in the direction of the brush (Taylor, Witt, & Grimaldi, 2012). Leder, Bär, and Topolinski (2012) found that simultaneously performing hand movements that resemble the movements the artist made while creating the paintings (van Gogh style and pointillism) can enhance the liking for paintings of the corresponding style. But style also affects aesthetic experiences in a broader sense. Non-experts like representative artworks more than abstract art (O'Hare & Gordon, 1977), patterns of visual exploration in terms of number and lengths of fixation vary with different art styles (Latif, Gehmacher, Castelhana, & Munhall, 2014), and experts use art styles to classify artworks according to similarity, while non-experts do not (Augustin & Leder, 2006). Leder *et al.* (2004, p. 497) argued that 'Our analyses of modern art revealed that the need for innovation has resulted in a huge variety of art styles representing schools of art or even single artists. To understand and appreciate art, a perceiver profits from the processing of these art-inherent features. It seems that in the 20th century, recognition and understanding of individual style have become essential for aesthetic experiences. Thus, an aesthetic experience involves a processing of stylistic information'. Clearly, the study of how style, depiction and empathy are associated will be a promising field of study for the future.

### ***The interplay between cognition and emotion***

More generally, the possibly positive affect when people deliberately search for aesthetic experience makes it likely that often-positive emotional experiences should occur (...) Explicit measurements of aesthetic pleasure might be provided by neuropsychological means. Leder *et al.* (2004, p. 502–503)

Although with little available evidence at the time, the model proposed a close and dynamic interaction between cognitive and affective processing pathways. These two aspects are also associated with two different outputs. On the one hand, the model posits a cognitively based aesthetic judgement, related to the evaluation of the artworks qualities, the thoughts they trigger, the level of understanding achieved or the ambiguity. A second output, an aesthetic emotion, is driven by the affective pathway that can consist of the feeling of uncertainty, surprise, pleasure and many other emotions that can be experienced in relation to art. Importantly, the model claimed that the two outputs could be diverging, and not necessarily have to have a positive correlation. However, today it seems that this interaction – emotional states that are continuously updated with the outcome from the five cognitive processing stages – was under-specified in the original model (Leder, 2013). Moreover, although the model is often cited as a framework for the developing cognitive neuroscience of aesthetics (Chatterjee, 2011; Kirk, Skov, Hulme, Christensen, & Zeki, 2009; Lacey *et al.*, 2011), recent studies on the neural correlates of cognitive orienting (Cupchik *et al.*, 2009),



encourage a more systematic examination of the interplay between cognition and emotion during an aesthetic episode.

Aiming to clarify this interplay, Wagner, Menninghaus, Hanich, and Jacobsen (2014) examined the impact of verbally elicited cognitive schemas about art on the affective processing of images. Participants viewed the same stimuli, which depicted disgusting objects, framed as either artistic photographs or as educational documentary materials. Their results showed that positive affective responses were higher when the photographs had been framed as artworks. In contrast, the negative emotions were comparable under both framing conditions. Taken together, both results suggest that the framing conditions activated two different cognitive schemata, which in turn triggered different expectations and beliefs about the stimuli's significance, leading to differences in the way the stimuli were processed affectively. Thus, people can enjoy disgusting objects when they believe they are artworks, though this does not mean that they do not experience them as disgusting.

In another study, Leder, Gerger, Brieber, and Schwarz (2014) tested one of the model's claims. According to Leder *et al.* (2004, p. 505), 'The model's predictions concern dependencies of affective states and judgments as a result of successful or unsuccessful cognitive mastering. This could be tested using psychophysiological measures of affective states'. Leder *et al.* (2014) compared the emotional responses given to contemporary artworks of negative or positive valence, measured by facial EMG and several rating scales. Their results showed that while the spontaneous physiological reaction reflected the artworks' valence, the experts gave distinctively different evaluations, not only to the artworks, but also to a control set of emotional images. The authors see this as evidence, that differences in the cognitive processing units in experts modulate the stronger than initial emotional responses, although there were also effects in the emotional responses over time.

## **Challenges today: Hot topics, and pending assignments**

In this section we describe the topics that are being researched with greater emphasis, such as the role of aesthetic emotions and context in the aesthetic episode, and reflect on how results from such studies could be integrated into Leder *et al.*'s (2004) model. We also examine some long-standing pending research assignments, including the integration of the psychological, neuroscientific and evolutionary perspectives.

### ***The moving component: Aesthetic emotions***

It is so obvious that art can elicit strong emotions that such a remark borders on triviality. When the original model was published, however, emotion was among the emerging aspects in the scientific study of aesthetic responses to art. This situation owed mainly to three related reasons:

First, because knowledge about aesthetic emotions is grounded on knowledge about emotions in general, the difficulties in understanding the nature of emotion itself – how emotions are elicited, regulated, and so on – translated into difficulties in understanding the nature of aesthetic emotions. Disagreements about emotions led to disagreements about emotions elicited by art. For instance, Scherer (2004) argued that aesthetic emotions differ from utilitarian emotions in that they lack the appraisals of goal relevance and coping potential, common to utilitarian emotions. In contrast, Lazarus (1991) argued

that there are no exclusive or prototypical aesthetic emotions; that an aesthetic emotion is actually a common emotion experienced in response to art or any other object of aesthetic contemplation. Against this view, Konecni (2005) conceived aesthetic awe as ‘the most pronounced, the ultimate, aesthetic response, in all ways similar to the fundamental emotions’ (Konecni, 2005, p. 31). Other researchers have maintained that the emotional response to art is dual. One sort of emotions is aroused by the represented content, and these could be any of the common emotions, and another is aroused by the style, the medium, or the process of achieving understanding of the artwork or the object (Frijda, 1986; Tan, 2000). Consistent with this latter perspective, Hanich, Wagner, Shah, Jacobsen, and Menninghaus (2014) argued that, at least in the case of film, there is a specific emotion they describe as ‘being moved’ that is constitutive of aesthetic experience. This emotion can be heightened by the common emotions related to the content of the film, such as sadness.

These profound discrepancies as to the nature of aesthetic emotions is intimately linked with the second reason why this topic has been frequently overlooked, namely, the problems with the measurement of emotions. It is easy to see that limitations in the characterization of aesthetic emotions would lead to limitations in the available means to measure those emotions, and the psychological and physiological processes that mediate them. Moreover, the lack of precise means to measure emotions and their underlying mechanisms has hampered empirical testing of hypotheses derived from the theoretical positions outlined above and others. And this led to the third reason for the significant neglect of emotions in psychological aesthetics: when empirical work was carried out on aesthetic emotions, it was often lacking theoretical foundations (Juslin, 2013).

Nevertheless, since the publication of the model, empirical studies of emotions in aesthetic experience have been grounded on stronger theoretical frameworks. For instance, emphasizing the role of appraisals, Silvia (2006) argued that a broad range of common emotions could be a part of aesthetic experience. Appraisals constitute the key mechanism underlying the elicitation of all kinds of emotions in response to objects of aesthetic contemplation, and specifically to artworks. Interest, confusion, and surprise, that is to say, the knowledge emotions, are elicited by appraisals in terms of novelty, complexity, familiarity, and coping potential. Appraisals of goal-incongruence, intentionality, harmfulness, or contamination can lead to such hostile emotions as anger, disgust, or contempt. People can also feel self-conscious emotions, such as pride, shame, and embarrassment, while engaging with art. They are related to appraising the congruence of artworks with one’s own values, self-image, or goals, the degree personal responsibility, and the consistency with one’s standards (Silvia, 2009).

Other studies have aimed to determine the ways in which aesthetic and common emotions are different. Goldstein (2009), for instance, found that when participants viewed films eliciting sadness or anger in fictional or real settings, they reported equivalent degrees of anger or sadness. This suggests a considerable similarity in the subjective experience of emotions in response to fiction or reality. Contrary to this conclusion, however, Mocaiber *et al.* (2010, 2011) found that fictional contexts attenuate the psychophysiological and behavioural components of the emotional responses to negative stimuli. Gerger *et al.* (2014) extended these results by using contemporary visual artworks and images from the International Affective Picture System (IAPS, Lang, Bradley, & Cuthbert, 1999). Participants were instructed either that they would view photographic artworks or press photographs that depicted real scenes. Their results showed that this manipulation had no appreciable effect on ratings or psychophysiological responses in the case of negative emotions (anger, disgust, shame, sorrow, sadness, fear).

They did, nevertheless, find differences between both conditions in relation to the positive emotions (liking and joy). When participants believed that they were viewing real world scenes, their liking and joy ratings of negatively valenced stimuli were lower than when they believed they were viewing artworks. These differences in ratings were also accompanied by changes in the psychophysiological responses. Thus, these results indicate that whether or not aesthetic and common emotions are mediated by the same mechanisms cannot be resolved with a clear-cut yes or no.

### **Out into the real world: The challenging role of context**

Empirical approaches to aesthetics have been profoundly influenced by formalist views of art and aesthetics. A century ago, Clive Bell (1914) asked: ‘What quality is shared by all objects that provoke our aesthetic emotions?’ His answer summarizes his formalist theory of art: ‘In each, lines and colours combined in a particular way, certain forms and relations of forms, stir our aesthetic emotions’ (Bell, 1914, p. 8). If form is the source of aesthetic experience, and form is unchanged by the circumstances, it follows that ‘Great art remains stable and unobscure because the feelings that it awakens are *independent of time and place* (. . .)’ (Bell, 1914, p. 37, emphasis added). The enormous amount of psychological research on the sensory qualities that people find aesthetically pleasing (including complexity, order, proportion, colour combinations and so on), constitutes a search for an answer to Bell’s question, and shows the extent to which formalist views of art impregnated psychological research on the appreciation of art and aesthetics. Moreover, given how much of this work has been performed in laboratory settings, it is also clear that the psychology of art and aesthetics has traditionally accepted the formalist argument that aesthetic experience is, to a large extent, contextually impermeable, that is to say, that aesthetic episodes in the laboratory differ little from those that occur in other contexts.

Leder *et al.* (2004), however, distanced themselves from this tradition by embedding the cognitive and affective processing stages within cultural, institutional and physical contexts. This move was consistent with John Dewey’s belief that ‘Experience is a matter of the interaction of organism with its environment, an environment that is human as well as physical, that includes the materials of tradition and institutions as well as local surroundings’ (Dewey, 1934, p. 256). By highlighting the role of contextual factors on aesthetic experience, the model was aligned with the growing realization that cognition is contextually situated (Clark, 1997; Hutchins, 1995), and with evidence showing that presentation format influences interest and liking ratings of artworks, even though it has little effect on formal features, such as complexity or composition (Locher *et al.*, 1999).

Thus, a pressing question remained: To what extent, and how, does context affect the aesthetic experience of art? In the decade since the model was published, a number of psychological and neuroimaging studies have shown that semantic context and framing has a substantial effect on the experience of art. Kirk *et al.* (2009) demonstrated that expectations elicited by labels modulated people’s preference for visual stimuli and the activity of brain regions involved in aesthetic experience. Participants viewed a series of reproductions of original abstract artworks while in an fMRI scanner. They were told that some of these, which were accompanied by the label *gallery*, were reproductions of artworks exhibited at a renowned gallery, and that the other images, presented with the label *computer*, had been created by the experimenters using graphic editing software. Even though all stimuli had the same origin, participants preferred the images they believed belonged in a gallery. Moreover, this effect was accompanied by an increase in the activity of the medial orbitofrontal cortex, a brain region known to play a key role in

the processing of reward value. Huang, Bridge, Kemp, and Parker (2011) reported similar effects when manipulating participants' beliefs about the authenticity of the artworks: participants preferred what they believed were the genuine pieces, and this increased preference was associated with an increase in the activity of the orbitofrontal cortex.

Gartus and Leder (2014) compared the appropriateness of a virtual context for two different kinds of art. They studied abstract paintings and graffiti – or street art – matched for complexity, when these were either embedded in a museum context, or in natural scenes on the street. Moreover, they measured art and graffiti-art interest with a questionnaire. A positive attitude towards either kind of art had strong effects on evaluations, participants with high interest in graffiti art showed even stronger positive emotional responses to art presented in street context, as compared to museums. They concluded that the effects of the contexts in which artworks are exhibited are modulated by individual attitudes.

There is growing evidence, however, that even beyond the influence of semantic context, the actual physical surroundings have a substantial effect on cognition (Mesquita, Barrett, & Smith, 2010). To what extent does the laboratory distort or attenuate aesthetic episodes? Although there is still very little evidence to answer these questions, research on the cognitive processes underlying aesthetic episodes in museums can provide an indication. Tröndle *et al.* (2012), for instance, showed that the experience of art in museums is closely related to visitor's movement patterns through the curated space. The effect that the laboratory's restriction of freedom of movement and of proactive exploration has on the aesthetic episode is currently unknown. Tröndle *et al.*'s (2012) results, however, suggest it might not be negligible. In addition, Mastandrea, Bartoli, and Bove's (2009) results show how context (laboratory vs. museum) even modulates the relationship between personality traits and preference for art.

Although these studies suggest that there are differences between the processes underlying the experience of art in the laboratory and in museums, they do not provide a direct assessment of the contextual effects on the experience of art. Brieber *et al.* (2014) aimed to do just this. They compared participants' aesthetic experiences of contemporary artworks and viewing times in a museum and in a laboratory. Their results show that participants liked the artworks more, found them more interesting, and spent more time looking at them, when they were viewed in the context of a museum than in the context of a laboratory. This direct evidence that people's experience of – and behaviour towards – art is modulated by context shows that it is actually *not* independent of time and space. On the contrary, aesthetic appreciation happens in a given time and space, and both are crucial ingredients of the episode. Moreover, Brieber *et al.*'s (2014) study suggests that the laboratory context, in which most of the research in empirical aesthetics is carried out, attenuates and shortens the experience of art, probably due to the removal of contextual factors that are integral to the experience of art, as also suggested by Hanich *et al.*'s (2014) field work.

### **Back into the inner world: The neural underpinnings of aesthetic experience**

The notion that a comprehensive explanation in psychological aesthetics is not possible without a firm grounding on neuroscience was central to Berlyne's (1971, 1974) reformulation of empirical aesthetics. He believed that neuroscientific facts have the potential to strengthen, complement, and constrain explanation at the psychological level. At that time, unfortunately, not much was known about the neural underpinnings of

aesthetic appreciation. Consequently, Berlyne's (1971) premature biological foundations turned out to be weak and overly simplistic.

It was about the same time as Leder *et al.* (2004) published their model that the first neuroimaging and electrophysiological studies of aesthetic appreciation were published (Cela-Conde *et al.*, 2004; Jacobsen & Höfel, 2002; Kawabata & Zeki, 2004; Vartanian & Goel, 2004), and that the first reviews of the neuropsychological literature on aesthetic production and appreciation were written (Bänzner & Hennerici, 2006; Bogousslavsky, 2005; Chatterjee, 2004; Miller & Hou, 2004; Zaidel, 2005). It might seem, at first sight, that this confluence of publications is purely coincidental. Actually, it was a reflection of the times: Cognitive neuroscience had been making remarkable progress in understanding the biological foundations of higher cognition, neuroimaging and psychophysiological techniques gained in refinement and precision, and Zeki (1999) presented arguments suggesting that the production and appreciation of artistic features could be related with specific brain processes. Understanding how cognitive and affective processes involved in aesthetic appreciation are related to the brain's structural and functional organization was now within science's grasp.

As anticipated in Chatterjee's (2003) neuropsychological model, the results of neuroimaging studies performed since the publication of Leder *et al.*'s (2004) paper converge on the notion that aesthetic appreciation is related to activity in three functionally distinct sets of regions (Cela-Conde, Agnati, Huston, Mora, & Nadal, 2011; Nadal, 2013). One of these sets is the reward circuit. Aesthetic appreciation relies on processes involved in reward representation, prediction and anticipation, affective self-monitoring, emotions, and the generation of pleasure, that take place in cortical (anterior cingulate, orbitofrontal, insular, and ventromedial prefrontal) and subcortical (i.e., caudate nucleus, substantia nigra, and nucleus accumbens) regions, as well as some of the regulators of this circuit (i.e., amygdala, thalamus, and hippocampus; Cupchik *et al.*, 2009; Harvey, Kirk, Denfield, & Montague, 2010; Ishizu & Zeki, 2013; Kirk *et al.*, 2009; Lacey *et al.*, 2011; Vartanian *et al.*, 2013). Aesthetic experiences also involve an attention-related enhancement of activity in sensory processing and heteromodal convergence zones. These regions include the bilateral fusiform gyri, angular gyrus, and the superior parietal cortex in visual aesthetic experiences (Cela-Conde *et al.*, 2009; Cupchik *et al.*, 2009; Ishizu & Zeki, 2013; Lacey *et al.*, 2011; Lengger, Fischmeister, Leder, & Bauer, 2007). Finally, aesthetic experiences are also related to an increase in activity throughout a network of cortical regions involved in evaluative judgment, allocation of attentional resources, and retrieval of information from memory to contextualize the stimuli and judgment, including the dorsolateral and ventrolateral prefrontal cortex, anterior medial prefrontal cortex, temporal pole, posterior cingulate cortex, and precuneus (Cattaneo *et al.*, 2014; Cela-Conde *et al.*, 2013; Cupchik *et al.*, 2009; Jacobsen *et al.*, 2006; Lengger *et al.*, 2007). Nevertheless, as highlighted by recent studies (Cela-Conde *et al.*, 2013; Vessel, Starr, & Rubin, 2012), such mapping is only the first step. The key to understanding the neurobiological foundation of art appreciation lies in charting the dynamics of the networks that integrate these regions.

The results of these studies lead to four main conclusions. First, they support the model's conception of aesthetic appreciation as a complex interaction among perceptual, cognitive and affective processes. Second, they reveal that there is no localized seat for art in the brain; that our experience of art emerges from the interaction among the nodes of a broadly distributed network of cortical and subcortical brain regions (Cela-Conde *et al.*, 2013; Chatterjee, 2014; Vessel *et al.*, 2012). Third, they show that none of these brain regions is specialized in responding to art alone. They all play crucial roles in other



domains of human experience, from perceiving small details in the world or making small decisions to abstract reasoning or establishing social relationships. This distributed and unspecific quality of the neural underpinnings of the art experience might explain why it is resilient to neurological disorders, such as Alzheimer's disease. In spite of the impaired memory of artworks, patients continue to engage with art in personally meaningful ways, even though perceptual or memorable qualities might escape them (Graham, Stockinger, & Leder, 2013; Halpern, Ly, Elkin-Frankston, & O'Connor, 2008; Halpern & O'Connor, 2013). In terms of Leder *et al.*'s (2004) model, these results show that art can be appreciated in the absence of explicit memory integration, and that its enjoyment can rely on the contribution of the rest of the components.

### ***Looking far back into the past: Evolutionary foundations of aesthetic experience***

Obviously no animal would be capable of admiring such scenes as the heavens at night, a beautiful landscape, or refined music; but such high tastes, depending as they do on culture and complex associations, are not enjoyed by barbarians or by uneducated persons. (Darwin, 1871/1998, p. 96)

Leder *et al.*'s (2004) model did not attempt to provide an evolutionary account of aesthetic experience. This did not owe to oversight or belittling the importance of evolutionary perspectives. The reason was mainly that, although plausible hypotheses about the origin and evolution of aesthetic appreciation and art abounded, not much had actually been proven since the earliest proposals, based on Darwin's (1859/1991, 1871/1998) principles of natural and sexual selection. Two main reasons explain this meagre progress. First, there is relatively little material evidence that can be used to understand the evolution of art and aesthetics. Second, our closest living primate relatives produce nothing like art, and appear to lack aesthetic appreciation. This discontinuity is difficult to reconcile with the slow and gradual process of natural selection, and limits potential comparative studies.

These difficulties, however, have not deterred researchers from postulating possible scenarios for the evolution of art and aesthetics. Most hypotheses about the evolution of art and aesthetics assume that they are adaptations, that is to say, traits that endow us with specific selective advantages and that emerged through natural selection owing to those benefits (Lauder, Leroi, & Rose, 1993). But what benefits might have art and aesthetics provided humans? Different possibilities have been set forth. The majority of these adaptive hypotheses postulate individual selective advantages in several domains of life, including habitat selection (Kaplan, 1987; Orians & Heerwagen, 1992) and mate choice (Miller, 2001).

The modern version of the mate choice hypothesis is based on Zahavi's (1978) work on costly signalling. His approach was based on the observation that animal decorative patterns constitute reliable signals of biologically relevant features, such as the species, sex or age of individual. Such patterns, however, also make the animal more conspicuous to predators or rivals. Zahavi (1978) argued that this cost is not just a secondary effect of efficient signalling. The cost of the signal is, in fact, an essential attribute because it makes the signal reliable. From this perspective, Miller (2001) suggested that 'many design features of art function as indicators of the artist's virtuosity, creativity, intelligence, conscientiousness, and other important heritable mental and physical traits. This 'aesthetic fitness' view suggests that aesthetic judgment is a natural part of mate choice

and social cognition, in which an art-work is viewed as the extended phenotype of the artist' (Miller, 2001, p. 25).

On the other hand, understanding the mechanisms underlying facial attractiveness and its function has developed into a major research domain. People invest considerable time and effort in appearing attractive to others, and in accessing other attractive people (Hayden, Parikh, Deaner, & Platt, 2007; Leder, Tinio, Fuchs, & Bohrn, 2010; Shimojo, Simion, Shimojo, & Scheier, 2003). It is known that facial attractiveness can be processed in visual periphery (Guo, Liu, & Roebuck, 2011), and that it increases activity in brain networks associated with reward (Aharon *et al.*, 2001). Interestingly, the different drives for preference in mating situations are related to similarity – that is, I look for features that indicate someone is like me – and genetic distance, to avoid inbreeding (Laeng, Vermeer, & Sulutvedt, 2013). Studying variables such as self-relatedness and individual differences regarding art in the future might shed a new light on similar processes in art. Beauty however, also comes at a price: Attractive faces are not recognized particularly well, even when distinctiveness is controlled (Wiese, Altmann, & Schweinberger, 2014). Although it is still unclear how the rather well studied features that determine facial attractiveness are related to beauty in other domains, such as design, and art, researchers interested in psychology of the arts have exploit the strong effects of faces. They have studied representational artworks containing faces and people (Massaro *et al.*, 2012), or they have used portraits as a kind of special visual material for which aesthetic judgments can be made (Graham, Pallett, Meng, & Leder, 2014), while allowing the beauty of content – the depicted person – and style to be assessed separately (Leder, Ring, & Dressler, 2013).

Whether with regards to art or attraction to others, mate choice and habitat selection emphasize the advantages conferred by art on the individual. Some researchers, however, have suggested that art does not confer advantages to individuals, but to groups; that art enhances the fitness of groups in competition for resources with other groups. Dissanayake (1992) and Brown (2000), for instance, argued that, by promoting engagement in group activities and rituals, art's main selective advantage was to reinforce social cooperation and group cohesion.

However, there is an alternative to these adaptive scenarios. It is conceivable that the arts and aesthetics have provided no adaptive advantage, that they are exaptations, at least in part (Chatterjee, 2014). Davies (2012), for instance, concluded: 'When I review the theories and the evidence, I am doubtful that the arts, either together or singly, are selected to serve an adaptive function. If I had to bet, I would say that the adaptations that give rise to art behaviours are intelligence, imagination, humour, sociality, emotionality, inventiveness, curiosity. (...) Art gives vivid and powerful expression to these qualities, which are central to our human nature and indicate our humanity' (p. 185).

Evolutionary approaches have, for the most part, aimed at identifying *the* advantage conferred by art or aesthetics; the single benefit that could explain their origin and evolution. However, as underscored in Leder *et al.*'s (2004) model, and as shown by the psychological and neuroimaging evidence reviewed in previous sections, aesthetic experience involves numerous psychological processes related to many brain regions. The appreciation of art and aesthetics are the result of neural processes that also enable many other cognitive capacities and experiences, some of which are unique to our species, and others we share with our primate relatives (see Nadal, Capó, Munar, Marty, & Cela-Conde, 2009; and Zaidel, Nadal, Flexas, & Munar, 2013). Therefore, what needs to be explained is how aesthetic experience came about from psychological and brain systems that participate in many other spheres of human life, ranging from economic decision making to empathy, many of which we share with other living primates. This could be

achieved by extending Davies (2012) and Chatterjee's (2014) work, which already takes into account some of these issues.

### Looking forward into the future: The next 10 years

One of greatest challenges facing scientific aesthetics today is the need for integration with the neurobiological and evolutionary perspectives on art and aesthetics, forging a true cognitive, neuro- and evolutionary science of aesthetics (Jacobsen, 2006, 2010). This perspective, however, does not entail reducing psychology to neuroscience or evolutionary biology. Integrating psychological and biological explanations 'does not make the psychologist a physiologist, for precisely the same reason that the physiologist need not become a cytologist or biochemist, though he is intimately concerned with the information that cytology and biochemistry provide. (...) The psychologist is interested in physiology to the extent that it contributes to his own task' (Hebb, 1949, p. xv).

To achieve this integration, however, scientific aesthetics requires more sophisticated neurobiological explanations than those available today, which tend to rely excessively on localizing brain regions involved in aesthetic experience. There is no denying that in the last decade we have considerably increased our understanding of the neural underpinnings of aesthetic appreciation. However, our concepts and methods are still too closely bound to what Singer (2013) has called the classical view of information processing in the brain, based on 'the notion of serial processing across hierarchically organized cortical areas' (p. 616). A new vision of the biological foundations of cognition is required; one based on 'distributed processing in densely coupled, recurrent networks with non-linear dynamics (...) capable of supporting high-dimensional states'. In this sense, cognition emerges from the temporal coordination of distributed neural processes and mechanisms 'implemented to dynamically bind local processes into coherent global states' (Singer, 2013, p. 616). From this perspective, the cognitive and affective processes at the heart of aesthetic appreciation emerge from distributed functional networks, not isolated brain regions; and from the dynamics of neural activity, not static states.

From another perspective, the tools and methods afforded by cognitive neurogenetics have the potential to contribute a deeper understanding of the biological foundations of aesthetic experience, even below the level of networks of regions. This approach would allow clarifying the role of hormones, neurotransmitters, or genes, whose role in art and aesthetic appreciation has still not been addressed. Studying how genetic variations influence brain function is fundamental to understand the origin and development of pathologies, but it also holds great potential to clarify the mechanisms underlying healthy cognitive function (Green *et al.*, 2008). Individual differences in genes related to neurotransmitter function translate into differences in neurotransmitter synthesis, transport, postsynaptic uptake, presynaptic reuptake, or breakdown. Such variation can affect the extent or location of neural activity involved in cognitive function, which, in turn, can even lead to differences in overt behaviour and performance (Green *et al.*, 2008; Ramsøy & Skov, 2010). Thus, it is foreseeable that in the next decade genetic imaging will be used to identify genomic variations related to emotional or cognitive processes underlying aesthetic appreciation. It might even be possible to characterize neural connectivity patterns associated with such processes in participants that differ in terms of their genetic makeup. It is easy to see, however, that these exciting advances will require comparable progress in our understanding of the cognitive and affective processes that enable us to create and appreciate art and aesthetics, and the factors that modulate them.

## Acknowledgements

This research was supported by a grant from WWTF CS11-023-LedRos and a FWF grant P23538 to Helmut Leder.

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Received 11 April 2014; revised version received 24 July 2014