Aesthetics as an emotional activity that facilitates sense-making: Towards an enactive approach to aesthetic experience

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Abstract Nowadays, aesthetics are generally considered as a crucial aspect that affects the way we confront things, events, and states of affairs. However, the functional role of aesthetics in the interaction between agent and environment has not been addressed effectively. Our objective here is to provide an explanation concerning the role of aesthetics, and especially, of the aesthetic experience as a fundamental bodily and emotional activity in the respective interactions. An explanation of the functional role of the aesthetic experience could offer new orientations to our understanding of embodied cognition and of aesthetics as a fundamental part of it. We argue that aesthetic experience, especially its emotional dimension, is an evaluative process that influences the anticipation for stable and successful interactions with the environment. In other words, aesthetics facilitates sense-making as they affect what might be anticipated by an action tendency with respect to an environment.

On the nature of aesthetic experience

The conception of the 'aesthetic' has always been attracting thinkers from philosophy, psychology and more recently from neurobiology. From the ancient ages of Plato and Aristotle to the present, the understanding of the 'aesthetic' remains an ambitious and complex task within a more general attempt to analyze human behavior. In philosophical writings, which are the most influential in the study of the 'aesthetic', aesthetic experience has too many and mostly contradictory meanings concerning the processes that are related to perception and to evaluation of objects. Although aestheticians accept that the 'aesthetic' is connected to emotional phenomena, the role and the content of such experiences seem confusing even in contemporary writings. As Levinson (1997) argues, the variety of those approaches suggests that there is indeed something puzzling about aesthetic emotions. For those following the Kantian tradition, aesthetic emotions have traditionally been characterized by *disinterestedness* and *purposelessness*. The 'aesthetic' is appre-

hended as an unintentional process (experience with no-purpose), and consequently, the agent must show no-interest in respect to the existence and the role of the object with which it aesthetically interacts (Kant 2000). This emotional pleasure, which leads to beauty, should not be based on any kind of interest that may have its origin on bodily reactions (Coleman 1971). Accordingly, aesthetic emotions should not involve any purposive cognitive process or other feelings that could relate such experiences with senses (Stecker 2010).

In such philosophical tradition there is a puzzling division in emotional experience: the ordinary experience of pleasure, which is related to bodily reactions, and the aesthetic, which is mental. This argument is also extended to the understanding of beauty and to the assignment of aesthetic values. According to Bahm (1947), every aesthetic emotion of pleasure is somehow directly related to beauty, and as such, aesthetic emotions and beauty are sharing an intrinsic value. Aesthetic value is irrelevant to the sensitivity an agent exhibits (or learns) by detecting objects. Aesthetic emotions provide values for their *own sake* and not for the sake of anything else that relates a physical attribute to a value. An aesthetic value demands imaginative realization and detachment from desires, needs and practical concerns that an agent could exhibit in interaction (Levinson 2005; Budd 2007).

Considering the above approaches as speculative and unclear, naturalism or pragmatism aims to explain the 'aesthetic' by linking its experience to the respective embodied processes that governs human nature. From a naturalist point of view, the 'aesthetic' is a product of interaction between the agent and its environment (Dewey 1929). An aesthetic experience involves a reorganization of energies, actions, and materials, hence the physiological processes that constitute the 'aesthetic' are not limited to those concerning the interaction with works of art but they exceed in the coupling of the agent with any type of objects and environments. Moreover, the engagement in aesthetic experience is not only a matter of natural feelings that are somehow related to cognition, but it also involves the physiology of sensorimotor responses (Shusterman 2001). On this basis, Shusterman (1998, 2008) introduces the notion of *somaesthetics* in order to describe the aesthetic experience beyond the dualism of aesthetic emotions and body. As he argues: "Somaesthetics connotes both the cognitive sharpening of our aesthesis or sensory perception and the artful reshaping of our somatic form and functioning, not simply to make us stronger and more perceptive for our own sensual satisfaction but also to render us more sensitive to the needs of others and more capable of responding to them with effectively willed action" (Shusterman 2008, p. 43). From a philosophical perspective, Shusterman argues that human beings aim to the 'right action' for which they need knowledge, self-knowledge and effective will. Since action is a bodily process, the process of selecting the best action is also embodied. According to Shusterman, such selection is originated in somaesthetic awareness and control.

Then, in order to understand *the emergence of the 'aesthetic' in interaction* we need to explain the aesthetic experience in terms of natural needs and of the particularities of the respective embodied processes that take place during the interaction, and which can also be experimentally detected, tested and justified. Follow-

ing this naturalistic perspective, the 'aesthetic' has exactly the same scope as all other activities; it works in the service of agent's well-being and it is particularly related to *selective activities* (James 1980). In this way, we consider the aesthetic experience as an embodied phenomenon directly linked to adaptivity. More specifically, we consider the 'aesthetic' to involve emotional processes, which are elicited in the service of agent's autonomy as it interacts with the environment within a context of insecurity, instability and uncertainty (Dewey 1980; Schulkin 2009; Xenakis et al. 2012; Xenakis & Arnellos 2014). According to this view, aesthetic experience is naturally engaged when agents interact both with, in general, uncertain physical and cultural contexts. Particularly, physical objects are aesthetically experienced not as mere objects, but as conditions that are emotionally evaluated by the agent in order to support actions or meanings that could reduce the interactive uncertainty (Xenakis & Arnellos 2012; 2014). Hence, no matter the way in which an interaction is culturally mediated, the aesthetic experience is ultimately grounded on the evolutionary development of the agent (Shusterman 2011).

The reconceptualization of the 'aesthetic' as a process demands pragmatic explanations. In this attempt, and with a focus to investigate the underlying mechanisms, we consider aesthetic experience as emerging out of the structural coupling of an agent with its environment -- as any other interactive outcome. The concept of structural coupling is a key element in the *enactive approach* (Di Paolo 2005) according to which sense-making emerges from the recurrent sensorimotor patterns that characterizes perceptually guided action (Varela et al., 1993; Thompson, 2007). In this chapter, we argue that the 'aesthetic' in interaction is emerged in this structural coupling, when emotions, as adaptive processes, aid the agent in assigning values to interactive conditions, and as such, in bringing forth (in enacting) its situated environment. According to Thomson (2007), this evaluation introduces attractiveness or repulsiveness to conditions and enables the agent to behave accordingly. Our aim is to suggest and discuss some of the characteristics that should constitute a naturalized description of the aesthetic behavior.

In this direction, the present chapter is organized so as to explore two domains in which the aesthetic experience could be described. The first domain refers to descriptions concerning the agent's organization and the composition of its various subsystems engaged in an aesthetic experience. Particularly, our aim is to describe how the basic aesthetic emotions of pleasure and pain are elicited, and how they contribute to the generation of meaningful patterns of activity serving the autonomy of the agent. The second domain is derived from the first and concerns the implications of these aesthetic outcomes in adaptive behavior, when the agent is prepared for various forms of coupling with its environment. Considering the aesthetic experience as a regulatory process that tightly interconnects brain/body and environment, our argument is that aesthetic experience prepares the agent to act by facilitating the formation of adaptive motor activities. Aesthetic emotions are evoked during this preparation and signal the agent to avoid all those situations that exhibit a high degree of uncertainty and to bring forth and interact with those that are evaluated as being closer to goal fulfillment. In other words, aesthetic ex-

perience facilitates the agent in the resolution and reduction of interactive uncertainty, and consequently in fostering the enaction of a meaningful environment.

Sense-making and values

Autonomy and adaptivity (appropriate regulation) are both necessary in order to achieve sense-making. Generally speaking, an autonomous system is one that continuously produces the components that specify it. At the same time, the system is organized as a network of processes, which continuously regenerate and realize the network that produces them, and in this way, it also differentiates itself from the environment that interacts (Moreno et al. 2011). Autonomous systems are operating far-from-equilibrium, therefore, they are open to their environments, not only as a fact but also as a matter of their ontological necessity. Cutting them off from their environments results in loss of their recursive self-maintenance (Bickhard 2000). This means that autonomous agents in general cannot be inactive. They always have to act in order to maintain their organizational autonomy.

In a very general but also fundamental way, adaptive agents should at least be able to sustain and monitor a certain range of external perturbations and to compensate for them based on internal changes. In other words, agents should have the capacity to regulate themselves with respect to the boundaries of their own viability, namely, they should be "tolerant to challenges by actively monitoring perturbations and compensating for their tendencies" (Di Paolo 2005, p.438). This is what adaptivity is all about. The agent should exhibit ways to regulate its states always in relation to the environmental conditions by evaluating when these states serve the maintenance of its viability. As Di Paolo states "adaptivity allows the system to appreciate its encounters with respect to this condition, its own death, in a graded and relational manner while it is still alive" (p. 439). In this terms, agency in general and adaptivity in particular are framed within a context that emphasizes their negative tendency, a tendency of states to approach the proximal limits of viability.

However, some agents are motivated in the course of interaction to preserve their autonomy in a different way, or/and even to enhance their autonomy, and to satisfy their preferences (Barandiaran & Moreno 2008; Arnellos et al. 2010). We would like to emphasize this complementary point of view, according to which agents do not only appreciate things in respect to a negative tendency, but on the contrary, they appreciate the conditions that lead them to viability; i.e. every interaction is appreciated/evaluated on the basis of a primitive truth-value (see also Bickhard, 2006). This means that an engagement in a certain interaction could be appreciated positively or negatively with respect to its conditions, but in both cases the agent considers the appreciation optimal for its goals. However, this truth-value could be falsified in case of interactive failure. Thus, an agent should have the infrastructure to detect the interactive error. This is fundamental to learning, and enables agents to count on previous experiences in order to enact 'safer'

meanings in their future interactions. To go one step further, the problem of sense-making should not only be considered as relying on the fact that agents should do something rather than nothing and thus cease to exist. From the perspective we adopt here, the emergence of sense-making relies also on what makes agents do one thing rather than another. Roughly speaking, sense-making is the process through which the agent selects the way of interaction that could be the most appropriate for its own viability, and in consequence, for its autonomy.

Adaptive autonomous agents engage in interactive cycles with their environment (Barandiaran & Moreno 2008). These interactive cycles provides agents with the ability to create new distinctions (actions) based on previous ones, to *evaluate* their distinctions, and to increase their autonomy by creating new meanings. Therefore, sense-making has an intrinsic dimension of bringing forth significance and value (Thompson, 2007). This value is generated from an evaluation process by which the agent appreciates the potential implications of a future interactive state according to present conditions (anticipation). Through its anticipation, the agent, in a way, 'generates an understanding' of the appropriate conditions and of the interactive alternatives (action tendencies) that could be valued as appropriate for its own viability. Therefore, anticipation becomes ways of interaction. Such potential actions (enacted meanings) have always the possibility of failure as manifested in cases where the chosen action has not the anticipated results (Arnellos et al. 2010).

What we have described so far should be considered as a part of a *preparatory process* for further interactive potentialities together with the agent's ability to detect when those preparations fail to be met (Bickhard 2000). Those preparations are directly related to adaptations of the body to support an intentional motor activity (Freeman 2000). As we argue in the next sections, aesthetic experience, and particularly, aesthetic emotions, are elicited in such preparations, and allow agents to avoid all those situations that exhibit a high degree of uncertainty (risky situations), and to seek for those that will lead closer to goal fulfillment.

It is important to note that not all agents have access to such operational mechanisms, through which they are able to distinguish the different implications of potential paths of encounter with the environment (ways of interaction). Furthermore, agents achieve different degrees of sense-making according to their organizational complexity and the diversity of the respective counteracting mechanisms. In higher cognitive agents such as humans, for instance, sense-making involves complex self-regulatory bodily mechanisms. Our claim is that a basic aesthetic emotion of pleasure and pain is such a mechanism that evaluates the effectiveness of the potential or chosen interaction, thus influencing and being directly related to the agent's adaptive behavior.

Aesthetic emotional values in sense-making

Sense-making requires the assignment of a value by which the agent judges a situation as beneficial or harmful according to its purposes (Weber & Varela 2002). In order to do so, the agent must be able to recognize in the respective interactive conditions the virtual tendencies that are related to the enhancement, decrease or potential loss of its autonomy. This awareness allows agents to bring forth significance and value, which implies that agents should be capable to evaluate and act. This is the basis for normative sense-making, according to which the agent regulates its coupling with the environment.

This explanation prompts the questioning of the nature of these normative values that find their origin in self-sustaining, operationally closed processes. This body of theory that attempts to understand and explain these value-generating processes has always been a major challenge for cognitive science (Di Paolo 2005). From an enactivist point of view, embodied values are a fundamental aspect of all sense-making. Such values are produced by somatic states that signal (mark) the agent with respect to various interactive possibilities (Damasio 2000; Spackman & D. Miller 2008). Considering sense-making as the process by which the agent evaluates the consequences of an interaction for the conservation of its own autonomy, the question is: *how a value characterizes the experience as 'aesthetic'* and *how is such a value related to emotions of pleasure and pain*, a relation with which almost all theorists working in the field of aesthetics seem to agree (see e.g. Dewey 1980; Levinson 1997; Kant 2000; Higgins 2008).

An interesting argument that comes from the domain of aesthetic philosophy is one that segregates the emotional value from feelings and sensual experiences. The argument is that positive and negative aesthetic values are not necessarily linked to positive and negative feelings or sensual experiences, correspondingly. There are positive values, which can be present in aesthetic experience without the existence of pleasurable sensual experiences. Sensual pleasure can be absent from an experience that is positively valued, and respectively, a negative sensual experience can give rise to a distinctive form of a positive aesthetic value (Shusterman 2006). This means that, in a way, agents assign aesthetic values to situations with respect to how they anticipate these situations will influence their own adaptation toward their goals. Therefore, in aesthetic experience, anticipation could also exceed the prospects of viability. This could explain how a physically self-destructive action could deliver pleasure to some people. In other words, an interactive situation or an event is evaluated by the agent according to the implications it anticipates to have on the conservation of its own identity. In general, we could say that aesthetic experiences should be considered all those bodily activities that deliver emotional values (positive or negative) to the agent. At this point, and in order to provide a better understanding for this adaptive value-generating process by which agents, and especially humans assign aesthetic values to artifacts or events, the understanding of the role of aesthetic emotions in interaction seems necessary.

Almost all emotional theorists claim that basic emotions of pleasure and pain exert a strong influence upon the agent's goals and on its respective biological needs (Schwarz 2000; Rasmussen et al. 2006; Nelissen et al. 2007; Brehm et al. 2009). Roughly speaking, an abstract description of emotions normally consists of a type of processing that analyses a stimulus, and then, through an evaluative process, it signals other mechanisms that control actions and plans (Damasio 2000; Baumeister et al. 2007). Emotions are processes that detect opportunities and threats, and the existence or not of a solution, but they barely answer to what the system should do in a given interaction. According to Bagozzi et al. (1998), "emotions function to produce action in a way promoting the achievement of goals" (p. 2). The relationship between emotions and goals is neither automatic nor direct. Emotions emerge from the prospects for goal success or failure and their intensity is a crucial aspect that influences the potential motivation to pursue that goal (Rolls 2011). Hence, we can argue that such basic emotional activity plays two major roles; firstly, it notifies the agent to move towards the incentives and away from threats, and secondly, through an elaborated feedback system, it compares and rates signals that correspond to the progress the agent is making against a reference rate. It is the error signal of these processes that is manifested as an emotion. If the rate of the signal is either too low or too high, it produces a negative or positive value, correspondingly. In the case of an acceptable rate, no value occurs as an immediate result of the evaluation of the signal (Carver 2001, 2003). In other words, emotions with a positive value (euphoric) are associated with the attainment of a goal, and they lead to decisions that allow the agent to continue with its current plan. In contrast, emotions with negative value (dysphoric) emerge when the agent has problems with the ongoing plans and fails to achieve the desired goals (Bagozzi et al. 1998).

Thus, emotional activity could be considered as an adaptive process by which the agent generates values. We think that the notion of 'value' is more suitable than that of 'valence' to describe all those dynamic multidimensional types of organization that influence the emergence of action possibilities. As Colombetti (2010) argues, "the main problem with the notion of valence is that it is typically characterized as a dimension whose poles are mutually exclusive, which logically rules out the possibility of conflicts and mixtures. Yet our life is dominated by mixtures and ambivalences — something that depends on the coexistence of different values and meaning generating processes in complex organisms" (p. 160). According to Pugh (1979) emotions must be classified as values. Adaptive systems "try to avoid situations where the valuative signals are negative (or aversive), and it will seek situations where the valuative signals are positive (or rewarding)" (p. 60). Those positive and negative values signal all those mechanisms that constitute sense-making, thereby facilitating the agent to reconsider the existing goal structures in order to reconstruct new action plans. Thus, aesthetic values of pleasure and pain are not properties of the environment. The 'aesthetic' is not a characteristic of the artifact (or of the environment) but emerges as the agent interacts with it. Our body generates pleasant or unpleasant aesthetic values in response to those aspects of the environment that could be a consistent benefit or threat to our

autonomy. Through emotions the agent has adapted a way of anticipating bodily movements in order to engage in safer and faster responses (Prinz 2004). This means that aesthetic values are generated not only in response to an actual goal achievement, but also in response to anticipated actions, thus giving to aesthetic experience a future-oriented perspective (Freeman 2000; Desmet 2007; Xenakis et al. 2012; Xenakis & Arnellos 2014). Therefore, by the term 'aesthetic pleasure', we refer to emotional reactions with positive values, which are associated with a positively valued anticipation of the plans (provision and selection of actions with the environment) of the agent, with respect to the fulfillment of its goals. In contrast, by the term 'aesthetic pain', we refer to those emotional reactions characterized by a negative value, which emerge when the agent anticipates problems with its plans for the fulfillment of its goals (Xenakis & Arnellos 2012, 2013; Xenakis et al. 2012).

According to Pugh (1979) and Roll (2011), these valuative signals could be related to experience in a very simple and direct way (pleasure and pain), or in a very complex and implicit one (joy, excitement, happiness, etc.). Their intensity could determine the relationship between motive and action, thereby generating a valuative experience of high complexity (e.g. aesthetic appreciation), which motivates human social behavior to be related to certain types of socio-cultural expressions (e.g. appreciating or even making/creating/producing art). We have argued elsewhere (Xenakis et al. 2012) with respect to the occurrence of two fundamental levels of aesthetic value-generating processes, where the first takes place in a visceral (non-conscious) manner having strong underlying motivational substrates, while the second presupposes evaluations with stored information, schemata and expectations of the agent even for the simplest perturbation that elicits emotion. Under this conception, we could also argue for three properties that characterize the 'aesthetic' in interaction: a) the 'aesthetic' (even for values with the same valence) exhibits qualitative differentiations (grades of intensity), which are causally dependent on the dynamic character of the value-generating processes, b) the 'aesthetic' is embodied in every level of the experience, denoting that in each of these levels bodily states are related to several types of action (Prinz 2004), and c) an aesthetic value is incorporated automatically in the anticipatory system of the agent during sense-making (Pugh 1979).

Considering that aesthetics facilitates sense-making, and as such, they co-regulate the formation of what we might anticipate by an interactive outcome, in the next section we suggest that agents experience the 'aesthetic' in the course of interaction, when their preparation for further interactive potentialities (i.e. for action selection) is characterized by uncertainty.

The aesthetic experience reduces the interactive uncertainty

In everyday activities, agents stand in front of many complex decisions, for the most of which they are not aware of their direct consequences. In fact, agents live

and act by knowing only something about the future; while the problems of life and its manipulation arise from the fact that the available information needed to handle those problems is often uncertain (Knight 1964; Yoshida & Ishii 2006). Thus, surviving in those dynamic conditions depends on the ability of the agent firstly to anticipate how an interactive situation could affect its autonomy, and secondly, to decide which action (or set of actions) from those that seem available is the 'most promising' for the specific goal. The 'most promising' aspect denotes that anticipation, and thus the enacted meaning, has always a primitive truth-value (e.g. engage or not to a particular interaction with the environment, always with respect to the current goal of the system) as an implicit predication about the appropriateness or not for the interaction. Therefore, the primitive truth-value that characterizes the content of the enacted meaning could be influenced from the evaluation outcomes of each interactive alternative (which may be aesthetically valued in a positive or negative way), but its value is always truth (i.e. either engaging or avoiding a particular interaction would be beneficial for the agent). However, as already mentioned, there will always be the possibility that this primitive truth-value is false (Bickhard 2000, 2003; Arnellos et al. 2010). For instance, while, under specific conditions, the interaction of an agent with its environment results in a negative or positive aesthetic valuative signal that influences sense-making, the agent in both cases enacts by accepting that the selected action (whose selection has been influenced by this aesthetic value) is compatible to its goals (truth-value). However, the result of the selected action may finally be proved unsuccessful, as in cases when the new interactive state differs from the one that it was initially anticipated. This means that a system that detects when this truth-value is falsified is necessary. From our point of view, this precariousness of sense-making is related with the risk of interactive error thus providing the interaction with an uncertain character. This is what we here call *interactive uncertainty* (see also Bickhard 2000).

This detectable interactive failure enables agents to learn from their unsuccessful interactions thus enhancing their adaptability with respect to the same or similar situations. As we mentioned in the previous section, *preparations* combined with the ability of the agent to detect when those preparations have failed are fundamental for sense-making. When everything goes as anticipated the agent does not need to learn (Bickhard & Campbell 1996). Learning requires output and error feedback, and it is the only process by which the agent could effectively handle and eliminate the interactive uncertainty (Bickhard 2000).

The problem that still remains regarding the reduction of interactive uncertainty is that knowledge is not always available to the agent. This means there are situations, where the agent is motivated to act before learning. Then, the agent should have the necessary interactive variety (i.e. an adaptive anticipatory system that operates before learning) in order to be able to evaluate whether the current interactive conditions initiate a deviation or not from a desired state, and to act accordingly (Porr & Wörgötter 2005). Hence, this anticipatory system should operate so as to both motivate and facilitate the agent to resolve the interactive uncertainty and to proceed in the active generation of a meaningful environment (i.e. to enact).

This motivational tendency is a creative process through which the agent approaches new solutions, and enacts new meanings (Arnellos et al. 2007). As we have argued so far, aesthetic emotions provide the agent with the capacity to enact even before learning, by assigning values to current interactive conditions as provisions of the enacted meaning. Thus, aesthetic experience motivates the agent to avoid situations, for which the valuative signals are negative (or aversive), and to seek situations for which those signals are positive (or rewarding). This is what we call *motivational tendency of aesthetic experience*. Accordingly, we suggest that *a minimal aesthetic experience* should be considered as *an aesthetic emotional evaluation that forms an anticipation for a certain interaction, thereby reducing the interactive uncertainty*.

There are several recent neurological evidences that support this hypothesis. Relevant studies have showed that there are several operations that are simultaneously taking place in various interconnected areas of the human brain during an aesthetic experience, in particular, or/and during other anticipative/evaluative interactions in general. These studies suggest that humans anticipate the impact of future behavioral choices on the basis of reward values, using processes that involve the amygdala, which is mostly known for emotional processing during an aesthetic experience (Ramachandran & Hirstein 1999; Cinzia & Vittorio 2009), as well as areas in the prefrontal cortex (PFC) (Hampton et al. 2007). Moreover, both the amygdala and the orbito-frontal cortex (OFC), which is also activated in most of the studies related to aesthetic experiences (Chatterjee 2011), are extremely well positioned to tune perceptual processing in sensory cortex based on stimulus evaluation (Pessoa 2008). Dysfunction of OFC is associated with disturbances in motivation and an inability to anticipate interactive consequences, leading to maladaptive behavior (Schoenbaum et al. 1998).

Additionally, experimental results suggest a reciprocal interaction between motor responses and regions that have often been associated with a variety of emotional states. These are the orbito-frontal cortex (OFC) and a widespread network of interconnected cortical regions that are activated during an aesthetic experience (Kawabata & Zeki 2004). According to this evidence, it seems there is an important connection between the experience of the 'aesthetic', emotions and motor functions. It is also important to note that during the evaluation of sensory input, emotional and cognitive processing in these areas cannot be separated (Pessoa 2008). For instance, the PFC receives highly processed and integrated sensory information, which is useful to the agent for more abstract processing (i.e. higher order meaning making processes). Simultaneously, fast processing of emotional valuative signals relies on multiple, parallel cortical pathways that rapidly convey information to the amygdala and other evaluative sites such as the OFC (Pessoa 2010). The generally accepted view is that emotional signals are elicited so as to prepare the agent to enact in the sense that such signals facilitate action-selection during the development of strategies for the reduction of its uncertainties (Pessoa 2008; Heilman et al. 2010).

Recently, Ishizu and Zeki (2011) have claimed that the activity in medial orbito-frontal cortex (mOFC) is also correlated with the aesthetic experience, and

particularly, with pleasure and reward, whether it is real, imagined or anticipated. In that sense they argue that: 'Beauty is, for the greater part, some quality in bodies that correlates with activity in the mOFC by the intervention of the senses' (p. 7). Accordingly, they argue that the positive aesthetic experience is strongly linked to values of reward and pleasure. In other words, for Ishizu and Zeki ''beauty is a value'', and value evokes desire. For them, the tension to place 'beauty' more in the agent than in the object is in accordance to our consideration of the 'aesthetic' as an emotional evaluation that is evoked during the agent's interaction with its environment.

Therefore, there should be a link in the cortical processing that is related with value, desire, and beauty, and there might be a sub-system in the brain that assigns those values. According to Grabenhorst and Rolls (2011), neural activations in OFC and in adjacent anterior cingulate cortex (ACC) are correlated with the subjective pleasurable values produced by many different stimuli. They particularly argue that the OFC projects to ACC information about the valuative signal of pleasure (reward). The ACC brings together information about actions, and values that derive from the implications these actions may have for the agent. This process associates actions with a value of their anticipated outcomes, thereby facilitating the agent to select the best possible action. This is in accordance to our consideration of an aesthetic value as an influence (affection) to the anticipatory system, which contributes to sense-making. The ACC has strong connections to motor areas, and it is activated while the agent cognizes actions and outcomes, including values that predict errors or effort costs with respect to those actions. Negative emotional values (punishers) form negative predictions when the anticipated outcome is not in accordance with the agent's goals (Pessoa 2008; Grabenhorst & Rolls 2011).

Based on results from the works of Hampton et al. (2007) and Pessoa (2008), the OFC's role in anticipating future events extends to the amygdala, which is likely to receive error signals concerning the input stimuli with respect to agent's goals. Also, according to Paton et al. (2006) the amygdala may be essential in creating updated 'representations' of values. As Pessoa argues, the circuit (OFC-ACC-amygdala-OFC) indicates that the processing related to the cost/benefit analysis of the potential implications that the current interactive state will have for the agent, is emotional or affective. Each time the agent uses these processing circuits, better predictions are being made, and the perception of the object is getting less and less uncertain, while at the same time the agent enacts more and more functional meanings (Stapleton 2013).

What is important with respect to our argument is that several studies show that the primate OFC is involved in the processing of unlearned interactive conditions. The OFC provides valuative signals with respect to these conditions, thereby facilitating the agent to make the most positively reinforcing choice that is currently available. Additionally, the OFC is associated with the history of values received in previous trials, making this region important for learning a value related to an action. Either a situation is known or unknown to the agent, those OFC-related processes are influencing the conscious control system, which, together with its

long-term planning algorithms can evaluate which action should be performed next. Therefore, the OFC has important functions in motivational behavior and in emotional and social behavior (Rolls 1999; Rolls 2004; Rolls & Grabenhorst 2008; Rolls 2011).

Conclusions

We have argued that aesthetic experience originates in the adaptive processes of action selection. Adaptive behavior requires the ability to make advantageous decisions by anticipating the possibility of future success. However, the virtual falsification of anticipation introduces uncertainty in interaction. What we experience as 'aesthetic' is a valuative emotional process that reduces the interactive uncertainty so that the agent is able to prevent the interactive error, even before learning is possible. Agents generate aesthetic values under uncertainty in response to those aspects of the environment that could be a benefit or a threat to the conservation of their autonomy. These aesthetic emotional values influence the anticipatory system and facilitate the agent in action-selection.

Therefore, aesthetics are more than just another aspect of cognition pertaining to the appealing nature of events and states of affairs. Considering the aesthetic experience in a wider sense than that of mere application of values related to beauty and to ugliness, aesthetics provide values that could characterize situations that emerge through embodied interactions. Our claim is that these aesthetic values are related to the world of the agents not as an external realm, which is specified or represented in their brains, but as emergent and enacted in their own cognitive and emotional domains, while they try to actively adapt to their environments. Overall, we have suggested that aesthetic values, through their embodied emotional basis, reduce the uncertainty of an action tendency thus facilitating sense-making and the constitution of meaning in general.

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