A THEORETICAL INTERDISCIPLINARY ANALYSIS FOR A NEW COGNITIVE AND EMOTIONAL NEUROSCIENCE OF APPRECIATION AND ARTISTIC CREATION

by

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DECLARATION

Student no. 4631-100-9

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ACKNOWLEDGMENTS

To my supervisor – Chris Janeke: Thank you for your support, guidance during this process, it has been of great value to me and I would not have been able to finish this project without your expertise and valuable contributions.

DEDICATION

For my beloved daughter Anna. You are in my heart.

For my grandfather Walter, who found his peace somewhere in Russia.

THESIS SUMMARY

This work is organised around two main objectives: a) the formulation of a new conceptual framework as the basis for a new scientific aesthetic; and (b) an attempt to explain the possibilities and current limitations of neuroscience in aesthetics.

The first part of the work is devoted to the conceptual foundations of aesthetics. In the first chapter, I analyse the philosophical assumptions reflected in neuroaesthetics. In particular, I would like to show that the concept of art on which neuroaesthetics is based is both conceptually and empirically untenable.

In the second chapter, I propose a new conceptual framework for a theory of aesthetics; in particular, I present new definitions of key concepts in aesthetics, such as 'art', 'artistic system', 'artistic movement', 'artwork', and so forth.

Furthermore, in the second chapter, I advance the view that—even though the neurosciences are an essential part of aesthetics—not every aesthetic problem requires a neuroscientific solution. In other words, there are aesthetic problems that cannot be answered satisfactorily by neuroscience using only its special concepts and terminology. Some questions may require additional sociological, physical and/or semiotic concepts, and explanatory devices.

The second part of this thesis deals with the experimental aspects of the neuroscience of artistic appreciation. First, I argue that the conceptual foundations underlying much of the current approaches to neuroaesthetics are still problematic and that the experimental approach cannot be applied in any straightforward manner to conduct neuroaesthetic research.

I then review some of the most important results of experimental aesthetics and cognitive neurosciences with regard to the mechanisms of aesthetic appreciation before proposing a new neurocognitive model of artistic appreciation based on the notion of an artistic 'task-set'

Finally, I end the second part with a theoretical postulate and a neurocognitive framework pertaining to the interactions between mental images and emotions and their possible role in the process of appreciating literary artworks.

In the third and final part of the work, I briefly discuss the central ontological preconditions of the neurocognitive studies of art, namely, the neural hypothesis of identity, ‘mind = brain’, and compare it to other approaches of the mind-brain relationship. I also offer a hierarchical model of mental functions based on both the anatomical and the functional aspects of the brain.

Key terms: conceptual framework, scientific aesthetic, cognitive neuroscience, artistic appreciation, hypothesis of identity, imagery, expertise, prefrontal cortex, philosophy of mind

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Part I:

TOWARDS A NEW CONCEPTUAL FRAMEWORK OF AESTHETICS

CHAPTER 1: NEUROAESTHETICS

1.1 Introduction

Art and science are allocated to different aspects of life in our Western culture, where art is generally regarded as a subjective, interpretable and sometimes controversial domain, while science is considered logical, and helps us to gain an understanding of the world. In this sense, we have two opposing cultural areas where convergence is difficult to achieve. The neuroscientist Erich Kandel, Nobel laureate for his work on neural mechanisms and processes in the context of synaptic and molecular changes in learning processes, comments on this as follows.

> *WHY WOULD WE WANT to encourage a dialogue between art and Science, and between Science and culture at large? Brain Science and art represent two distinct perspectives on mind. Through science we know that all of our mental life arises from the activity of our brain; thus, by observing that activity we can begin to understand the processes that underlie our responses to works of art. How is information collected by the eyes turned into vision? How are thoughts turned into memories? What is the biological basis of behavior? Art, on the other hand, provides insight into the more fleeting, experiential qualities of mind, what a certain experience feels like. A brain scan may reveal the neural signs of depression, but a Beethoven symphony reveals what that depression feels like. Both perspectives are necessary if we are to fully grasp the nature of mind, yet they are rarely brought together (Kandel, 2012, xvi).*

Kandel points to the great progress of the new sciences of the 21st century when compared with the 20th century, which can be seen in the new technological possibilities (fMRI, PET, MEG etc.) that emerged for understanding the human mind as a biological entity. This window into the mind was opened through ground breaking research in both the cognitive and neurosciences, and thus derives not only from research within various areas of the neurosciences, but also from progress in the humanities during the last century. The results are a ‘new science of the mind’ that seems to offer a deep vision of what makes us ‘who’ and ‘what’ we are. Furthermore, it is a science which continues the dialogue between the neurosciences and other disciplines such as cognitive psychology. This dialogue can help us to explore the neural mechanisms that make aesthetic experience and creativity possible, and through the course of this dialogue, new scientific knowledge could become part of our everyday cultural experience.

But what are the key applications of this exchange of ideas, and who really stands to benefit from them? This is only slowly becoming apparent as scientists struggle with the great challenges of neurobiology, and gradually advance in their attempt to understand how our brain works. However, it is already evident that an exchange between neuroscience and the humanities in the course of this scientific process could well provide a framework for understanding perception, experience and emotions, and that it may also yield insights of fundamental benefit to aestheticians, artists, visual researchers and art historians.

According to Kandel (2012, xvii), the understanding "of visual perception and emotional response" processes can stimulate a "new artistic" language, and can deliver new forms of art, and, perhaps, even new expressions of creativity. The perfect artistic representation of the human body can be found in the anatomical knowledge of Leonardo da Vinci and other Renaissance artists, while many contemporary artists have been able to generate new kinds of illustrations based on the scientific discoveries about the functions of the brain (see also Zeki, 1999).

Much of what we find interesting and compelling about an artwork cannot be explained by the current science of the mind.

> *Yet all visual art, from ancient cave paintings of Lascaux to contemporary performance pieces, have important visual, emotional, and empathic components that we now understand on a new level. A greater understanding of those components will not only clarify the conceptual content of art but, may also help to explain how the beholder brings memory and experience to bear on an artwork and, as a result, assimilates aspects of art into a broader body of knowledge (Kandel, 2012, xviii).*

In the year 1871, during a lecture, the German physiologist Hermann von Helmholtz, submitted that:

We must look upon artists as persons whose observation of sensuous impressions is particularly vivid and accurate, and whose memory for these images is particularly true. That which long tradition has handed down to the men most gifted in this respect, and that which they have found by innumerable experiments in the most varied directions, as regards means and methods of representation, forms a series of important and significant facts, which the physiologist, who has here to learn from the artist, cannot afford to neglect (Helmholtz, 1871, as cited in Cahan,1995, p.280).

From an historical point of view, the artists were the first researchers of visual perception. This was, however, only an approach to repeat experiments or verifiable results, so the investigation moved into the nebulous dimension of the mysteries of the visual process and its visual brain areas. Leonardo da Vinci investigated with his technique of 'sfumato' and 'chiaroscuro' how changes in the form of the eye could contribute to depth perception due to a gradual change of the incidence of light, and he did this centuries before psychologists and neuroscientists had developed their own theories of depth perception. Artists also gained new insights into visual perception in parallel to scientific discoveries. Mention should be made here of the example of the optical art movement that has become known for the last 60 years as Op-Art. This form of art was especially suitable for the exploration of an interest in contrast and the effects of colour on the retina and is a good example of the interplay of mutual ideas between art and science. The creation of some artists who feel called to the understanding of visual perception can certainly be compared to the investigations of neuroscientists. But what is the current relationship among philosophy and neuroscience and the psychology of art?

1.2 Consolidation of the theoretical research focus

On closer inspection, it is evident that in the current era, the neurosciences constitute a loose grouping of sciences, and that many social and humanistic disciplines, such as economics (Loewenstein, Rick & Cohen, 2008), ethics (Chatterjee & Farah, 2013), law (Goodenough & Tucker, 2010), history (Burman, 2012), pedagogy (Sigman, Peña, Goldin, & Ribeiro, 2014), philosophy (Smith Churchland, 1989, 2002), marketing, advertising, have been integrated in this grouping. It is also evident that these other disciplines have re-oriented their own approaches owing to the extensive advances within the cognitive neurosciences, and that they have adapted their methods accordingly.

The idea that the neurosciences are considered to be important for aesthetics is still, however, a controversial issue, especially in the humanities. There are quite a few scholars and practitioners in the humanities who believe that neuroscience is relevant to the study of art, but many others would argue that, for art at least, the research results of neuroscience are at best merely anecdotal. There are various reasons for this. For example, there is a rejection of the basic tenets of neuroscientific research, namely the inherent materialism and realism which appears to be in conflict with the irreducibly subjective nature of artistic experiences (Massey, 2009). Researchers in the humanities further reject the assumption of psycho-physical identity underlying neuroscience (see Chapter 4), and some would even raise a more radical objection, maintaining that artistic creation and appreciation are topics that are best viewed as *ignoramus et ignorabimus*, because they are not amenable to scientific explanation.

Part of this scepticism is certainly justified and has its origin in the fact that neuroscience research has so far dealt with only rather trivial aspects of aesthetics. A proper neuroscientific explanation of aesthetics is an ‘as yet undeveloped’ chapter of cognitive neuroscience. The current, very reductionist approach offers a rather too simplistic explanation, implying that art is nothing more than just part of the ‘handbook of neuroscience’. An exemplary case of this radical reductionism or 'neuroscientific imperialism' is the current state of the so-called ‘neuroaesthetics’ research domain in neuroscience.

The perspectives propagated in both the scientific publications and the mass media of neuroscientific research concerning art creation and the artistic appreciation of the neuroaesthetics have probably caused more harm than good. This is because the current state of neuroaesthetics research is still far from satisfactory as an overall project of research into artistic appreciation and artistic creation, and in its current form it does not adequately capture the specific ontological and epistemological dimensions of what art is and how it has to be studied (see Sections 1.3.1, 1.3.2, 1.4 and 3.1; Tables 1.1 and 1.3; Figures 1.14, 1.16, 3.1, 3.2 and 3.3). Many would argue that neuroaesthetics is just an example of the senselessness of the application of neuroscience to the exploration of artistic creation and artistic appreciation.

One important issue to address in this context is whether a failure of neuroaesthetics would mean that any attempt to explain the art (or rather, some aspects of art) with the conceptual and methodical tools of neuroscience would also lead to failure? In this thesis, I will try to show that a neuroscience of artistic creation and aesthetic appreciation is not only possible, but also necessary. Alternatively stated, I will argue that neuroscience provides insight into an integral aspect of aesthetics or, what amounts to the same postulate, that every mature and profound aesthetic must have a neuroscientific component. My own approach can be seen in the context of developing a field theory of artistic appreciation in contrast to the rather structural and static approaches usually presented.

This work is organised around two main objectives: a) the formulation of a new conceptual framework as the basis for a new scientific aesthetic; and (b) an attempt to explain the possibilities and current limitations of neuroscience in aesthetics. Consequently, I have divided this work into three parts: the first part consists of chapter 1 and 2 and deals primarily with the conceptual basis of aesthetics. The second part consists of chapter 3, which deals mainly with the neuroscience of artistic appreciation, and, finally, in the third part of the work which is further exemplified and elaborated in chapter 4, I deal primarily with the central ontological preconditions of cognitive neurosciences, namely the psycho-neural identity.

The three parts of the work form a coherent system, and the work should be judged according to its overall coherence as each part of this thesis is also quasi-independent and can, thus, be read without reading the other two parts. In addition, the reader can decide in which order he or she wishes to read the different parts. I would suggest that the reader who has a greater affinity with the philosophy of art should read the first two chapters first, while the reader with a greater affinity for experimental aesthetics begins to read this work at the third chapter. Finally, the reader with a greater affinity for the philosophy of the mind can begin with Chapter 4. It goes without saying that, in order to gain an overall impression of the work, all three parts need to be read.

Finally, to facilitate reading, and as a reminder, at the end of the first and second part there is a summary in which the core points of each chapter are highlighted (see Sections 2.9 and 3.6).

The first part of the work is devoted to the conceptual foundations of aesthetics. In the first chapter, I will analyse the philosophical assumptions that are reflected in neuroaesthetics. In particular, I would like to show that the concept of art on which neuroaesthetics is based (see Table 1.1) is untenable both conceptually and empirically (see Table 1.2).

In the second chapter I will propose a new conceptual framework for a theory of aesthetics; in particular, I will present new definitions of key concepts in aesthetics, such as 'art', 'artistic system', 'artistic movement', 'artwork', and so forth. (see Table 2.3, p. 104 for a summary and the most important concepts of my conceptual proposal with their respective definitions). Furthermore, in the second chapter, I will advance the view that, even though the neurosciences are an essential part of aesthetics, not every aesthetic problem requires a neuroscientific solution. In other words, there are aesthetic problems that cannot be answered satisfactorily by neuroscience using only its special concepts and terminology. Some questions may require additional sociological, physical and/or semiotic concepts and explanatory devices (e.g., physical and semiotic artefacts / artworks) (see Section 2.5, 2.6, 2.7, 2.8, Figures 2.38, 2.39 and 2.6).

The second part of this thesis, deals with the experimental aspects of a neuroscience of artistic appreciation. Firstly, I will argue that the conceptual foundations underlying much of the current approaches to neuroaesthetics are still problematic (Sections 3.2 and 3.2.1), and that the experimental approach cannot be applied in any straightforward manner to conduct neuroaesthetic research (Sections 3.2.1.1 and 3.2.1.2).

I will then review some of the most important results of experimental aesthetics and cognitive neurosciences with regard to the mechanisms of aesthetic appreciation (Sections 3.3 and 3.4, Figures 3.4 and 3.10) before proposing a new theoretical neurocognitive approach of artistic appreciation based on the notion of an artistic 'task-set' (Section 3.4, Figures 3.11 and 3.15).

Finally, I will end this second part with an theoretical postulate and a theoretical neurocognitive approach pertaining to the interactions between mental images and emotions and their possible role in the process of appreciating literary artworks (Sections 3.5, 3.5.3 and 3.5.4, Figure 3.4; For a general overview of the second part see Section 3.6).

In the third and final part of the work, I will discuss briefly the central ontological preconditions of the neurocognitive studies of art, namely, ‘mind - brain’ identity hypothesis, and compare it with other approaches of the mind-brain relationship (Figure 4.1). I also offer a hierarchical framework of mental functions based on both the anatomical and the functional aspects of the brain (Figures 4.1 and 4.2).

The questions about the conceptual and experimental fundamentals of aesthetics are complex and comprehensive, and I would not presume to say that this work provides an answer to all questions, and certainly not that it solves all problems. But I think the theoretical approach developed in this thesis is an original one and that it can serve as a starting point from which a scientific aesthetic can be built. It serves not only as a prolegomena for a promotion of the neurosciences in the humanities, but also for the application of science in the humanities more generally.

1.3 What is neuroaesthetics?

In the last decade, we have noticed a growing interest in the systems and mechanisms of cerebral artistic appreciation (i.e., neural underpinning of artistic/aesthetic appreciation) and aesthetics (e.g., beauty) (Carroll, Moore & Seeley; 2012; Cela-Conde, Agnati, Huston, Mora & Nadal, 2011; Chatterjee, 2010; Di Dio & Gallese, 2009; Zaidel, 2010).

Both in specialist publications and popular literary, the interest in the mechanisms of cerebral artistic appreciation, identified by Semir Zeki as ‘neuroaesthetics’, has greatly increased. However, this identification of aesthetics with its neural mechanisms is probably not only wrong, but it may also be counterproductive. This is because neuroaesthetics, as understood by Zeki, Ramachandran, and their supporters or colleagues, is a specific research project based on certain ontological and epistemological assumptions. In other words, neuroaesthetics is by no means to be understood as an overall project of the brain as the 'basis' of appreciation and artistic creation, but rather as a specific programme for exploring what art is and how it can be understood, and, as I will show, it may be a conceptually and empirically untenable programme.

Neuroaesthetics - understood as the (scientific) exploration of art - can be regarded as a radical attempt to reduce aesthetics and to replace it by the neurosciences. As has already been mentioned, in this approach "The project of neuroaesthetics could be considered as an attempt to identify a 'neural essence' of art, i.e., a set of necessary and sufficient conditions formulated in the language of neuroscience which define the concept art" (Frixione, 2011, p. 699).

This radical goal is based on a set of both ontological (e.g., what is art?) and epistemological (for example, how can art be studied?) assumptions. In addition, neuroaesthetics also postulates very specific hypotheses about the brain as the 'basis' of art. I will summarise such statements below and begin to analyse what art means for neuroaesthetics. In what follows I will deal with the position of neurosciences within aesthetics in more detail.

1.3.1 Conceptual postulates of neuroaesthetics

Apart from differences in detail, the neuroaesthetics project is based on the following set of assumptions (for a summary, see Table 1.1):

A) Defining the concept of 'art' implies postulating the conditions (properties) that are necessary and sufficient to turn an object into an artwork.

B) The necessary and sufficient condition for an object to be an artwork is the ability of the object to be defined by a function, which in turn is identified as the function of art. In other words, if x is an artwork, then the function f (x) is the one in which f is identified as the function which x, and every other artwork, must fulfil. Some of the specific functions identified as being traditionally associated with art are their ability to provoke an aesthetic experience (usually associated with beauty), to imitate reality (mimesis), to introduce ethical dilemmas, to 'purge' passions (catharsis), and so on. In the case of neuroaesthetics, the function varies according to authors, but in all cases the functions that have been postulated are associated with the ability of art to provoke a special kind of cerebral response, one that can be applied to all artworks, and that can be caused only by an artwork.

For example, for Changeux and others, artworks are defined by their ability to provoke aesthetic feelings associated with beauty (Changeux, 1994; Redies, 2007; Silva, 2009, 2012).

C) Through the postulates a and b we get a definition of ’art’, which reduces to the cerebral responses identified with the specific function of artworks.
D) Art is reduced to the systems and neural mechanisms involved in ‘cerebral reactions’ associated with specific functions of art, and thus the neurosciences are regarded as "the key to understand what art really is" (Ramachandran & Hirstein, 1999, p. 17).
E) Aesthetics - understood as the study of art - is nothing but a chapter within the neurosciences, that is, aesthetics is fully integrated into the neurosciences.
This set of assumptions are summarised in Table 1.1 below.

Table 1.1 Conceptual foundations of neuroaesthetics.

What is art?	How art is explored?	What is aesthetics?
By ‘art‘ is meant a) a series of artefacts (artworks) and b) the specific function which is carried out only by these artworks. In particular, the specific function of art is to provoke a special kind of cerebral (neural) response.	By illustrating that art can be reduced to specify such systems and neural mechanisms that underlie the cerebral responses associated with specific functions of art.	A branch of neurosciences.

As can be clearly seen, the project of neuroaesthetics is philosophically considered to be nothing more than neo-functionalism with a neuronal background (Davies, 2006).
At the same time, neuroaesthetics establishes a concrete research programme based on the following postulates (see Section 1.3.2).

1.3.2 Experimental requirements of neuroaesthetics

The experimental project of neuroaesthetics is based on the following set of preconditions:
F) Cerebral reactions identified by the specific function of the art are entirely determined by the objective properties (sensory/formal) of the nature of the work

(Redies, 2007). In other words, our artistic responses to an artwork are a function of the objective (physical) properties of the works.

G) The mechanisms associated with the artistic responses are essentially bottom-up mechanisms, that is they rely exclusively on the particular modalities of the respective cortical regions (e.g., visual cortical areas, auditory cortical areas, etc.) against the background of the objective (sensorial) characteristics of the works. In the terminology of neuroaesthetics, artworks are a special class of 'supernormal sensory stimuli': sensory because the associated responses depend solely on the objective properties of the stimulus, and 'supernormal' because of the objective properties of the works (usually stronger). 'Supernormal' reactions are triggered in the brain regions which are responsible for the processing of such sensory properties (see Tinbergen, 1953; Ramachandran, 2004).

H) The experimental research programme of neuroaesthetics, thus, limits itself by focusing on the following main issues:

• What objective (sensory) characteristics of the artworks are responsible for the creation of aesthetic (artistic) reactions?

• Which cerebral mechanisms are involved in these aesthetic (artistic) reactions?

In this first part of the work I will not go deeply into the project of experimental natural neuroaesthetics, this will be done only in the second part of the work. Although this experimental model is untenable in the light of empirical evidence, and although its conceptual underpinnings are problematic, the overall approach should not to be considered negatively, for two basic reasons.

Firstly, neuroaesthetics has served to revive the interest in the relationship between art and science in general, and the relationship between art and the brain in particular, not only among professionals, but also in the general public. This interest is illustrated by the growing number of publications on art and brain in magazines, newspapers and other mass media.

Secondly, research in neuroaesthetics has generated, and continues to generate, a number of interesting hypotheses that explain certain artistic effects in relation to known properties of cortical areas (Battaglia, Lisanby & Freedberg, 2011; Byatt, 2004; Conway & Livingstone, 2007; Miall, 2009, 2011; Ramachandran, 2004; Ramachandran & Hirstein, 1999; Zeki, 1999, 2002).

These postulates are exemplified by the research of Semir Zeki and Vilyanur S. Ramachandran (undoubtedly the main figure within neuroaesthetics), and also by David S. Miall, the principal representative of literary neuroaesthetics.

1.4 Three cases: the neuroaesthetics of Zeki, Ramachandran and Miall

Despite some differences in the details, the suggestions regarding the neural basis of art and artistic appreciation of these authors can be situated in the general conceptual framework of neuroaesthetics. Let us recapitulate the basic approach:
(a) The main postulate is that art should be characterised in terms of a particular function that an artwork performs;
(b) This function is defined in terms of cerebral responses;
(c) These cerebral responses manifest the (sensory) characteristics of the artworks as a kind of supernormal stimulus; and
(d) The research task is to illuminate the systems (i.e.,brain areas) and cerebral mechanisms involved in this artistic appreciation. (For a summary of the approaches of Zeki and Ramachadran, see Table 1.2).

For Zeki, “the function of art” is primarily cognitive, and, therefore, the purpose of art is to "represent the constant, lasting, essential and enduring features of objects, surfaces, faces, situations, and so on, and thus allow us to acquire knowledge" (Zeki, 1999, p. 9-10). For Ramachandran, the function of art primarily builds on emotional principles, which "involves deliberate hyperbole, exaggeration, even distortion [of reality-author’s note], in order to create pleasing effects in the brain" (Ramachandran, 2004, p. 171). This view of art is encapsulated in his statement, "all art is caricature" (Ramachandran & Hirstein, 1999, p.18).

The next step is to analyse what features (characteristics) of the artworks provoke, according to Zeki and Ramachandran, the perceptions that characterise them as functions of art.

In the case of Zeki, the focus is on determining the essential features of objects, surfaces, faces, and so on that define them as artworks. Unfortunately, Zeki does not offer an explicit definition of what an artwork is, nor does he provide a list of those qualities which are indispensable for an artwork. It is, however, possible to derive these properties by reference to Zeki's general neurocognitive fundamentals. One of the most consistent findings of cognitive neurosciences is that each brain area (e.g., vision, hearing, feeling, smell, etc.) is composed of many functionally and anatomically distinct subsystems. Each of these subsystems is specialised for the processing of one (or a few) perceptual attributes of stimuli. For example, the auditory cortex consists of different specialised subsystems involved in the processing of the various characteristics of the sounds such as tone colour, tone pitch, harmony, and so forth. This applies, similarly, to the somatosensory, gustative, and olfactory cortices from several specialised subsystems (Cabeza & Kingstone, 2006; Squire, 2009). In the case of vision, for example, we know that the visual cortex consists of no fewer than forty anatomically and functionally distinct subsystems (see Essen, 2004), and that each subsystem further focuses on specific visual attributes such as motion, shape, colour, position, texture, and so on. (Chalupa & Werner, 2004; Farah, 2004; Palmer, 1999; Zeki, 1999; see Table 1.2).

Regarding each piece of information received by a stimulus, each subsystem is specialised for the selection of a subset of this information for further processing. For example, the visual area V5 - an essential component of the system involved in processing the movement - is particularly sensitive to differences in brightness between the stimulus and the environment, and it uses such cues to extract the direction and velocity of the movement of the stimulus. The organisation of the visual cortex is illustrated in table 1.2, and the visual subsystems in figure 1.1 below.

Table 1.2 Extremely simplified representation of the functional organisation of the visual cortex. The presentation should be for illustrative purposes only.

V1	Spatial orientation, local edges
V2	Contours, figure-ground segregation
V3	Movement
V3a	Texture
V3b	Segmentation, grouping
V4	Colour
V5 (MT- Middle temporal area)	Movement
IT (Inferior Temporal Cortex)	Forms of complex structures

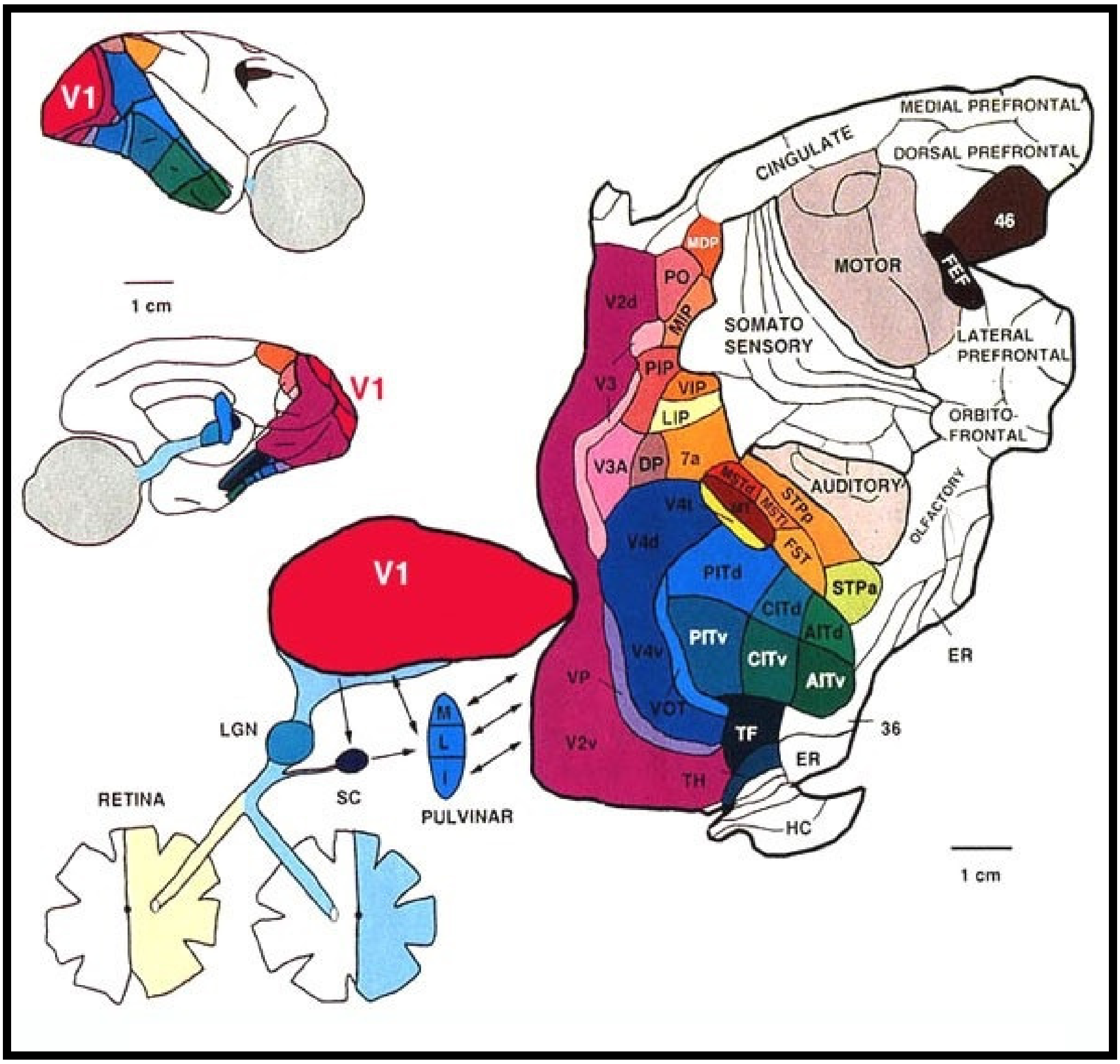

Figure 1.1 A map of functionally specialised subsystems of the visual cortex of macaques (Felleman & van Essen, 1991).

Consider how the perception of a visual image representing an artwork occurs in terms of such specialised neural systems and subsystems. The key properties of the image must be first be identified and highlighted, or 'maximised', for further processing, and b) then there must also be a limitation or 'inhibition' of any irrelevant stimuli that simply interfere with the activity of the specialised neural subsystem, so that the focus is only on the essential properties of the image. In the case of movement, for example, this means that the brightness contrast between the stimulus and the environment must be maximised and, at the same time, the presence of interfering properties, such as colour, must be limited. The V5 subsystem is indifferent to the colour of the stimulus that is processed in other subsystems of the visual cortex, and, therefore the colour ‘competes’ with brightness for the resources of attention, which also limits our ability to perceive differences between moving stimuli and their environment (see Britten, 2004; Zeki, 1999).

Let us return to Zeki and his neuroaesthetical approach, which implies that something is an artwork if it is so designed. For this the selection and highlighting of cues are needed to identify its essential attributes, and a limitation or inhibition of a number of irrelevant properties are also required. According to this method, therefore, the artist creates a work which is capable of representing the constant, essential and permanent properties of surfaces, faces, situations, and so forth, and, thus, enables us to acquire knowledge about the properties of the objects which the artist wants to highlight. For example, to reveal the true nature of the movement, according to Zeki, the mobiles of Calder are based on simple shapes and only a few colours (especially black and white, see Figure 1.2). In this way, Calder allows us to gain the experience of pure movement without the presence of distracting elements and, thus, also to gain knowledge about what movement means for the brain and how the brain processes it (Zeki, 1999).

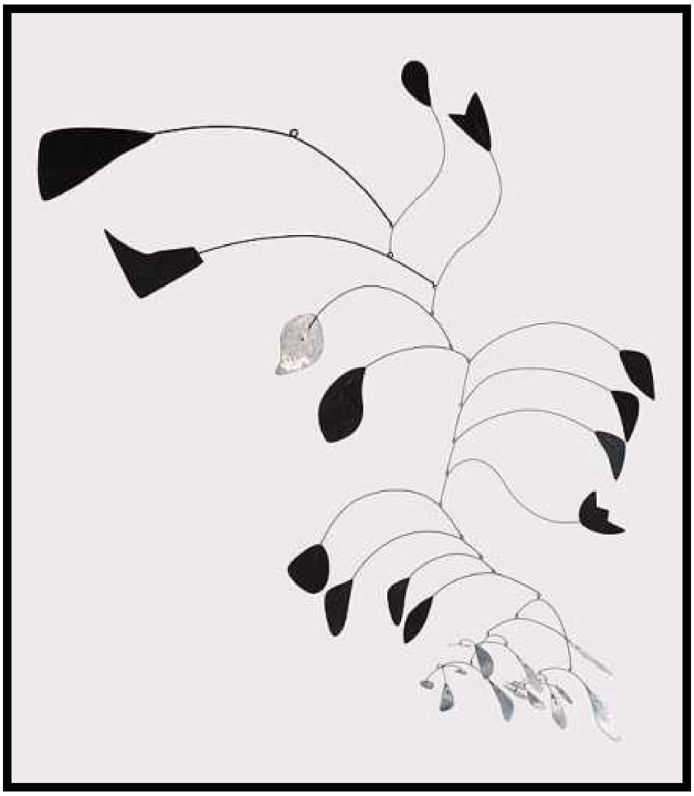

Figure 1.2 Alexander Calder, Mobile, 1941, ‘Arc of petals’, painted and unpainted sheet aluminium and iron wire, 240 x 220 x 90 cm (from: Lippman, J., 1976).

Ramachandran, however, claims that he has found at least ten universal formal attributes (or laws as he calls them), which, if applied to objects, would enable them to become artworks and will accordingly be capable of realising the functions and aims of art. These are:

- peak shift;
- isolation;
- grouping;
- contrast;
- perceptual problem solving;
- symmetry;
- metaphors;
- abhorrence of coincidence/generic viewpoint;
- balance; and
- repetition, rhythm and orderliness (Ramachandran, 2004, p. 173; Ramachandran & Hirstein, 1999).

According to Ramachandran's view, for an object to be considered to be an artwork, the embodiment of these 'laws' is indispensable. But how many must apply? Unfortunately, he does not provide any information regarding this issue.

If some differences in the perspectives of Zeki and Ramachandran are ignored, it is clear that both neuroscientists assume that art is defined by a cognitive or emotional function, and that what distinguishes an artwork from an everyday object is precisely the ability of art to provoke these emotional or cognitive reactions in recipients, abilities that are characterised by the obvious (physical) properties associated with this special class of objects (Table 1.3).

Table 1.3 Summary of neuroaesthetic approaches by Semir Zeki and Vilayanur Ramachandran.

	Ramachandran	**Zeki**
Function of art	"Hyperbolas and deliberate exaggerations, including distortions [of reality] to cause enjoyable effects in	" A representation of the permanent, essential and sustainable characteristics of objects, surfaces, faces,

	the brain".	situations, and so on to enable the acquisition of knowledge in this way".
Artwork	Any artefact that embodies some of the ten universal laws: 1) peak shift; 2) isolation; 3) grouping; 4) contrast; 5) perceptual problem solving; 6) symmetry; 7) metaphors; 8) abhorrence of coincidence / generic viewpoint); 9) balance; and 10) repetition, rhythm and orderliness.	Any artefact that maximises the availability of relevant keys for the effective further processing of one (or more) perceptual attributes.

At this point I would like to emphasise the two epistemological consequences of the approaches of Zeki and Ramachandran. Firstly, because both researchers define art exclusively in the context of neural responses, they thus attempt to reduce aesthetics to neuroaesthetics. The implication is that, in principle, the neurosciences could explain all matters relative to art simply by reference to those cerebral reactions that are specific to them. In other words, the answer to the question "what is art?" - and all that emerges from it – can be found in the grooves and folds of the brain. Secondly, with the observation that the brain responses evoked by the artworks depend solely on the obvious properties of objects, neuroaesthetics would not have recourse to any social science, such as history or sociology, and so on, to answer the problems related to art. Any problems of aesthetics would, thus, reduce the manifest features of artworks due to processing by the brain (see Redies, 2007 for a similar approach). It is essential to emphasise that these neuroaesthetic approaches have been meticulously studied and criticised by other neuroscientists, philosophers, art historians and art critics, (Casati & Pignocchi, 2007; Chatterjee, 2010, 2012; Croft, 2011; Gombrich, 2000, Hyman, 2010; Seeley, 2011). Undoubtedly the main criterion used for arguments against this trend in neuroaesthetics was not only that the definitions of the approaches of Zeki and Ramachandran are not satisfactory, but rather that the same ‘project of art’ is embodied in their approaches, and that art is essentially reduced to ‘privileged’ emotional or cognitive functions, and the manifest properties of objects that define these functions. Neuroaesthetics, as understood by Zeki, Ramachandran, and their supporters, would be nothing more than classical functionalism in new clothing, namely the neurosciences. It is easy to see that the proposed approaches of Zeki and Ramachandran give a very poor and unsatisfactory picture of what characterises art.

It does not require large amounts of imagination nor a profound knowledge of art history to recognise that there are hundreds of objects that are recognised as accepted artworks that do not lead to "pleasure in the brain" or represent “permanent, essential and sustainable" properties of objects, surfaces, faces, situations, and so on." It is also easy to find examples of objects that create pleasurable sensations, such as certain landscapes as well as other works that represent the ‘essential properties’ stipulated by these scientific theories, but which are not considered to be artworks (see Redies, 2015). In addition, consider the following examples:

A) The single-colour by Ad Reinhardt as abstract painting (Figure 1.3);

B) Conceptualistic experiments of Mel Ramsden as secret painting (Figure 1.4);

C) The hyper-realistic colour of Chuck Close, as Robert / 104, 072 (Figure 1.5); or

D) The works of Piero Mazoni as Merda d'Artista, with ninety cans (allegedly) filled with faeces of the artist (Figure1.6).

Many more examples can be cited, but the main idea should be clear. There is a huge number of artworks which cannot be subsumed under the definitions of Zeki and Ramachandran. Furthermore, it should be clear that there are not many artworks, in the period from conceptualism to art in the present day, that will be correctly classified as such by the definitions of art that the neuro-aesthetes propose.

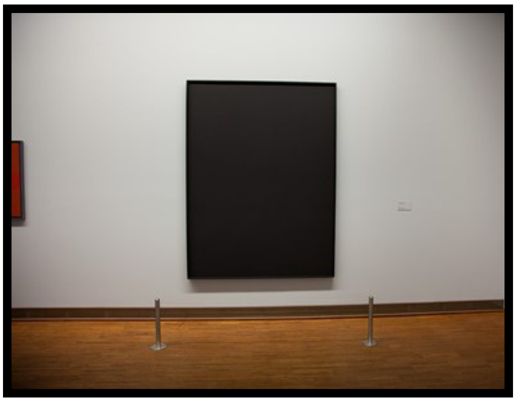

Figure 1.3 Ad Reinhard, 1962, 'Abstract Painting No. 5', oil on canvas, 152.4 x 152.4 cm (from: https://www.moma.org/collection/works/78976 and http://www.ajkesslerblog.com/art-is-just-a-story/).

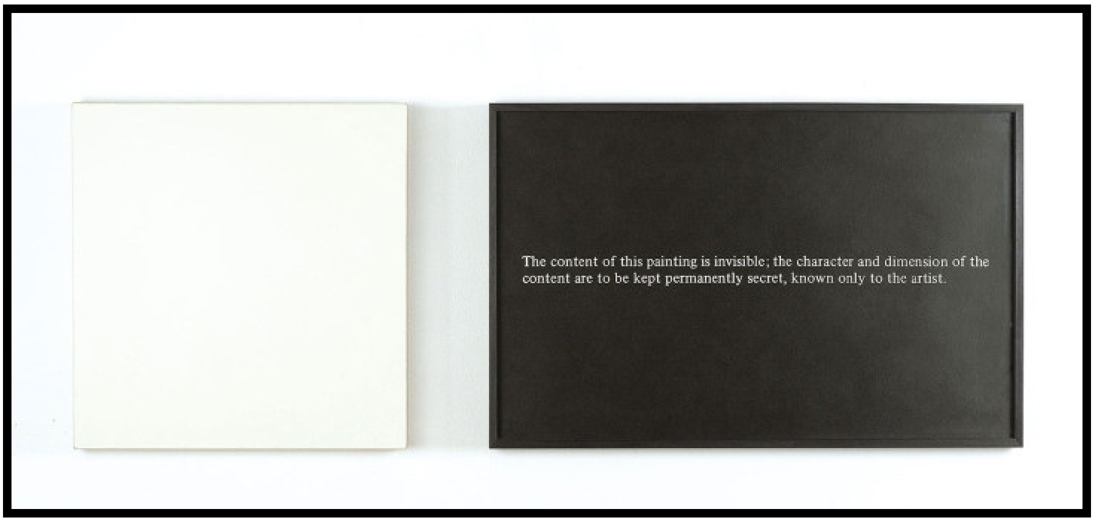

Figure 1.4 Mel Ramsden, 1967-68, 'Secret Painting (Ghost)', oil on canvas and photocopy (from: https://www.flashartonline.com/article/art-language/).

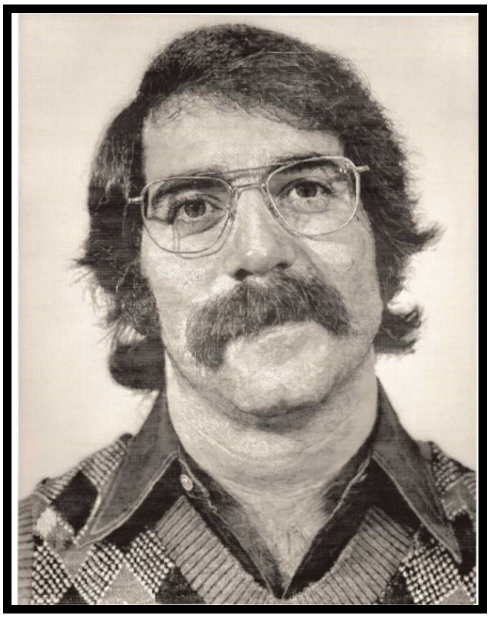

Figure 1.5 Chuck Close, 1973-1974, Robert/104,072, acrylic, ink, and pencilon gessoed canvas, 274.3 x 213.4 cm (from: http://chuckclose.com/work048.html).

Figure 1.6 Piero Mazoni, 1961, 'Merda d'Artista', Metal can with printed banderole, 4.8 x 6.5cm (from: http://www.tate.org.uk/art/artworks/manzoni-artists-shit-t07667).

Note also that none of the works 'excluded' by these definitions are marginal in the world of art, nor are the artworks of these artists inferior or unknown. On the contrary, they are some of the most representative artists and artworks of the twentieth century. In addition, all these works were produced in the sixties and seventies, almost thirty years before Zeki and Ramachandran published their work on neuroaesthetics. If I have restricted these examples to visual art, it is simply because both Zeki and Ramachandran asserted that their neuroaesthetic approaches apply to all the arts, but, in their articles and books, their theoretical models as well as examples are taken from the visual field of art. Obviously a stronger objection to the definitions proposed by these authors can be levelled based on the fact that it is not quite clear how the approaches of Zeki and Ramachandran should be applied to such works as those of Marina Abramovic (see, for example, https://www.youtube.com/watch?v=1sRSoGAc3H0 and https://www.youtube.com/watch?v=Z9YjXNjq3E4 , where both performances are from the seventies) or experimental music by John Cage (see, for example, https://www.youtube.com/watch?v=YO4YbACZKi4) to mention only two cases of acclaimed experimental artists who are recognised and celebrated by renowned critics. (For example, it should be noted that Marina Abramovich has a retrospective of her performances at the Museum of Modern Art (MoMA) - certainly a mecca of modern art). One can only guess what Zeki and Ramachandran would say about contemporary authors such as Ai Weiwei, Win Delvoye and Francis Alÿs (Figures 1.7, 1.8, and 1.9).

Figure 1.7 Ai Weiwei, 1995, 'Dropping a Han Dynasty Urn', series of photographs showing how the artist breaks a vase of the Chinese Han dynasty (from: Yap-Yap, 2014)

Figure 1.8 Delvoye, 'Art Farm'. He began to tattoo live pigs in 1997. After the death of the pigs, he extracted the skin and hung it as a canvas (from: https://theculturetrip.com/europe/belgium/articles/wim-delvoye-tattooing-pigs-or-the-art-of-provocation/).

Figure 1.9 Francis Alys,1997 'Paradox of Practice 1', artist in the streets of Mexico City pressing an ice block until it is completely melted (from: http://francisalys.com/sometimes-making-something-leads-to-nothing/).

However, the main problem underlying the approaches of Zeki and Ramachandran is not that just they would not be able to explain the artistic qualities of a variety of artworks, although this is admittedly a serious problem. Their main problem is deeper and lies in their attempt to define art in terms of a set of obvious features and specific emotional and cognitive responses linked to the cortical processes of the viewer (or reader) (see Chapter 2). One of the most cited philosophical critiques against the approaches of Zeki and Ramachandran is the method of identity of indiscernibles raised by the American philosopher Arthur C. Danto (Danto, 1964). The argument - in a few words - is that it is conceivable that there could be two or more objects that are perceptually indistinguishable (indiscernible) from one another, yet one of them may be considered to be an artwork whereas the other objects may not be judged to be artworks. Accordingly, the implication is that an artwork is not defined just by perceptible properties. Of course, the question can be raised whether there exist such almost indistinguishable objects, and the short answer is yes, there are many such items. A classic example of this given by Danto is the Brillo boxes used by Andy

Warhol which serve as copies of cartons of Brillo (cleaning cloths for glasses) (Figure 1.10).

Figure 1.10 Andy Warhol, 1964, 'Brillo Soap Pads Box', Silkscreen Ink and House Paint on Plywood, 43.2 x 43.2 x 35.6 cm (from: http://www.moderndesigninterior.com/2014/09/andy-warhols-pop-art-brillo-box-will.html).

One could name hundreds of other examples, of which only a small selection of unmistakably works of modern art are:

A) 'In advance of the Broken Arm: a snow shovel' (Marcel Duchamp, Figure 1.11);

B) Untitled 'A curse': a 27.94 cm sphere of space floating 27,94 cm above the top of a pedestal cursed by a witch (Tom Friedman, Figure 1.12);

C) ‘1000 Hours of Staring’, a simple sheet of paper, the artist watched for a thousand hours in five years (Tom Friedman, Figure 1.13).

Figure 1.11 Marcel Duchamp, 1964, ‘In advance of a broken arm’, Wood and galvanized-iron snow shovel, 132 cm high (from: https://www.moma.org/learn/moma_learning/marcel-duchamp-in-advance-of-the-broken-arm-august-1964-fourth-version-after-lost-original-of-november-1915).

Figure 1.12 Tom Friedman, 1992, Untitled, ‘A curse’, A 27,94cm sphere of space floating, 27,94cm above the top of a pedestal cursed by a witch 133.4 x 28 x 28 cm (from: http://www.saatchigallery.com/aipe/tom_friedman.htm).

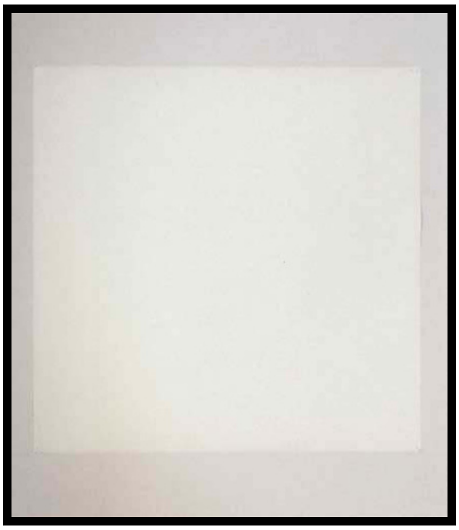

Figure 1.13 Tom Friedman, (1992-1997), ‘1000 Hours of Staring’ (from: http://the-purest-of-treats.blogspot.de/2009/02/1000-hours-of-staring-by-tom-friedman.html).

Note that all these works were created before Zeki and Ramachandran had written their neuroaesthetic essays, and they are works of acknowledged artists in modern and contemporary Western art. If Zeki and Ramachandran had taken more cognisance of classical debates in the philosophy of art, or had placed the focus of their scientific attention more on modern and contemporary art, they would have realised that their neuroaesthetic theory of art was simply a return to the long-discredited functionalism. While both Zeki and Ramachandran concentrated on aesthetic (artistic) responses to visual stimuli, they have also both asserted that, *mutatis mutandis*, the presuppositions of neuroaesthetics can be applied equally to nonvisual forms of art such as music and literature (Ramachandran, 2004; Zeki, 2002).

1.5 Miall´s literary neuroaesthetics

In the case of literature, David Miall is undoubtedly the leading exponent of the model of neuroaesthetics in relation to literary aesthetics. Following the proposed outline, we take a look at the main points of Miall's literary neuroaesthetics (Miall, 2001, 2008, 2009).

A) What makes a written text literature is its ability to provoke a special kind of emotional and cognitive response, which Miall calls the "defamiliarisation-reconcepualisation cycle" (Miall, 2009, p. 235; Figure 1.14). The idea is that literary texts contain passages that, through their stylistic qualities, give the reader a sense of surprise or alienation.

B) The reaction of surprise or alienation first evokes various emotional (unconscious) states in the readers, which, in turn, serve as an emotional context for a reconceptualisation or reinterpretation of what has been read so far. This response, the 'defamiliarisation-reconcepualisation cycle', is a function of the formal and stylistic resources of the text.

C) In this way, literary aesthetics is reduced to the discovery of the systems and cerebral mechanisms involved in the defamiliarisation-reconcepualisation cycle and the formal and stylistic stimuli that provoke them.

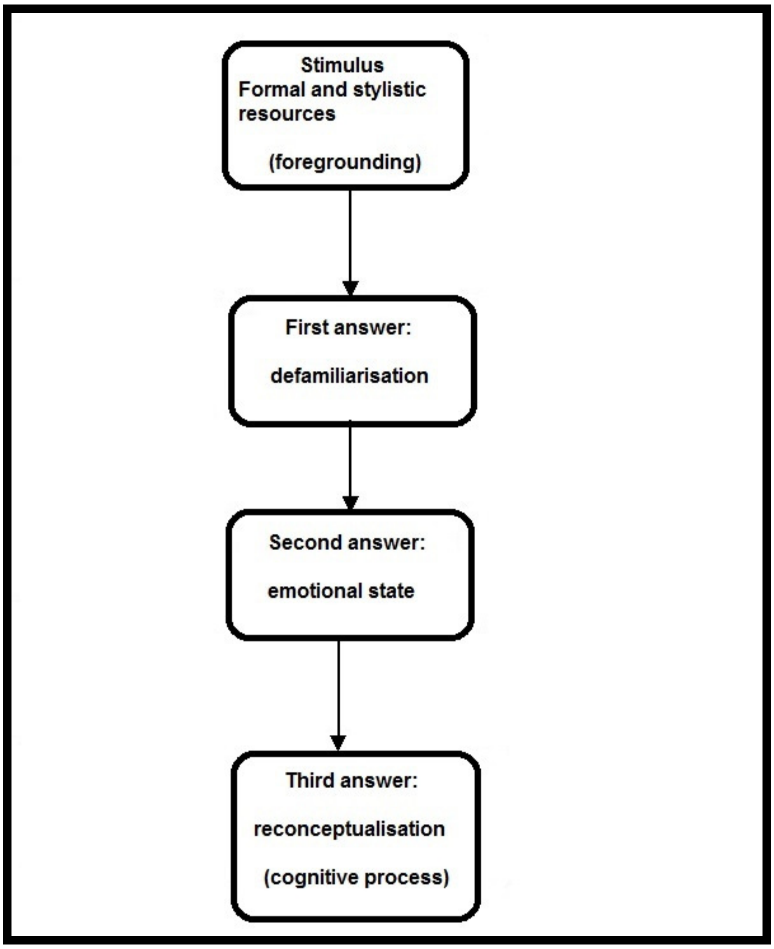

Figure 1.14 Literary reading process.

It should be obvious that Miall's approach is nothing more than a translation of ancient Russian formalism into a neuroaesthetical proposition. As such, it is not only exposed to the critique of neuroaesthetics but also to the criticisms and objections to which formalism is and was subject (Eagleton, 1996; Lamarque, 2007, 2010; Wellek & Warren, 1963).

To conclude this section, it should be noted that there is a small problem of ambiguity of the term 'aesthetics' in theories of neuroaesthetics. The ambiguity relates to the fact that aesthetics can generally be interpreted either as being a particular type of emotional reaction (associated with beauty) in relation to both natural and artificial objects, and as the study of such reactions, or as the 'science of art ' (Carroll, 1999). It is, thus, possible to identify another branch within the neurosciences, also called neuroaesthetics, but which has little to do with the programme of neuroaesthetics as understood by Zeki and Ramachandran and their supporters (Cela-Conde et al., 2011; Chatterjee, 2010, 2012; Nadal & Pearce, 2011; see Figure 1.16).

The second and also very influential branch of neuroaesthetics focuses in an objective manner on the study of the cerebral mechanisms and systems implicated in the appreciation of beauty, regardless of the stimulus type (Chatterjee, 2010; Jacobs, Renken & Cornelissen, 2012; Nadal et al., 2008; Nadal & Pearce, 2011, Redies, 2007; Munar et al., 2012; Skov & Vartanian, 2009). This branch is based on the hypothesis of the existence of a sense of beauty that is independent of the nature of stimuli (artworks, faces, bodies, objects, landscapes, etc.) and of the perceptual modalities (seeing, hearing, touching, etc.) (Moravcsik, 1980). In other words, the system and the cerebral mechanisms in our ability to appreciate objects as beautiful or aesthetic would be neutral with respect to the stimulus and perception mode. An influential model in this respect is the visual aesthetic model of Chatterjee, which would also be applicable to other modes of perception (Chatterjee, 2003, 2012).

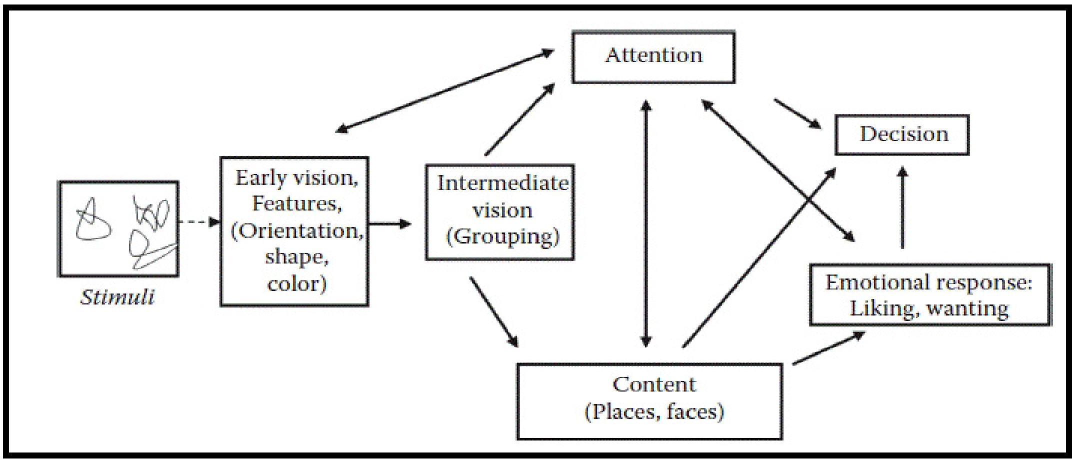

Figure 1.15 A general framework for the neural underpinnings of visual aesthetics guided by visual neuroscience (Chatterjee, 2003, p.55).

According to this model, the aesthetic experience results from an interaction between the emotional and attentional processing systems and the visual and decision-making systems. What makes a visual stimulus aesthetically attractive is a combination of a) the ability to create attention-related stimuli and thus directing the visual systems to certain properties of the stimulus, and b) the ability to elicit strong emotional responses. On this account, the emotional and the attentive responses are judged by the decision-making systems that evaluate the attractiveness of the stimulus, a) based on the perception of the features of the visual images, and b) the emotional responses evoked by the stimulus. Camilo Cela-Conde, Marcos Nadal and colleagues have identified the cerebral regions and the cerebral systems involved in each of the processing stages of the proposed model (Cela-Conde et al., 2004, 2009, 2011; Munar et al, 2012; Nadal, et al., 2008; Nadal, Capo, Munar, Marty & Cela-Conde, 2009).

It is conceivable that the cerebral processes such as the perception and appreciation of beauty involved in aesthetic appreciation are the same, regardless of the nature of the stimulus, but this would have epistemological and methodological implications that are anything but trivial. In particular, an important methodological consequence of this perspective is the implication that the specific type of experimental stimuli used is unimportant in the study of the mechanisms of aesthetic appreciation. A *reduction ad absurdum* of this position is that in the same experiment, different artworks, photographs, everyday objects, abstract patterns, and so forth can be used without any real additional effect resulting from the type of 'artistic' object (e.g., Cela Conde et al, 2013).

I will not concentrate any further here on this perspective because my main objective is to propose a conceptual framework for the study of neurosciences in art and to show that the cerebral mechanisms of beauty are important, but that they are not decisive for a general framework of aesthetics (in the sense of fine art studies). In other words, the art-beauty relationship is just one of many relationships between emotional and cognitive art functions that need to be summarised in a general framework (see Chapter 2 for discussions on the art-beauty connection and see Brown & Dissanayake, 2009; Hopkins, 2000; Ishizu & Zeki, 2011; Kawabata & Zeki, 2004; Moravcsik, 1980; Smith, 2009).

For these reasons, and in consideration of the above, it is proposed to dispense with the term neuroaesthetics as a name for the neurocognitive study of art. Instead, I propose to use the more neutral but less attractive expression *the cognitive and emotional neuroscience of appreciation and artistic creation.*

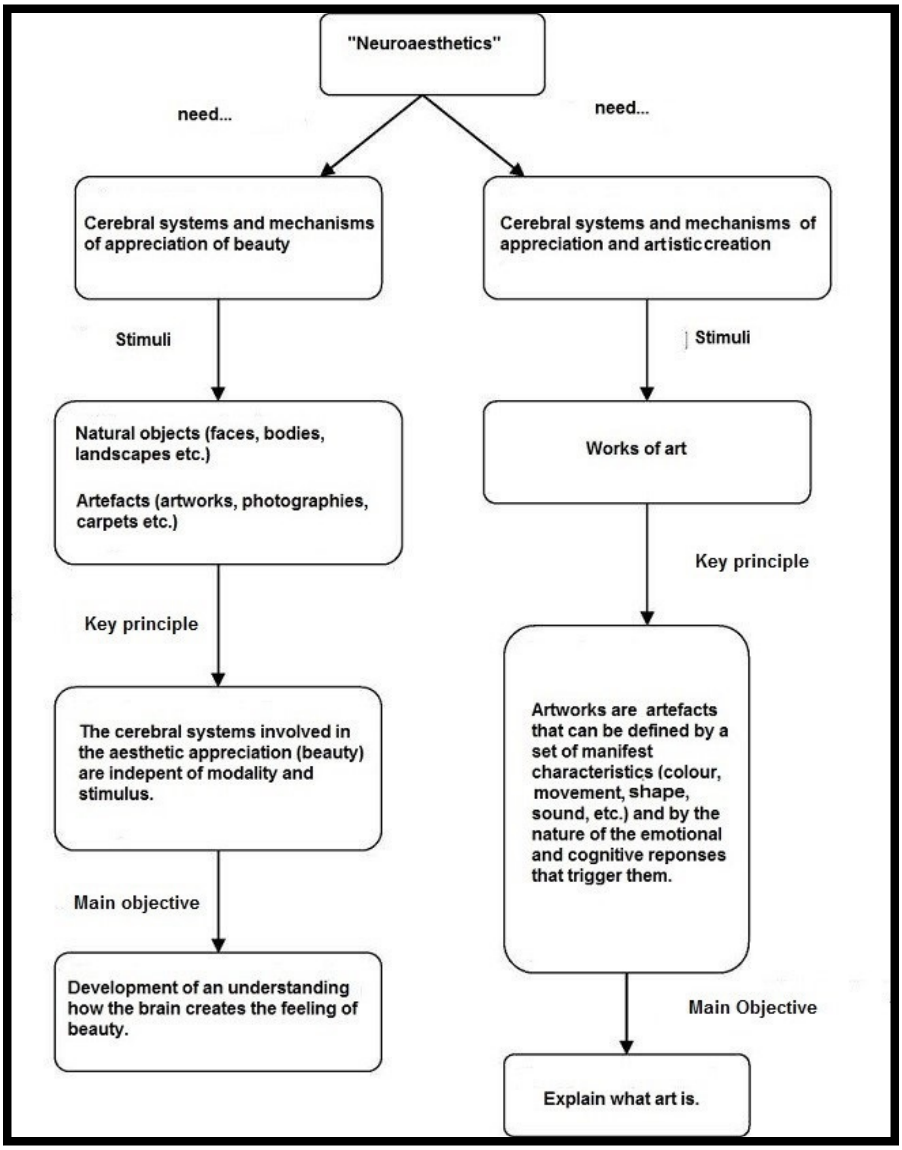

Figure 1.16 The both branches of neuroaesthetics.

1.6 Towards a new neuroscience of artistic appreciation

There are several discussed inconsistencies of the theories of Zeki, Ramachandran and neuroaesthetics in general which reveal the inability of studying art with the tools of neurosciences (see Tallis, 2008). However, a little more distant from the focus points of the mass media and, as it were, their sensationalism, a second branch of neuroscientists has been interested in the study of systems and mechanisms of appreciation and artistic creation since the middle of the last century. This new trend is less interested in conceptual questions such as 'what art is', or 'what properties define an object as an artwork' and focuses rather on the study of the systems and mechanisms of the brain in terms of the appreciation of art and the objects involved, as socially accepted artworks (e.g., Vartanian & Goel, 2004; Seeley, 2012). While this attitude has fostered the creation of interesting results (see Chapter 2), it has also encouraged the development of comprehensive conceptual frameworks that facilitate a) the integration of the various empirical results, b) the interpretation of the various empirical results, and c) the generation of new research questions and hypotheses.

However, it should be noted that this is not a particularly idiosyncratic and hopeless situation. Often the price that must be paid for exploring new experimental fields is that of conceptual vagueness at the early stages of exploration**,** and one of the main tasks of philosophers is to examine the foundations of theoretical fields to determine whether these are really sound. Certainly, one of the most important contributions of this philosophical exploration in the domain of art is to provide a proper conceptual framework for new scientific areas such as the neuroscientific study of art.

An important conceptual weakness of this second brand of neuroaesthetics is that an explicit definition of technology is still lacking. However, neuroaesthetics should not be condemned too quickly for this omission, because one could point out that a) the philosophers have failed to reach a kind of consensus after more than two thousand years of reflection on what art is, and b), in an emerging discipline such as neuroaesthetics, scientists are often reluctant to define and fix terminology too quickly.

In fact, the latter approach can be regarded as a 'healthy' attitude in an emerging discipline, because one does not want to cling too quickly to a definition when little is still known about the subject. A recent example is the investigation of so-called complex systems in which, despite this now being a very active scientific field, there seems to be no strong consensus about what a complex system actually is (see e.g., Bak, 1996; Ladyman, Lambert & Wiesner, 2013; Mitchell, 2009).

Nevertheless, I would like to submit that more conceptual clarity can be given to neuroaesthetics as a research domain if at least some of the basic terminologies are fixed and standardised, especially if one considers that a lack of consensus about the definitions of terms and concepts in this field could easily hamper progress. Consider, for example, the rather negative consequences of the very narrow and limiting definition of art suggested by Ramachandran and other neuro-aesthetes, who, as discussed above, have contended that the only function of art is to create pleasure or represent beautiful objects. Hence, in the next section, I will try to show that defining and illuminating what constitutes ‘original art’ may provide a new conceptual framework for aesthetic research, and one that is not just limited to the neuroscientific approach,but may have useful applications in art more generally.

1.7 Preview of subsequent chapters

The aim of the second chapter will be to propose a new conceptual framework for a theory of aesthetics. In particular, the presentation of new definitions of key concepts in aesthetics. Furthermore, the second chapter advances the view that not every aesthetic problem requires a neuroscientific solution in spite of the fact that the neurosciences may now constitute an essential part of research into aesthetics. There are aesthetic problems that cannot be answered satisfactorily by neuroscience using only its special concepts and terminology. Some questions may require additional sociological, physical and/or semiotic concepts and explanatory devices

The third chapter deals with the experimental aspects of a neuroscience of artistic appreciation. Some arguments will be provided regarding the still problematic conceptual foundations underlying a lot of the current approaches to neuroaesthetics and it will be argued that the experimental approach cannot be applied in any straightforward manner to conduct neuroaesthetic research.

In addition, a review of some of the most important results of experimental aesthetics and cognitive neurosciences with regard to the mechanisms of aesthetic appreciation will be provided before proposing a new theoretical neurocognitive approach of artistic appreciation based on the notion of an artistic 'task-set'.

The third chapter will lead to a theoretical postulate and a theoretical neurocognitive approach pertaining to the interactions between mental images and emotions and their possible roles in the process of appreciating literary artworks.

In the fourth chapter a short discussion with regard to the central ontological preconditions of the neurocognitive studies of art will be presented and the ‘mind - brain’ identity hypothesis will be dealt with. This hypothesis will be compared with other approaches concerning the mind-brain relationship, and a hierarchical framework of mental functions based on both the anatomical and the functional aspects of the brain will be offered as a theoretical compromise. The fifth and final chapter summarises the study briefly, highlights its main contributions, and teases out some implications of the research presented in this thesis. The chapter also indicates limitations of the current research and suggests topics that other researchers can pursue in future research.

CHAPTER 2:

A NEW CONCEPTUAL FAMEWORK FOR AESTHETICS

2.1 Introduction: The long way to a definition of art

Perhaps one of the most interesting facts of the philosophy of art is the inability of its scholars to reach a consensus about the definition of art after more than 2,000 years of research. Since Plato, philosophers have been striving to offer a satisfactory definition of art, but for each proposed definition, there are several counter-examples that show why the definition fails. The most influential contemporary proposals of the philosophy of art can be roughly divided into two groups. One group—often referred to as the North American analytic tradition—asserts that a satisfactory definition of art is possible and members of this group do not spare any effort in trying to develop such a definition. The important members of this group are George Dickie (1974, 2004), Peter Lamarque (2007), Arthur C Danto (1964, 2013), James Anderson (2000), Marcia M Eaton (2000, 2004), Noël Carroll (2011), and Robert Stecker (2010), to mention the most important ones.

The second group, which can be attributed primarily to the influence of the philosophy of Wittgenstein and the French poststructuralist tradition, assumes that it is impossible to define art, at least not within the conditions of the analytic tradition. However, this scepticism comes in two variants: a) a radical branch asserts that what we designate as art varies clearly in terms of culture and time; the mere belief in the existence of a single entity ‘art’ is, in the best case, an illusion (Eagleton, 1996), (b) a recent moderate branch postulates that art should be defined in terms of the necessary and sufficient conditions shared by all the elements that we call ‘art’. The important members of this moderate branch are Morris Weitz (1956) and Berys Gaut (2000) (for a critical review of contemporary art definitions, see Carroll, 1999, 2000, Dickie, 1974, Kivy, 2003, Stecker, 2010).

Despite the many difficulties, I would contend that it is possible to provide an acceptable definition of art. Moreover, I believe that the failures of the past are somewhat illusory because, despite the issues raised, it can be argued that the task of defining art (see above) and aesthetics has not been properly tackled in the philosophical literature. I will show that the ‘definitions of art’ offered from the outset of art were partly problematic, and that the failures in providing a satisfactory definition of art stems from problematic conceptions of what art is, and that these issues have prevailed since Plato's days.

2.2 What do we mean when we talk about art?

As mentioned above, one of the most striking features of the philosophy of art is that it has not yet provided a satisfactory definition of art. But how is it possible that after almost 2,000 years, there is still no consensus about 'what art is'? Although there are certainly many reasons for this failure to arrive at a satisfactory definition of art, I would nevertheless like to highlight a few that I think are the most important.

The first reason I would like to propose is that one of the answers to the question of 'what is art?' was founded on a misunderstanding. At least from the emphasis of Plato and Aristotle on the 'mimesis' and the emotional effects of music and poetry on viewers (e.g., catharsis) as the essential components in the definition or the characterisation of art, the discussions about 'what is art' have inadvertently assumed the following identity: *art=artwork*. That is, what commonly account for 'theories of art' or 'definitions of art' are, in reality, theories or definitions of 'artwork'. The implication of such an identity is to discover the properties all the artworks share. This immediately solves the problem of knowing what art is (Davies & Stecker, 2009; Stecker, 2000; Stock, 2009). The most important trends of the philosophy of art, namely formalism, structuralism, functionalism, pragmatism, contextualism, objectivity, aestheticism, expressionism, historicism, and institutionalism, all attempted to demonstrate the presence of a property or a set of properties collectively and exclusively encompassing all artworks. Consequently, the implication is that to explain what art is, it is only necessary to identify the necessary properties that these, and only these, works have in common, and that this will enable us to distinguish them from another non-artistic object. Robert Stecker's review of the theories of contemporary art notes explicitly that:

> *The question 'What is art?' is commonly asked when attempting to find conditions, necessary or sufficient, that make an item an artwork. That is, the goal is normally to find a principle for classifying all artworks together while distinguishing them from all nonartworks (Stecker, 2010, p. 95; see also Stecker, 2000).*

In a similar way, while offering a definition of art, Noël Carroll emphasised that:

> *A range of related topics are gathered together under the title 'The Definition of Art'. These include: (1) metaphysical questions, such as 'Is there a set of necessary properties whose possession is conjointly sufficient for a candidate to qualify as an artwork' and, if so, 'What are they?' And (2) the epistemological issue of how we go about establishing that a candidate is an artwork (Carroll, 2010, p. 42).*

The sceptics' claim that the concept of art cannot be defined actually oppose the possibility of defining the concept of 'artwork' in terms of necessary and sufficient conditions. In particular, two of the most influential anti-defining proposals—the 'Neo-Wittgensteinian' approach of Weitz (1956) and Gaut's (2000) 'Cluster Account of Art' (for a description see below)—are not about the impossibility of defining the concept of 'art' in terms of necessary and sufficient conditions, but on the impossibility of defining the concept of 'artwork' in terms of such conditions (see Frixione, 2011, p.700-701).

According to Weitz, a true (veritable) definition of art should consist of a set of properties. This is a necessary and sufficient condition for an object to be regarded as a legitimate member of the concept of art.

However, according to Weitz, if such a set of properties—common to all the artworks and only to them—does not exist, the concept of art is indefinable. Moreover, since it is in the nature of art to be in constant change, the mere pursuit of such properties is absurd (Weitz, 1956). As interesting as the arguments seem to us, it is clear that what Weitz had in mind is the conceptualisation of artworks. In this context, Weitz (1956) postulated that:

> *The primary task of aesthetics is not to seek a theory but to elucidate the concept of art. Specifically, it is to describe the conditions under which we employ the concept correctly. Definition, reconstruction, patterns of analysis are out of place here since they distort and add nothing to our understanding of art. What, then, is the logic of 'X is a work of art'?" (p. 33).*

Similarly, Gaut, also influenced by Wittgenstein, suggested the ‘cluster concept’ as a concept of art. This means a concept is defined by a set of *n* properties (‘criteria’), with the peculiarity that none of these properties are individually necessary or sufficient to determine whether an object belongs to the class of objects defined by the concept. It is clear that this approach is similar to a prototype theory of art (see Lakoff, 1986; Martindale & Moore, 1988; Prince, 2002). Thus, to put it in Gaut’s words, the properties defined by the cluster concept are “disjunctively necessary” (Gaut, 2000, p. 27). In other words, for an object to belong to the object class defined by the cluster concept, it is sufficient for it to have some of the properties listed by the concept. In addition, an object belonging to the class of objects defined by the concept can be distinguished in a subset of properties from other objects that also belong to the same class of objects defined by the cluster concept.

In the case of the cluster concept, Gaut introduced a long list of properties that are supposed to define the concept of art. Some of these properties are: (a) possessing aesthetic properties, (b) expressing an emotion, (c) being intellectually challenging, (d) being an artefact, and so on (Gaut, 2000). Although only a few examples are given here for all the properties listed by Gaut, it is clear that Gaut was concerned about the necessary characteristics pertaining to how an object should be considered as an artwork:

> *And suppose it can be shown that if various subsets of them obtain, then an object is art, that none of these properties has to be possessed by all artworks, but that all artworks must possess some of them. Then we cannot define ‘art’ in the sense of giving individually necessary and jointly sufficient conditions for it, but we can offer a characterization of it - an account of what it is in terms of criteria or characteristics (Gaut, 2000, p. 27).*

This does not mean that Gaut, Weitz, or the others were wrong (though I will try to argue that they were). I am only interested in demonstrating at this point that they were discussing not whether the concept of ‘art’ was definable or not, but rather whether the concept of ‘artwork’ can be defined, unless of course if one assumes that the concepts of art and artwork are one and the same (see Carroll, 2011, for further criticism of the approaches of Weitz and Gaut).

The identity of ‘art’ with ‘artwork’ is so strong within the philosophy of art that even Stecker explained that if the identity was proved, it would be false: “devastating for the project of defining art because the point of that project has long been to articulate the conditions under which we classify items as art” (Stecker, 2000, p. 56).

It is interesting to consider that ‘art’ and ‘artwork’ as synonymous concepts represent not only the craziness of academic practices but can be heard in daily conversation as well. It is common for people, especially when they see some modern or contemporary works of art, to ask (or to ask themselves) whether what they see or read or hear is effectively ‘art’. Books, articles, and news about contemporary art are full of anecdotes in which a visitor at a museum or contemporary art gallery did not know whether what s/he had in front was ‘art’ or a pile of waste materials of some kind that had not yet been removed. It can become very sensitive for the ‘poor’ visitors at a museum or gallery of contemporary art if indeed one were to ask him/her whether ‘something’ was an ‘artwork’ or not. Although defining an ‘artwork’ is undoubtedly a task riddled with obstacles (a problem that I will discuss below), the concept of ‘artwork’ should be distinguished from that of ‘art’. One of the main reasons why there is still no agreement among experts with regard to the question of ‘what art is’ can be seen in the fact that the definitions of the art of the past and the present are, for the most part, really ‘definitions of artwork’.

Unfortunately, this is not the only obstacle. Another factor that prevents a better understanding of art, and that is related to the earlier approaches, is that many of the contemporary art theories are concerned with the psychological processes involved in the classification and recognition of an object instead of defining an artwork. The idea is that from a theory of art, one should be able to expect an answer to the question of ‘what art is’ based on the perceiver.

Stecker suggested clearly (and incorrectly) about contemporary theories of art, “the main thing we have to go on in defining art is our classificatory practise [art vs. non-art- author’s note] […] [a definition of art should be-author’s note] a ‘rational reconstruction’ of our classificatory practise” (Stecker, 2000, p. 60).

In the case of concepts relating to material entities, the relevant definitions must be specified in the sciences involved in the research of such entities. Definitions are objects of semantics and logic, whereas discovering the mental structures (brain systems) for the classification and recognition of objects as artworks constitutes an empirical problem that must be solved by psychologists and neuroscientists and not by philosophy.

In short, the problem of empirically exploring how the brain differentiates and recognises objects as artworks is independent of the conceptual definition of art.

One of the most obvious—and most pernicious—influences of Wittgenstein in the analytical philosophy of art is the assumption that a true definition of art must account for the everyday (non-specialised) uses of the word ‘art’. I have serious doubts that this should be a desideratum of a definition of art. Just imagine what it would be like to define concepts like ‘force’, ‘attraction’, ‘field’, ‘energy’, and so on, if one should not only clarify the technical significance of such concepts in physics, but also the meaning we would assign to these words in everyday language. Do we consider the misuse of information theory only because it ignores the technical meaning of the word ‘information’ and confuses it with the ordinary meaning of the word, which is more or less synonymous with ‘recognition’ (Pearce, 1980)? Therefore, I think that if the philosophy of art wants to be of benefit to the extension of a scientific aesthetic, one of its tasks would be to clarify the significance of the most relevant key concepts in aesthetics, such as ‘art’/‘artwork’, ‘artistic movement’, ‘aesthetic’/‘artistic function’, and so on—not how they are used informally, but how they are used in expert discourse. In the case of art, since scientific research is very new and largely unsystematic in art, it is another important task of philosophy to provide a theoretical framework for the extension of scientific aesthetics. As Gaut postulated, the only way to refute the sceptics is to juxtapose the definitions of art and object in pairs in a critical examination (Gaut, 2000). Consequently, I believe that in the sections that will introduce a definition of art, this work will be immune to both the arguments of the neo-Wittgensteinian and postmodernist theorists.

2.3 Definition of art

Here, I begin with the difficult task of clarifying what I understand by ‘art’. In view of the number of concepts that will be used and defined, it may be appropriate for the reader to look at table 2.3 (p. 104).

A difficulty in the definition of art is that the term 'art' is also used in expert publications to designate two concepts, which, though closely related, are different. These concepts are:

'Art' =$_{def}$ The set of all artistic systems.

'*Artistic complex'=$_{def}$ The system comprises two or more artistic systems in the society or societies at time 't'*.

As we can see in the first case, the concept of 'art' denotes a set, and, therefore, a conceptual object (immaterial) and not a material or real ('physical') entity.

What is real (material/objects) are the elements that build a set, the knowledge, and the artistic systems. Perhaps an analogy will be useful to us. Let us consider the concept of the 'mind' as it is managed in neuroscience literature (Chapter 3 will pay special attention to this point). For example, we read in the fifth edition of the monumental works 'Principles of Neural Science' of Kandel, Schwartz, Jessul, Siegelbaum, and Hudspeth (2013): "What we commonly call the mind is a set[1] of operations carried out by the brain" .

This means that the concept of the 'mind' denotes a set, an immaterial object, and not a physical or real unit. The mind is precisely performed by the operations of the brain. More specifically, the term 'mind' refers to the set of all mental functions, which, in turn, are defined with respect to cerebral mechanisms and systems. Consequently, the real and concrete are the cerebral mechanisms and systems from which the mental functions emerge, and consequently, the mind does not have any physical existence (see Table 2.1). Considering the aforementioned, there cannot be any conflict to the embodiment approach with regard to the postulate that the mind/brain should be viewed as a system intrinsically in the world and in a body, not as just a 'brain in a vat' (Cosmelli & Thomson, 2011; Thomson, 2007; Varela, Thompson & Rosch, 1991).

[1] My emphasis

Table 2.1 Relations between the definitions of 'art' and 'artistic complex', and the concepts of 'mind' and 'mental function'.

Concept	**Definition**	**Extension**
Mind	The set of mental functions	A conceptual object (set)
Mental function	A special class of cerebral function[2]	A material object (cerebral processes and systems)
Art	The set of all artistic systems	A conceptual object (set)
Artistic complex	The system composed of two or more artistic systems in society 's' at time 't'	A material object (social systems)

It is important to notice that the concepts of both 'art' and 'mind' designate a set, but this does not imply that both concepts describe the sets arbitrarily. On the contrary, in the case of the concept of the 'mind', *x* belongs to the mind- 'set' if and only if *(sys) x* is a brain system capable of performing mental functions—namely, only the cerebral systems of a special class are legitimate members of the mind-'set' (Damasio, 2010; Kandel et al., 2013; Squire et al., 2008; see Chapter 4). The same is true for the set of art: *x* belongs to the 'set' of art *sys if and only if (sys)x* is a legitimate member of the class of artistic 'mental' systems. In other words, all artistic systems and only these systems are legitimate members of the set of art.

For a better understanding, we can state that the concept of 'art' denotes a set that allows us to perform some operations with that set. In particular, we can form subsets that allow us to define other concepts that depend on the concept of 'art'. Thus, for example, we can define the following concepts:

'Literature' $=_{def}$ The subset (of a set of art) composed of all artistic literary systems, or what amounts to the same:

The subset (of a set of art) composed of the artistic systems dedicated to the creation, judgement, distribution, and exhibition of works of literary art.

'Music' $=_{def}$ the subsystem (of a set of art) composed of all artistic musical systems;

[2] This is clearly not a strict definition of mental function (see Chapter 3)

'*Painting' =$_{def}$ the subsystem (of a set of art) composed of all the artistic pictorial systems; and so on.*

Within the second concept the word 'art' refers to what I will call an 'artistic complex'. This concept denotes a (real) material entity—namely, the system consists of two or more art systems in society 'x' at time 't'.

This concept underlies expressions like 'contemporary art' or 'modern art'. In the case of 'modern art', for example, this expression does not apply to any individual artistic system, but to the ones that evolved and strengthened in the first half of the 20^{th} century. Among these are Cubism, Fauvism, Futurism, Post-Impressionism, Art Deco, De Stijl, and so on. The idea behind the concept of an artistic complex (in this case, 'modern art') is that artistic systems in a given society are related to each other in some way or the other, which gives rise to the development of a (supra) system (see Figure 2.1).

Unlike the concept of 'art', which denotes all artistic systems (regardless of place, date, relationships between systems, etc.), the material system which the concept of 'artistic complex' refers to is composed of artistic systems that relate to one another in a certain society at a given time, and as such, is susceptible to be studied experimentally (e.g., sociologically). In addition, unlike the set of art, every artistic complex changes in time (since it is a material object). Therefore, it is possible to study its history—emergence, consolidation, mutation, extinction, and so on. Paraphrasing Gombrich (1995), we can say that art does not exist; there are only artistic complexes and systems.

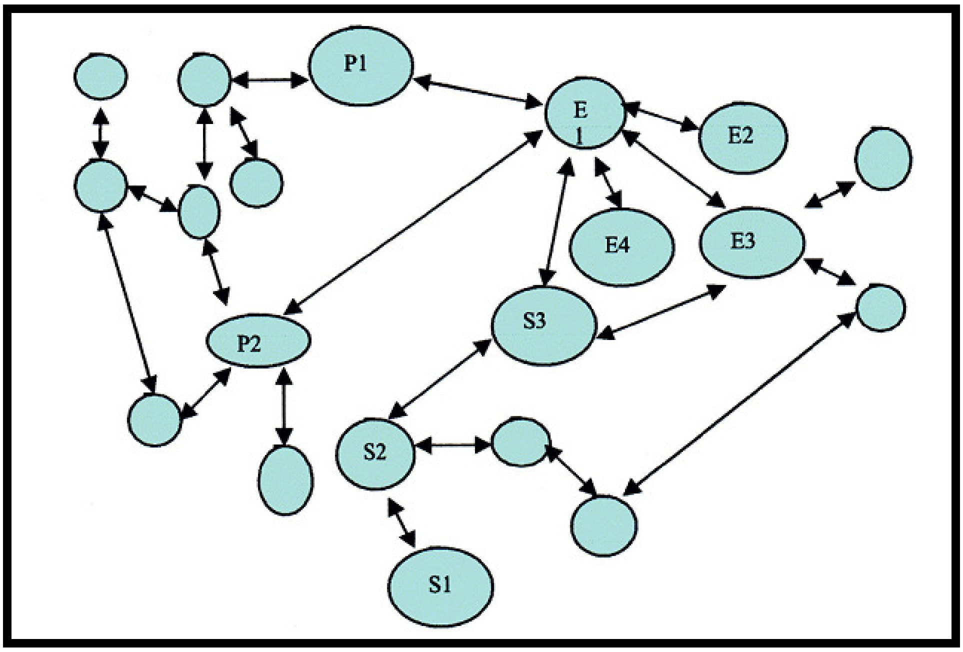

Figure 2.1 Artistic complex/artistic system relationship.

In the figure 2.1 above, each blue circle represents an artistic system, and each double arrow represents the interaction between two artistic systems. An artistic complex is the system composed of two or more related artistic systems. Note that the relative importance of an artistic system could be defined as the number of artistic systems with which it is related. Thus, for example, while the artistic system S1 is only related to S2, so that its relative value would be only one point, the artistic system E1 is related to E2, E3, E4, P1, P2, and S3, so that it would have a relative value of six points.

It can be stated that because of the definitions of 'art' and 'artistic complex' in my approach, the concept of the artistic system plays a key role. In the following sections, I will explain what artistic systems mean and why I think they are of central importance in the development of a scientific aesthetic.

2.4 Defining artistic systems

Artistic systems are the members of a set of art and the material components of the artistic complexes, but it is not an easy task to define or characterise artistic systems. This is mainly because these are extremely complex systems composed of a large number of components ('parts') of a different nature (social, biological, artificial, etc.), which establish multiple and dynamic relationships between them. Consider therefore the following definition:

More specifically, artistic systems are social (cultural[3]) systems made up of social institutions and biological (human) organisms, interrelated by a system of conventions, and whose main objective (or function) is to create, judge, distribute, and exhibit (or perform) a particular kind of artefact, namely artwork.

However, this definition is still incomplete because it does not specify the institutions that make up an art system, nor the features that define certain artefacts as artworks, and the mechanisms that are particularly suitable for the creation, judgement, distribution, and exhibition (or performance) of these artworks, and so on (see Table 2.2).

Table 2.2 Artistic Systems.

Components	**Structure**	**Objectives (function)**	**Mechanisms**
Societies Institutions Worlds of Art (artists and experts) Artefacts (works of art).	Since it is an object, compound and complex in terms of social, biological, and artificial elements (institutions and artworks). The structure of an artistic system is the result of social relationships (economic, political, and cultural) and semiotics.	The creation, judgement, distribution, and exhibition (or execution) of artworks.	Refers to the processes of the objectives of a system that ultimately become an artistic one. However, the most studied of these mechanisms, but in no way the only one, is the creation, dissemination, and acceptance (or rejection) of the conventions between the members of an art world.

Since artistic systems are complex systems consisting of several parts (e.g., institutions, artists, artefacts, etc.), manifesting different types of relationships (social, economic, cultural, semiotic, conventional, etc.), and because they require the collaboration of several mechanisms to achieve their goals, I think it makes sense to define the concept of the artistic system as an n-tuple. An n-tuple is a collection or a

[3] Cultural system because its objective is the creation, judgement, distribution, and exhibition of cultural objects (artworks).

list of elements, but with the special feature that this list should be treated as a unit (or as a whole). As such, conceptual tools are very useful when defining complex entities that are composed of many parts but behave as a whole. Without further ado, I will define the concept of the artistic system through the following 9-tuple:

φ = <S, A, E, F, T, M, H, O, W>,

whereby:

S = Society

A = Artist

E = Experts

F = Formal resources

T = Themes

M = Materials

H = Habitat

O = Objectives

W = Artworks

In future, I will refer to this as φ (Art).

In the following sections, I will characterise each of these elements. Arguments and justification referring to this will be provided in the next section.

2.5 Components of an artistic system

The intention of the following sections should be to examine each of the elements that constitute the artistic systems.

S (society): Artistic systems are greatly associated with societies, or vice versa. Societies are the development space given to interacting artistic systems. The importance of incorporating the environment into the definition of artistic systems is that different social environments 'tolerate' or 'ward off' various artistic systems. In other words, different social development spaces promote and restrict the activity of various artistic systems. This interaction between the aforementioned social environment and the artistic systems favours the creation, consolidation, and/or deletion of various artistic systems. As DiMaggio has shown, societies offer the 'opportunity space' (DiMaggio, 1994, p. 44) for an emerging system of artistic development, unfolding, and consolidation (or deletion). When we speak of the social environment of an artistic system, it makes sense to consider any society as a supra-system consisting of not less than one political subsystem, an economic subsystem, and a cultural subsystem (Bunge, 1979, 2010; Merton, 1968).

This enables us to differentiate among the influence of politics, economy, culture, and society on the evolution of the artistic systems (Baumann, 2001, 2007; DiMaggio, 1994; Lopes, 2002). For example,

a) Political environment: In certain political regimes of an authoritarian nature, the state maintains a strong regulation over admissible artistic practices, whereas in the democratic state, it is precisely the political environment that guarantees freedom of artistic expression

b) Economic environment: Some artistic forms consume many economic resources. For example, certain genres of opera require the establishment and care of special theatres (opera houses), stage sets and special costumes, musicians, directors and specialised actors, all of which are very expensive to keep (Becker, 1984)

c) Cultural environment: In states with a strong religious control, artistic systems that oppose religious orthodoxy have little chance of success or further development. Of course, this is a somewhat artificial simplification. Indeed, economic, political, cultural, and social influences are linked and cannot be disassembled properly. Moreover, not all of these 'environments' have the same or even proportionally the same effect. For example, as in the case of studying the emergence of Impressionism in Paris in the 20th century, we know that this movement was fostered by a number of political causes (e.g., the support of Napoleon III: 'the bourgeoisie of style'), economic (e.g., industrial expansion and economic growth of the bourgeoisie), cultural (e.g., the establishment of the 'Salon of the Refused'), technological innovation (e.g., the invention of photography and transportable oil paints), and so on. All these causes came together to prepare the fertile ground for the French Impressionism (Gombrich, 1995; Hauser, 1999; Gompertz, 2012). Let's take a look at some recent examples:

a) The consolidation and expansion of the North American abstract expressionism is inextricably linked to the political and cultural climate of the United States with the former USSR. In particular, the US government actively promoted abstract expressionism as an expression of freedom by organising exhibitions abroad and by providing financial support to the artists' development. This took place in opposition to the socialist realism in the US promoted by the Communist Party of the former USSR (Hopkins, 2000). Julian Stallabrass even claimed that after World War II, it is impossible to see the East-West divide as the most important driving force for the creation, consolidation, and extinction of various artistic systems. Stallabrass claimed that both in the West and in the East, state art is:

> *a negative image of the other: if the art of the East had to conform to and represent a specific ideology and have a particular social use, then the art of the West must be apparently free of any such direction, and attain perfect uselessness (Stallabrass, 2004, p. 10).*

b) A current example is the emergence and consolidation in London of the so-called Young British Artists (YBA or Britart)—especially in connection with artists like Rachel Whiteread, Tracy Amin, Damien Hirst, Sarah Lucas, and the Chapman Brothers. Many political, economic, social, and cultural factors fostered the emergence and consolidation of this artistic system. For example, (i) the political (and economic) aims of the English government to transform the picture of London into a modern and exciting city to lure tourists and real-estate investors, (ii) cutting state subsidies for art, which helped young artists get the attention of the media, gallery owners, collectors, and traders, (iii) the neo-liberal ideology of do-it-yourself, (iv) the so-called boom in the international art market of the 1980s which forced the artists, gallerists, and merchants to, among other things, find forms of art that could compete on the global market, (vi) the growth of the audio-visual media and, above all, the British tabloids (sensationalising media), and so on (Stallabrass, 2004; While, 2003). These factors (and many others) favoured the development and consolidation of an artistic system characterised by the artistic creation of easily recognisable artworks, of innovative technology, but, above all, of crass ideas, either due to the production cost of these particular kinds of artworks (Figure 2.2), the scandalous or sensational content (Figure 2.3, 2.4), and their monumental character (Figure 2.5).

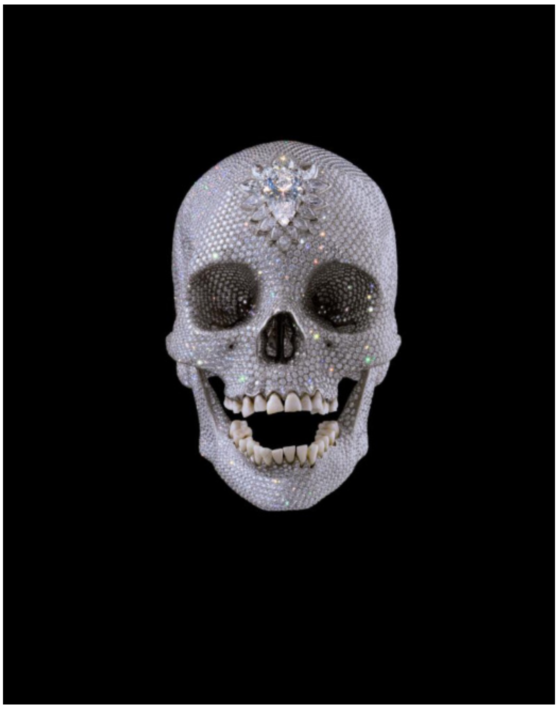

Figure 2.2 Damien Hirst, 2007, 'For the love of God', 171 x 127 x 190 mm, platinum skull, equipped with 8,601 diamonds with a total weight of 1106.18 carats (from: http://www.spiegel.de/spiegel/print/d-68425704.html) and http://www.damienhirst.com/for-the-love-of-god.

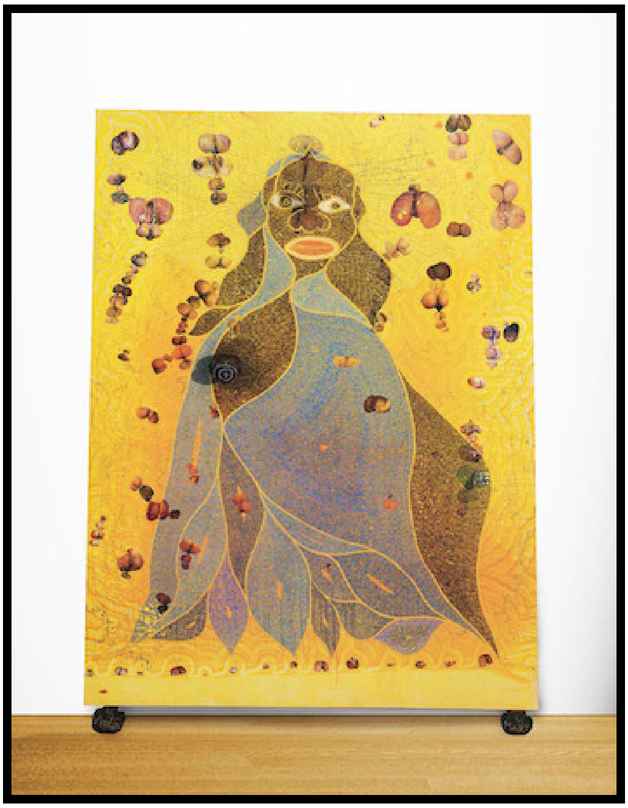

Figure 2.3 Chris Ofili, 1996, 'The Holy Virgin Mary', 243.8 x 182.9 cm

Paper collage, oil paint, glitter, polyester resin, map pins and elephant dung on linen ((from: https://www.khanacademy.org/humanities/global-culture/identity- body/identity-body-europe/a/chris-ofili-the-holy-virgin-mary).

Figure 2.4 Marcus Harvey, 1995, ‘Myra’, Portrait of Myra Hindley, convicted of murder and sexual abuse of five children between 1963 and 1965. The portrait was created with the hand imprints of children (from: https://hscvisualartresources.wordpress.com/2012/07/10/marcus-harvey/).

Figure 2.5 Rachel Whiteread, 1993, ‘Untitled (House)’

The sculpture shown in Figure 2.5 above is entitled simply 'House', and it was created by:

> *taking the Victorian building which originally stood as number 193 Grove Road, filling it with liquid concrete and then stripping away the four walls and roof. The result is an unnerving inversion of the original building, with doorways, staircases and fireplaces all marked out on the solid material (from: https://www.apollo-magazine.com/house/).*

An important consequence of the interaction between the artistic systems and their social environment is the fact that the first activity is formally regulated by legal or moral (or ethical) codes. This means that the artistic systems whose practices violate legal provisions or defy the moral or religious principles of a given society are less likely to arise or be consolidated. Even in democratic and liberal societies, art exhibitions are forced to close, and their sponsors (e.g., artists, gallery owners, merchants) even face the risk of being imprisoned or fined. Some famous cases are the refusal of the Corcoran Gallery of Art to exhibit the photographs by Robert Mapplethorpe titled 'The Perfect Moment' because of obvious homo-erotic considerations (Figure 2.6), or the compulsory closure of the retrospective of Leon Ferrari in La Recoleta (2004) which was largely due to the pressure of the former archbishop of the city of Buenos Aires, Cardinal Bergoglio, now known as Pope Francis I, on the basis that the art violated the feelings of the Catholic community (Figure 2.7). Also, in New York, the former mayor of the city, Rudolf Giuliani, started a legal battle against the Brooklyn Museum for exhibiting the work of Chris Ofili with the Blessed Virgin Mary (see Figure 2.3).

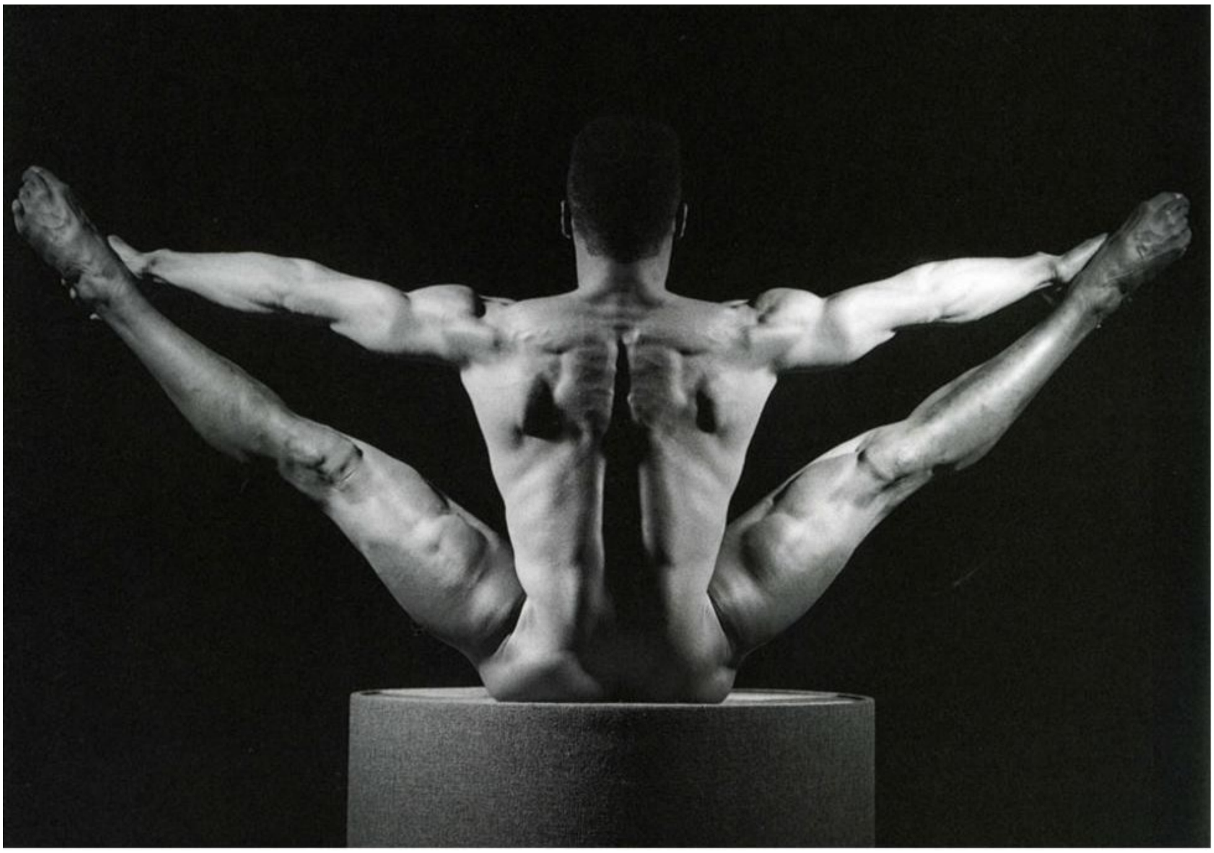

Figure 2.6 Robert Mapplethorpe, 1985, 'Derrick Cross', 40,64 x 50,8 cm, Gelatin silver print (from: http://www.adhikara.com/robert-mapplethorpe/sitemap.htm).

Figure 2.7 León Ferrari, 1965, ‘Western Civilisation And Christianity’, Plastic, oil painting and gypsum, 198 x 122 cm (from: https://www.moma.org/explore/inside_out/2014/01/09/drawing-homage-to-leon-ferrari-1920-2013/).

Above all, an interesting case that went to the highest court of the United States must be mentioned. In the fall of 1994, the US Supreme Court ruled against the free use of musical ‘samplers’ (fragments) because this practice would violate the copyright of composers whose works are used as samplers. This judgment almost completely eradicated the use of samplers because the new legislation imposed very high financial costs on their use. This measure affected rap music, in which the use of samplers was quite common. Rap albums became financially unworkable due to the new cost of using samplers. A consequence of this new legal regulation was the emergence of new types of rap music. Rap musicians began to compose their own music and to employ professional musicians. This situation favoured the proliferation of new genres in rap music to the point that it was possible to distinguish between the rap music that was composed before the failure of the court in 1994 and the rap music that was composed after 1994 (Lena & Pachucki, 2013).

(A) (Artists): This point expresses the banal fact that artistic systems comprise artists—or, in the negation that had there been no artists, there would not have been any artistic systems either.

What is far from being a trivial problem is pointing out what characterises an artist as an artist (Zolberg, 1990). Certainly, much has been proposed in principle about the qualities that would be necessary for someone to be considered as an artist. However, these are far from universally accepted properties. Let's take a look at some examples:

2.5.1 The artist as the author/creator of an artwork

'An artist is someone with the ability to conceive an idea and convert it into an artefact (artwork)'. This seems quite obvious, but this does not cover the entire spectrum of people whom one considers to be artists. Some illustrative cases are:

i) In most cases, neither the directors nor the musicians devise or write the scores in a series of classical music (symphonies, philharmonic, chamber group, etc.) in the same way as opera singers do not write the libretto they sing

ii) Although they conceive of the idea, most minimalist artists (e.g., Judd), regarding neo-pop (e.g., Koons) representatives of 'land/environmental art' (e.g., Smithson), and so forth, are not the real 'makers' of works. Rather, their work is carried out by specialist workers

iii) Similarly, from Renaissance artists to Andy Warhol, Damien Hirst, and Takashi Murakami, they have all relied on the help of some 'artist employees' (in the truest sense of the term, as if these were arts factories). They follow the guidelines of the 'artist' and are the true 'makers' of artworks

iv) In some cases, like in the movies, it is not clear who makes the artwork, since every aspect of it is created by a specialist. In most cases, the directors neither conceive the idea nor are they the authors of the scripts they film

v) Actors are usually not the authors of the scripts they interpret

vi) In some artistic systems, the work of the artist is reduced to a minimum in creating an artwork. Specifically, in the artistic system called poetry, the artists (poets) are restricted to the works of the authors for the rearrangement of other written texts or for the organisation of fragments of verbal speeches in the form of verses. So, in the case of ‘Pieces of Intelligence’, the existential poetry of Donald H Rumsfeld, Hart Seely has composed the speeches or briefings by the former US Secretary of Defence. They are organised as reminiscences in the form of verses in the style of William Carlos Williams (see below ‘The Unknown’):

The Unknown
As we know,
There are known knows.
There are things we know we know.
We also know
There are known unknowns.
That is to say
We know there are some things
We do not know.
But there are also unknown unknowns,
The ones we don’t know we don’t know
Feb. 12, 2002, Department of Defence news briefing (Seely, 2010, p. 2)

Finally, it is quite possible to look at an artist and not the creator of artworks.

2.5.2 The artist as an innovator

‘An artist is someone capable of creating unique and novel objects (originals)’. The finished Duchamps are a clear counter-example of this statement (see Figure 1.11). There are, however, more radical cases. Consider the works of artists like Sherrie Levine and Mike Bidlo. For Bidlo, his works consist of exact replicas of famous artworks by artists of modern art. For example, one of the most famous works by Bidlo is an exact replica of the Warhol Brillo Box installation, because it is important to remember that it was already a replica of everyday objects (Figure 2.8 and 1.10). In addition, Bidlo even arranged the boxes in the same way that Warhol had placed them in his first exhibition (Stallabrass, 2004).

Figure 2.8: Mike Bidlo, 2005, ‘Not Warhol (Brillo Boxes, 1964)’ (from: http://tmagazine.blogs.nytimes.com/2010/07/02/asked-answered-mike-bidlo/).

Levine, meanwhile, is known for his accurate reproductions of famous photographs with the peculiarity that Levine does not make any duplication in the traditional sense. For instance, it could be said that the photographs in a photo gallery are recognised reproductions. Levine transforms exactly the same photos of the copies and recreates them. For example, the series ‘After Walker Evans’ consists solely of the reproduction (or re-photography) of photographs of the American photographer Walter Evans (Figure 2.9).

Figure 2.9: Sherrie Levine, 1981, ‘After Walker Evans’. The photo on the right is the original by Evans, taken in 1936; the photo on the left is the current recreation by Levine (from:

https://www.khanacademy.org/humanities/global-culture/identity-body/identity-body-united-states/a/the-pictures-generation).

It is important to note that neither Bidlo nor Levine is a marginal or unknown person working in complete darkness. Both are recognised and admired artists and two of the greatest exponents of what is known as Appropriation Art.

2.5.3 The artist as a craftsman

'An artist is someone who is skilled or talented and able to create extremely complex and complicated objects.' Although this is quite true in the case of many artists, it is by no means the norm, at least with regard to modern and contemporary art. It is clear that no special manual talents are required to 'create' a 'readymade' or 'painting' in the form of a white monochromatic image (Figure 2.10). On the contrary, many craftsmen are very talented people and produce complicated objects, but not as artists.

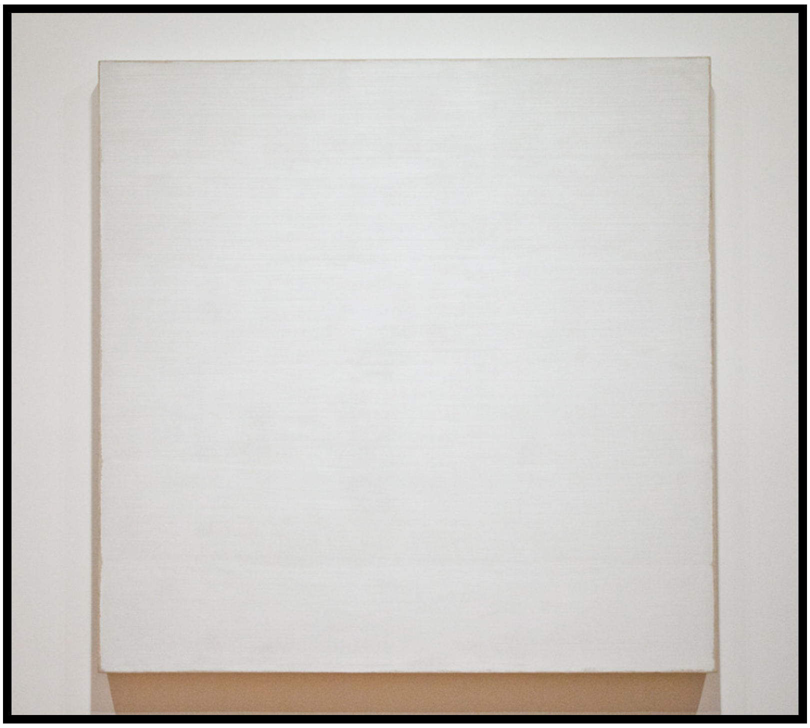

Figure 2.10: Robert Ryman, 1965, 'Twin', Oil on cotton, MoMA, Museum of Modern Art, New York, USA (from: https://www.moma.org/collection/works/80266).

It is possible to find many other features that are supposed to be necessary for someone to be considered an artist. Nevertheless, for any property or group of properties that is considered universal, it is possible to find at least one artist who lacks this property and is, nevertheless, considered an artist.

2.6 Distinguishing between art and artist

Faced with this situation, one could think that just in the way that many have stated that the concept of art is indefinable, the same would occur with the concept of the artist. But I don't think this is the solution. Quite the contrary, I believe that the concept can, and should, be defined. I also believe that one of the greatest difficulties in defining the 'artist' is that, as we have seen with the word 'art', the word 'artist' identifies two related but distinct concepts (see Table 2.3, p. 104).

So, I would like to submit the following definition:

Φ-*artist: x is a* φ-*artist sys, that is, an artist that belongs to at least one artistic system,*
if (a) x is a human being, and (b) x has performed the activity (cognitive or manual) valued by experts as necessary and sufficient for the production of at least one φ-*-artwork*

This definition will become clearer when we reach the definition of the concept of 'φ-artwork' at input W (artwork) (Table 2.3, p. 104), it is clear that some further explanation and comments are necessary.

To summarise, this definition implies that through the concept of the artist, the set of all φ-artists can be defined. To be more precise, the concept of the artist refers to the collection of all artists belonging to at least one current or past artistic system. An essential difference between the concept of the artist and the φ-artist, and why a connection between the two should be avoided, is to be seen in the following circumstance. While the first concept is a collection of already deceased as well as living artists, the concept of the φ-artists tends to develop hierarchical structures or 'status orders', both within and between artistic systems (Bourdieu, 1996; Dubois & Francois 2013; Lena & Pachucki, 2013)

Being more specific, this definition reveals that depending on the type of artwork that is being created, certain actions are considered necessary for its creation, while others are not, though they may still be useful. For example, in conceptual art (an artistic complex), the idea or concept 'behind' the artwork is considered necessary, while the manual tasks required to realise those ideas are considered as secondary. Thus, although Judd, Stella, LeWitt, and other sculptors of American minimalism (an artistic system that composes a conceptual artistic complex) are not the executors of the works, they are considered artists, whereas the workers who actually implemented the works are not considered so (Osborne, 2011). For example, most of Donald Judd's sculptures were made by the Bernstein Brothers metalworking company following the sketches and instructions given by Judd. However, no one treats the Bernstein Brothers as minimalist artists (Figure 2.11) (Marzona, 2009).

Figure 2.11 Donald Judd, 1969, 'Untitled', copper, 10 units at 22-cm intervals, (457.2 x 101.6 x 78.7 cm), Solomon R Guggenheim Museum (from: https://www.guggenheim.org/artwork/1741).

This situation also explains why it is so difficult or impossible to find a set of properties common to all artists: different types of φ-work require different skills and resources by artists.

A new problem is precisely who or what determines the essential activities that someone must perform to be considered an artist. Here, I would like to submit the existence of not less than two mechanisms: a) In the case of an already consolidated artistic system, they are the artists and experts of that system (what I will define below as the world of art of an artistic system) that establishes what makes an artist of someone, that is to say, someone who has performed 'the activity considered essential for the creation of a φ-artwork', but (b) in the case of an artistic system that is still in the development phase (still not fully recognised as an artistic system), I propose that what happens is a negotiation between the artists and experts of a consolidated artistic system and the proto-artists and proto-experts of the new artistic system.

Finally, φ-artists do not work in isolation. On the contrary, φ- artists of the same artistic system and φ-artists of the same artistic complex often make up a community that is more or less cohesive with hierarchical structures or 'status' structured through social relationships, such as the cooperation, collaboration, competition, and so on (Becker, 1984; Bourdieu, 1996; Dubois & Francois, 2013; Lena & Pachucki, 2013, Zolberg, 1990). This leads us to the definition of two more concepts:

System of artists:

'The system composed of φ-artists of the same art system'

Complex of artists: 'The system composed of φ-artists of the same artistic complex'

For example, as Green pointed out, one of the most outstanding characteristics of the artistic systems that emerged during the 1970s and 1980s are the emergence of artists who not only actively collaborated with each other, but who signed works as a collective—for example, Gilbert & George (Figure 2.12), Art & Language (Figure 2.13), Marina Abramovic and Ulay (see link to video in Section 1.4), (Green, 2001). A known local case is that of the *Mondongo* group (Figures 2.14 and 2.15).

Figure 2.12 Gilbert and George, 1984, 'Death Hope Life Fear', 241,9 x 302,9 cm (from: https://www.brooklynmuseum.org/exhibitions/gilbert_and_george).

Figure 2.13 Baldwin and Ramsden, 1980, Portrait of V.I. Lenin with Cap, in the Style of Jackson Pollock III, acrylic on canvas, 242.4 x 213.4cm (from: http://www.tate.org.uk/art/artworks/art-language-portrait-of-v-i-lenin-with-cap-in-the-style-of-jackson-pollock-iii-t12406).

Figure 2.14 Collective of artists called Mondongo: Juliana Laffitte, Manuel Mendanha, and Agustina Picasso, 'Calavera', 2009, skull, Plasticine® on wood (https://www.mfah.org/art/detail/105433). See also figure 2.2.

Figure 2.15 Detail of figure 2.14 (https://www.mfah.org/art/detail/105433).

I would like to conclude this section with the submission of the following hypothesis: The particular kind of relationships existing between φ-artists of the same artistic system and φ-artists of the same artistic complex (e.g., relations of cooperation, rivalry, etc.) determines some emerging (systemic or global) properties of the artistic system and of the artistic complex, their stability, cohesion, dynamics, and so on.

2.6.1 Art and expertise

E (experts): It seems that the meaning of what I call ‘experts’ has received only limited attention in literature. However, their meaning, vis-à-vis the consolidation, evolution, and strengthening of artistic systems, should not be underestimated. By ‘experts’, I mean institutions and people whose special functions are: a) recognising the fact that artists need political, economic, cultural, technical, as well as material support and legitimisation (Baumann, 2007), and b) the evaluation, distribution (or sale), and promotion for the exhibition of artworks. Some of the mechanisms by which the experts perform these tasks are: (i) creating a market and fixing the price of the works (Currid, 2007), (ii) providing artists with places to exhibit (or execute) their artworks (e.g., founding galleries, theatres, libraries, etc.) or places where artists can work (e.g., studios), c) to establish criteria for the valuation of artworks (e.g., universities, cultural societies, etc.), d) organising labour unions for artists, e) providing technical knowhow for the creation of artworks (e.g., stylists, cameramen, sound artists, etc.), g) generating publicity and disseminating artists’ activities, h) providing artists with the tools and materials necessary to perform artworks (e.g., Steinway, Luthiers, etc.), and j) awarding prizes and offering scholarships. An example of material support would be the creation of a type of Plasticine® specially designed by the Alba paints factory according to the specifications of the Mondongo Group. This special type of Plasticine® was used by the group to create Calavera, among others (Figures 2.14 and 2.15) (de Arteaga, 2009). Although necessarily incomplete, this list gives an idea of the range of tasks the ‘experts’ carry out and their importance for the development of an artistic system.

However, nothing in this life is free, and the participation of the experts is not an exception. Although the main function of experts within an art system is to provide political, economic, cultural, technical, and material support, it is a standard practice for this support to involve the experts both in the idea and the execution of the artworks. The case of cinema is perhaps the most obvious: although one tends to associate the creation of a film with its director, the reality is much more complex. Making a film involves the active participation of executive producers, producers, casting directors, directors of photography, special effects specialists, makeup artists, cameramen, sound engineers, screenwriters, investors, sponsors, and so on—each with their particular demands, competencies, and options. In short, making a film is a much more group-oriented and dynamic work than it may seem (Becker, 1984).

Not less obvious, the participation of experts in the creation of artworks in other art systems is no less direct. Let us briefly consider the case of literature. Literary agents, publishers, proofreaders (or style), graphic designers, and so on make up a system of actors necessary for the production and publication of a literary work. The role of the editor is perhaps the most influential in the final form of a literary work. For example, in an interview that appeared in the *Paris Review*, writers like Toni Morrison, Doris Lessing, John Le Carré, and others recognised the influence of the editor Robert Gottlieb in the process of writing his texts. Gottlieb's work was not limited to superficial or minor suggestions. On the contrary, he suggested final changes, reduced or eliminated complete chapters, changed the names of characters, and even came to propose the titles of the works (MacFarquhar, 1994, p. 199). As author Joseph Heller *(Catch-22)* recognised in the same interview:

> *The day the interview ran, Bob [Robert Gottlieb - author's note] called me and said he didn´t think it was a good idea to talk about editing and the contributions of editors, since the public likes to think everything in the book comes right from the author. That's true, just from that time on, I havn´t (MacFarquhar, 1994, p. 2).*

2.6.2 The case of Bio-Art

As I pointed out earlier, the case of minimalist sculptors is already interesting because they generally depend on qualified personnel to carry out their works. A very interesting contemporary case, because it clearly illustrates the extent to which 'experts' can be involved in the creation of an artwork, is the so-called Bio Art. *Bio Art* is what I call an artistic complex; that it is so to say a system composed of artistic systems (for bio-art, transgenic art, art biotechnology, etc., see Figure 2.16).

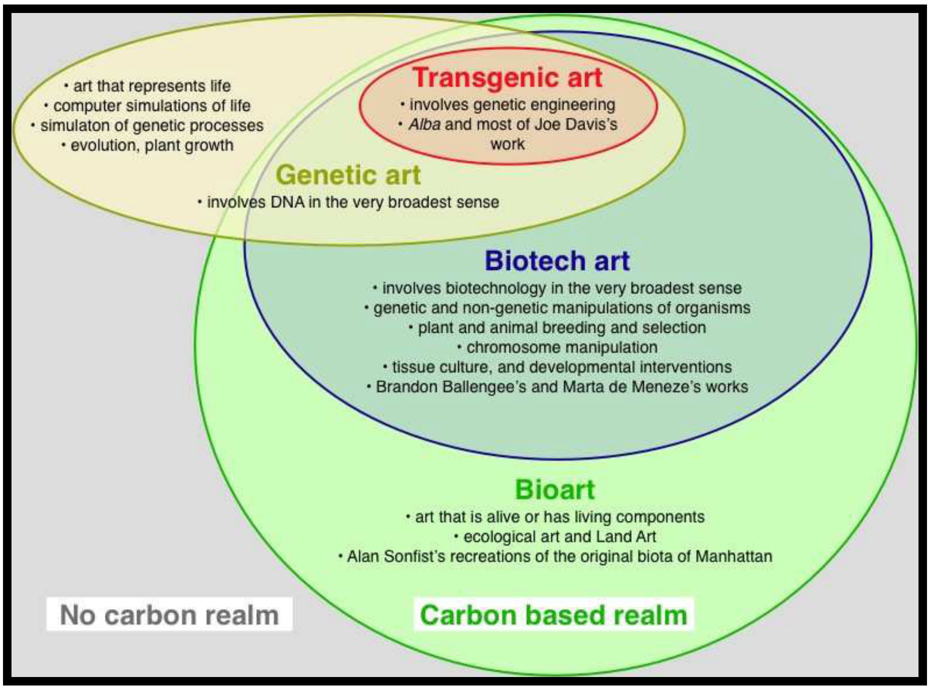

Figure 2.16 This figure represents some of the most important art systems of the Suprasystem *Bio Art* (Capucci & Torriani, 2007).

A property shared by the artistic systems that compose the supra-system Bio Art is the appropriation of methods, resources, and materials typical of the biological sciences—from molecular biology, genetics, and epigenetics to neurosciences and evolutionary biology—for the creation of artworks (Gessert, 2010; Kac, 2007; Stracey, 2009; Tomasula, 2002) (Figures 2.17, 2.18, 2.19, 2.20).

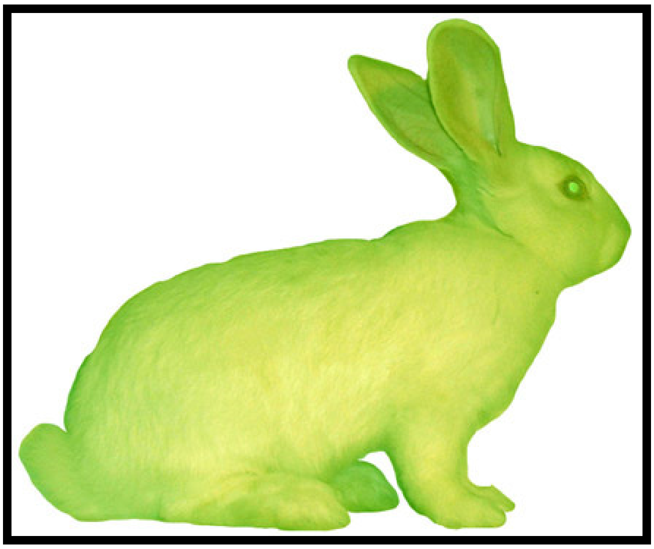

Figure 2.17 Eduardo Kac, 2000, GFP-K9, 'Rabbit (Alba)', live rabbit treated with Green Fluorescent Protein (GFP) (from: http://www.ekac.org/gfpbunny.html#gfpbunnyanchor).

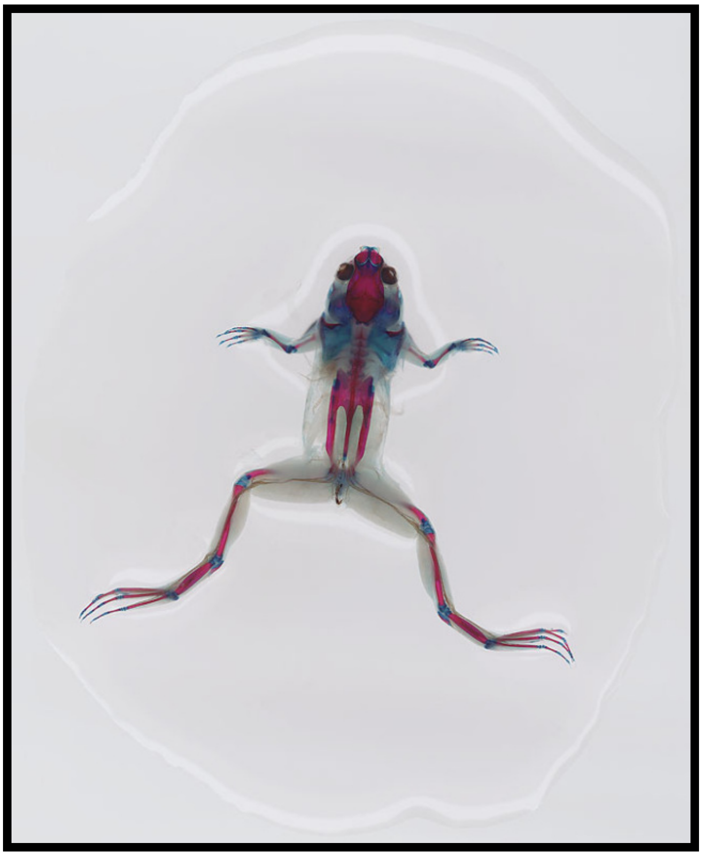

Figure 2.18 Brandon Ballengée, 1998-2006,'Species Reclamation' via a Non-linear Genetic Timeline: An Attempted Hymenochirus curtipes Model Induced By Controlled Breeding (from: https://brandonballengee.com/species-reclamation/).

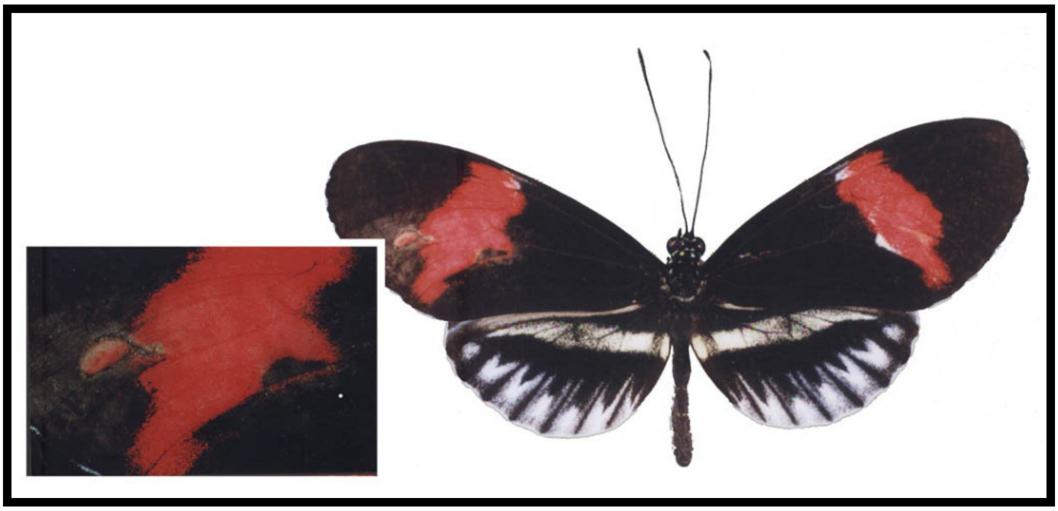

Figure 2.19 Marta de Menezes, 2000, 'Nature?', live H. Melpomene butterfly with modified wing pattern (from: http://www.clotmag.com/marta-de-menezes).

Figure 2.20 Hybrid 488 by George Gessert

George Gessert is a bio-artist who creates new species of flowers, in particular, irises, by hybridising wild specimens. He then retains and reproduces only the flowers that he considers aesthetically satisfactory and discards the rest. The image shown above is an iris that was hybridised in 1990, with the first outbreak in 1994 (http://geneticsandculture.com/genetics_culture/pages_genetics_culture/gc_w02/gc_w02_gessert.htm).

The particularity of Bio Art which I want to emphasise here is the intimate relationship of complexity established between the artists of the various artistic systems that make up Bio Art, and scientists, in particular, biologists. Primarily, none of the artworks of Bio Art could have been performed without the active participation of scientific laboratories (e.g., genetics laboratories). For example, the butterflies of the 'Nature?' series of Marta de Menezes (see Figure 2.19) were produced by molecular biologists A. Monteriro, M. Bax, K. Koops, R. Kooi, and P. Brakefield, in charge of the latter, in the laboratories of the University of Leiden, the Netherlands. It is important to note that this university is ranked at position 77 in the US New's Global Best Universities[4]. Prof. Paul Brakefield is the author of more than 70 scientific papers published in specialised journals (peer-reviewed)[5]. This gives the work of Menezes an aura of scientific credibility and legitimisation of the methods used. It is interesting that the involvement of Menezes was criticised in one of the scientific journals that

[4] https://www.usnews.com/education/best-global-universities/search?country=netherlands&name=Leiden (consulted 29/07/2017)

[5] https://www.ncbi.nlm.nih.gov/pubmed/?term=Paul+Brakefield (consulted 29/07/2917)

specialise in molecular biology—the Nature Reviews: Molecular Cell Biology (Stracey, 2009).

Another artist who collaborates actively with laboratory scientists is Eduardo Kac (Kac: 2007a). For example, to make his famous phosphorescent rabbit Alba (Figure 2.17), Kac collaborated with biologists Louise Marie Houdebine and Patrick Prunet of the Institut National de la Recherche Agronomique-INRA, Paris, and with biologists for the realisation of Edunia (petunias containing genetic sequences of Kac himself, expressing the IgG protein in the veins of the plant [Figures 2.21 and 2.22]).

Figure 2.21 Eduardo Kac, 2003/2008, 'Plantimal VI' (Edunia), Natural history of the enigma, Print on diasec[6], 42 × 42 cm (from: http://www.ekac.org/nat.hist.enig.html) .

[6] Diasec is a method for permanently connecting image material between a carrier plate (usually aluminium) and acrylic glass.

Figure 2.22 The artist Eduardo Kac watering a copy of Edunia, the genetically modified plant expressing the genetic sequence of the artist's own IgG protein, 2009 (from: http://www.ekac.org/nat.hist.enig.html).

However, the involvement of the 'experts' in Bio Art is not limited to the participation of scientists in the creation of artworks. In an unpublished work, Steve Tomasula (2016) analysed the network of experts involved directly and indirectly in the creation, judgement, diffusion, and distribution of Edunia (Figure 2.23). As the graph shows, this network involves not only scientists and their laboratories and universities, but also a complex network of art galleries (e.g., Black Box Gallery), museums (e.g., Weisman Art Museum), multinationals (e.g., Monsanto), publishers (e.g., Blackwell), investors (e.g., Bonita Baskin), and so on. As Tomasula pointed out,

> *Part of the significance of Edunia comes from the interplay of the networks from which the techniques used to create it emerge: unlike the stereotypical mad scientist or artist working alone in a garret, Kac put into play networks of scientists, galleries, labs, museum systems, and the home—us (Tomasula, 2016, p. 290).*

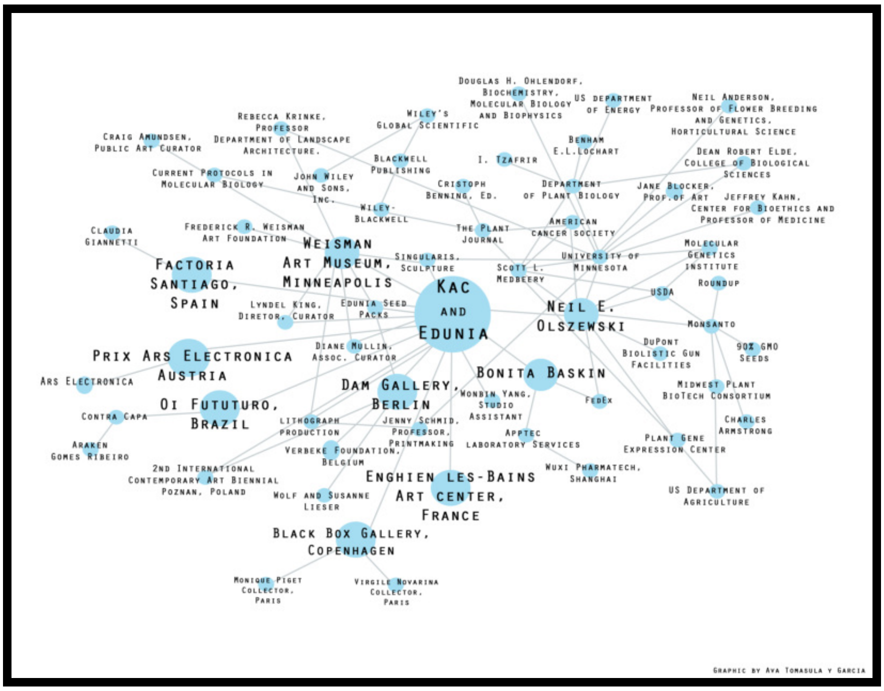

Figure 2.23 Network of experts involved in the creation of Edunia by Eduardo Kac (from: Tomasula, 2016).

Another important aspect of the relationship between bio-artists and experts, which is manifested clearly in the case of Bio Art, is the attention and support that Bio Art has received in specialised publications, not only in art, but also in science (Cohen, 2002; Stracey, 2009) and in philosophy, especially ethics/bioethics. An interesting case is the support given to this artistic complex by the prestigious magazine Leonardo of MIT Press. This support can be partly explained by the fact that both Eduardo Kac (Figure 2.22) and George Gessert (Figure 2.20)—key figures in Bio Art, are magazine editors. Moreover, both the critical anthology edited by Eduardo Kac on Bio Art (Kac, 2007a), as well as the book in which George Gessert set out the historical and philosophical bases of what he called *Evolution Art* (Gessert, 2010), were published by the editorial of MIT in the series *Leonardo Book*. Certainly, Leonardo, the *MIT Press*, and the *International Society for the Arts, Sciences, and Technology* (ISAST) are the three key players in the development and consolidation of art systems heavily influenced by scientific themes, methods, and developments (see, for example, Popper, 2007, Bolter & Gromala, 2003, Kozel, 2007, Morris & Swiss, 2006).

2.6.3 Artistic institutions

In sociological literature, it is not unusual to differentiate between artistic institutions (e.g., National Endowment for the Arts [NEA]), and what are called '*gatekeepers'* (e.g., Rocco Landesman, the current director of the NEA). These are, among other things, the institutions themselves and the people whose function can be seen in the determination or control of who has access to support (material, economic, cultural, etc.) and the legitimisation of these institutions (Barzilai-Nahon, 2009; Greenfeld, 1989; McGinty, 1999; Thornton, 2008; Van Maanen, 2009).

Some important institutions in the global artistic world are:

a*) Policies*: state agencies (e.g., National Endowment for the Arts, secretariats of culture), unions of artists (e.g., American Guild of Musical Artists), and so on.

b) *Economic*: galleries (e.g., Gagosian gallery), publishing houses (e.g. Random House), auction houses (e.g., Sotheby's), art biennials (e.g. Art Basel), local art markets, online stores (e.g. Amazon), and so on.

c) *Cultural*: museums (e.g., MoMa), cultural supplements (e.g., New Yorker), specialised magazines (e.g., Art Forum), specialised editorials (e.g., Taschen), and so on.

d) *Techniques*: universities (e.g., Goldsmith College of Arts), creative writing (e.g., Columbia University's School of the Arts), studies of recording (e.g., Abbey Road), and so on.

e) *Materials*: Fender, Gibson, Windsor & Newton, Steinway & Sons, and so on.

The list of 'gatekeepers' is literally unreachable, as it includes merchants (e.g., Larry Gagosian), art critics (e.g., Robert Huges), literary critics (e.g., Harold Bloom), editorial boards, curators (e.g., Catherine Hug), editors, producers, audio engineers, graphic designers, advertisers, and so on, as well as manufacturers of instruments and painting of articles, trade unionists, owners of bookstores, and so on.

This is, of course, a very incomplete and simplified list of artistic institutions and 'gatekeepers' of the contemporary artistic world. That is because, first, most institutions and 'gatekeepers' provide different types of legitimisation and support at the same time. For example, in the artistic complex of contemporary visual arts systems, art galleries and merchants not only provide artists with economic support, but also serve to legitimise culturally emerging artists or artistic systems. An emblematic case in the contemporary artistic complex is that of the publicist, collector, and art merchant Charles Saatchi, who, with his gallery (The Saatchi Gallery), has played an essential role in the promotion and consolidation of the YBA (*Young British Artists*) (Smith, 2009; Stallabrass, 2004; While, 2003). Saatchi has had such an influence on the consolidation of this group of British artists that While asserted,

> *Saatchi played a crucial role not only in branding YBa (and funding art that helped reinforce this brand), but also in framing YBa as a coherent movement that deserved serious attention within and outside the art world in Britain and abroad (While, 2003, p. 259).*

The same can be said of the collector and merchant Larry Gagosian and the Gagosian Galleries and their support to the emerging artistic system called Neen (component of the artistic complex called Internet Art or Web Art), with Milos Manetas as their most celebrated representative (to read the manifesto of Neen, visit the website: http://www.manetas.com/txt/neenmanifesto.html

For a sample of the artworks produced by Manetas and a representative of the Neen movement, one can visit the web pages:

http://thankyouandywarhol.com/,
http://www.luciofontana.com/).

A second missing point in the list is that artistic institutions and gatekeepers tend to organise themselves into networks or systems. That is to say, the various artistic institutions are related to each other, to a greater or lesser extent. The same happens with the gatekeepers (Barzilai-Nahon, 2008). As already mentioned with regard to the meaning of experts, the consolidation, evolution, and strengthening of the artistic systems should not be underestimated, not least in the creation of artworks. I have already mentioned briefly the phenomenon of Charles Saatchi and the emergence and consolidation of the YBA. Now, let’s look at a couple of more examples:

1) Although the music that we currently call jazz (or proto-jazz) emerged in the early 20th century, and the first jazz recordings date back to the 1920s (Phillips & Owens, 2004), it was not until the mid-1950s that jazz ceased to be considered a mere vulgar or uncultivated form of entertainment (not an art) and gained recognition as a legitimate artistic system. The lack of recognition of jazz music as a legitimate artistic expression (and not merely a form of entertainment) was largely a product of the ideas of the 'experts' about what was the only musical expression worth being called music: classical European music, performed by professional white men, before an educated audience.

An essential component in the process of legitimising jazz as a musical artistic system was the emergence of specialised jazz magazines (e.g., *Down Beat, Metronome*). These magazines favoured the development and establishment of a community of experts and critics of jazz that promoted the criteria to evaluate the quality of compositions, recordings, and performances of jazz. Moreover, these publications did an exhaustive work in framing jazz music in the context of the history of music, which contributed to the perception that jazz was indeed a derivative of already established musical forms (Lopes, 2002).

2) Similarly, Baumann argued that one of the forces behind the legitimisation of cinema as a genuine artistic form in the 1960s (in the US), was the intellectualisation of film criticism in magazines and newspapers. In particular, film critics began to adopt the terminology and discourse associated with art criticism in the 1960s. A strategy adopted by critics was, for example, to focus on the role of the director as the creator of the work, and, thus, films as the product of individual artists and cinema as a new means of expression for artists (Baumann, 2001).

3) The consolidation of Abstract Expressionism as the dominant artistic system in the US happened in addition to the support received by the US government (see Section *S = society*) in large measure, thanks to the patronage of Peggy Guggenheim, who, in his *Art of this Century Gallery*, promoted early exhibitions of artists unknown at this time, such as Jackson Pollock, William Grosvenor Congdon, Willem de Kooning, Mark Rothko, and Clyfford Still (Hopkins, 2000). It is also relevant to mention the critical writings of someone who went on to become one of the most influential art critics of the US, Clement Greenberg. In a series of articles published in the 1950s,

Greenberg introduced and praised the artworks of, among others, Jackson Pollock, Willem de Kooning, and Barnett Newman, and this despite the fact that the first time Greenberg had the opportunity to see many of the works of these artists was in the gallery of Peggy Guggenheim. In summary, Greenberg's strategy to promote Abstract Expressionism was to show that the methods used by these young artists and the goals pursued by them were nothing more than the natural development of the methods and goals of modern art: "Major art is impossible, or almost so, without a thorough assimilation of the major art of the preceding period or periods" (Greenberg, 1961, p. 210).

4) Finally, McGurl, in his study of the American literature of the post-war period, showed how some of the most characteristic properties of this literature, the predominance of the short story, the first-person narrator, autobiographical stories[7], middle-class characters, and so on, came largely from the demands and dynamics of university programmes on creative writing. These programmes experienced a boom and development at major American universities after World War II, and quickly became one of the main sources of income for writers. In particular, McGurl pointed out that the predominance of first-person narrators, autobiographical content, middle-class characters, and the anti-intellectualism of much of contemporary American literature was due to three of the central tenets of creative writing programmes: 'Find your own voice', 'Write what you know', and 'Show, do not tell'. In turn, the predominance of the form of the short story emerged from the fact that it demanded less time to read and correct (McGurl, 2009). As McGurl himself summarised,

> *that the rise of the creative writing program stands as the most important event in postwar American literary history, and that paying attention to the increasingly intimate relation between literary production and the practices of higher education is the key to understanding the originality of postwar American literature. Far from occasioning a sad decline in the quality or interest of American literature, as one so often hears, the writing program has generated a complex and evolving constellation of aesthetic problems that have been explored with tremendous energy—and at times great brilliance—by a vast range of writers who have also been students and teachers (McGurl, 2011, ix).*

[7] From the point of view of the narrator, not necessarily the author.

It is enough to observe the list of some American writers who conducted or took a creative writing course in American universities: Ken Kesey, Thomas Pynchon, Flannery O'Connor, Allen Ginsberg, John Barth, Kart Vonnegut, and so on.

In conclusion, all these examples serve to illustrate the type and magnitude of the role of the 'experts' in the development and consolidation (or extinction) of various artistic systems, and in the exaltation or consolidation of objective properties of artworks as well.

Finally, artists and 'experts' are the components of the system that has been called the 'art world' (Becker, 1986; Baumann, 2007; Dickie, 2000, 2004; Thornton, 2008; Zolberg, 1990) or 'artistic field' (Bourdieu, 1996)[8]. Both concepts, the 'artistic world' and the 'artistic field', were introduced precisely to capture and highlight the social nature of the creation, distribution, and exhibition (or execution) of artworks. Here, I will adopt the concept of 'artistic world' by defining it as follows:
Artistic world = the system consisted of the artists and experts of an artistic complex or artistic system.

As it is evident, artistic systems are very complex systems with a large number of elements (human beings and institutions) interacting with each other. This situation creates a problem for determining the mechanisms that hold them together and to establish what all the components are that interact to carry out the different functions of an art system.

2.7 Art as a system of conventions

One of the main mechanisms—and undoubtedly the most studied one—by which artists and experts interact and set more or less stable boundaries between various artistic systems is the adoption and communication of a system of conventions (Becker, 1974; Luhmann, 2000). In the further course of the section, I will define five of the most important conventions that define an artistic system. These are: formal resources, themes (abstract and concrete), materials, objectives, and habitat.

[8] Although the concept of the 'artistic world' was introduced for the first time by the American philosopher Arthur C Danto in the classic article of 1964 'The Artworld', Danto defined the artistic world not as the system composed of artists and 'experts' (art institutions and 'gatekeepers'), but in terms of the artistic (philosophical) theories necessary to categorise an artefact as an artwork (Danto, 1964). Even worse, Danto did not always define the concept of 'artistic world' in the same way (see Section W = artworks below).

F (formal resources): Formal resources are the first component of the system of conventions that allow artistic systems to function.

By formal resources I understand, basically:

a) Structure of the work: Various artistic systems are characterised by the adoption of one or more global ways of organising their works. For example, in the case of literary artistic systems, there are conventional forms like sonnet, haiku, detective novel, epistolary novel, fable, and so on, which prescribe how to organise the different parts of a work in a whole. The same is true *mutatis mutandis* for painting (e.g., the arrangement of the Holy Family in Byzantine Art), the theatre (e.g., the three Aristotelian units), music (e.g. the progression of the blues, or movements in a classical symphony), and so on.

b) Narrative schemes: For example, the narrator's point of view (first person, omniscient narrator, etc.), 'actant schemes', narrative times, and so on (Fludernik, 2009).

c) Rhetorical figures: From linguistic resources (metaphors, metonymies, etc.), visual (e.g. the arrangement of the letters on the sheet in the poetry of E. E. Cummings, metaphors and visual allegories in painting, the angle of the camera in the cinema), auditory (rhyme, alliteration, cacophony, onomatopoeia, etc.).

An interesting approach is that of Günsel and collaborators. They have developed the software *ArtHistorian* that can classify different pictures into five various artistic systems: Classicism, Cubism, Impressionism, Surrealism, and Expressionism. It takes into account only six formal properties of the pictures: i) percentage of dark colours, ii) gradient coefficient, iii) local and global maxima in the luminance histogram, iv) the range of colours to which the maximum peak corresponds to the luminance histogram, v) the deviation in the grey levels in different parts of the painting in relation to the grey average of the image in its entirety, and vi) the deviation in the distribution of the grey levels in relation to a Gaussian distribution (Gunsel, Sariel & Icoglu, 2005; Icoglu, Sariel & Gunsel, 2004). Although its scope is still very limited, the software provides quantitative—and not just qualitative—evidence of the idea that various artistic systems can be partially defined according to the formal resources used to create the artworks.

As already stated, the conventions adopted by an artistic system constitute a system that cannot be understood if its parts are analysed in isolation. In other words, the conventions adopted by an artistic system (formal resources, themes, materials, objectives, and habitats) form a system of conventions in which each adopted convention influences the remaining conventions and is, at the same time, influenced by them. For example, to understand why a certain artistic system adopts a particular set of formal resources, it is also important to analyse: i) the main themes of the artistic system, ii) its objectives (the relationship between formal resources, themes, and objectives is what Noël Carroll defined as an 'artistic form'), iii) the available materials (e.g., oil paintings vs. acrylics), iv) the tools available to manipulate these materials (from musical instruments to the possibilities offered by computers), v) the places available for the exhibition or execution of the work, vi) the social/political environment (which illustrates so well the quotation attributed to Borges [1999]: 'Censorship is the mother of metaphor'), vii) the cultural environment (e.g., the relative size of religious figures in medieval Catholic art), viii) the economic environment (e.g. the recommendation made by Durand-Ruel to the painters of the first Impressionism to create smaller paintings so that they could serve as decoration in the houses of the new wealthy bourgeois collectors—Gompertz, 2012), and so on. Undoubtedly, each of these conventions would merit a more detailed examination, but this exceeds the scope of this work.

T (themes): In relation to the themes that characterise an artistic system, it is better to differentiate between two classes of themes:

a) Abstract themes (A-themes): These are the themes or topics about art, society, politics, economics, and culture (religious, ethical, etc.) that influence the way in which an artistic system produces, evaluates, distributes, and exhibits (or executes) its artworks. Of course, it is not the case that all members of an artistic system have the same opinions on the issues that concern them. But it is simply that the members of an artistic system often share certain issues that concern them, from artistic ('one must go back to the artistic forms of the Greeks'), philosophical (what is death, time, etc.?), and social problems (e.g., social inequalities, social minorities, etc.), to topics such as mythology, dreams, the unconscious, the media, and so forth.

b) Concrete themes (C-themes): These are the concrete representations that function as embodiments of abstract themes.

It is important not to confuse both kinds of issues, if only because there is a many-to-many relationship between the two classes. That is, the same abstract theme can be represented (or embodied) in many different forms, and the same is true for the opposite case, a single concrete theme can represent many different abstract themes.

Consider an example from painting (the same point can be made with regard to theatre, literature, music, cinema, etc.):

a) An A-theme, many C-themes: for example, the same concern about ‘the death and the passage of time’ (A-theme) can be embodied in different ways, from a memento mori typical of Dutch Renaissance Realism (e.g., Figure 2.24), a pre-Raphaelite scene (Figure 2.25), to Dali’s clocks, a black monochromatic painting (see Figure 1.3), and so on. Certainly, the possibilities are manifold.

b) A C-theme, many A-themes: Obviously, the most obvious case is the monochromatic paintings: the same white box can be interpreted as an allegory of death, of the void, of emptiness, of purity, and so on (Figure 2.10). This is perhaps one of the ideas that Friedman wants to convey (see Figure 1.13).

Figure 2.24 Frans Hals, 1626/1628, 'Young Man holding a Skull (Vanitas)', Oil painting on canvas, 92.2 x 80.8 cm (from: https://mydailyartdisplay.wordpress.com/2011/04/11/young-man-with-a-skull-vanitas-by-frans-hals/).

Figure 2.25 John Everett Millais, 1851, 'Ophelia', Oil painting on canvas, 76.2 x 111.8 cm (from: https://www.artsy.net/artwork/sir-john-everett-millais-ophelia).

Two observations can now be made. First of all, from the figures previously shown (2.24, 2.25), it is impossible to define an artistic system based exclusively on the abstract themes that characterise them. Different art systems can share the same themes but differ in terms of the formal and material resources with which they realise their artwork. Second, an artistic system is characterised by several themes, not only one, as the previous examples may induce us to think. These examples are just a simplified illustration.

Consequently, this point merely states that the members of the same artistic world (more expert artists) of an artistic system share conceptual concerns ranging from moral, political, religious, and social to purely artistic ones.

As in the case of formal resources, the adoption of certain themes by an artistic system influences and, at the same time, is influenced by the context or the social environment (e.g. racial discrimination), cultural (e.g. the emergence of psychoanalysis), political (e.g. consolidation of fascism), economic (e.g. expansion of emergency villages), and formal conventions (e.g. how to represent a 3-D object in a 2-D environment), materials (e.g. the effect of mass media in the emergence of Pop Art), habitat (e.g. Street Art and its rejection of museums), and objectives (e.g. to represent faithfully the social reality) of the artistic system.

M (materials): Artistic systems are characterised by the use of different materials for the creation of artworks. Indeed, lots of artistic systems that have arisen after World War II were motivated by the exploration and tests with new substances that are unsuitable for the creation of artworks, such as rubbish, newspapers, body fluids, unconventional musical instruments, and so on (Hopkins, 2000).

The case of the artistic complex Bio Art (see Figure 2.16) is interesting because it shows that the choice of materials with which to create the artwork is not innocent, because it has social consequences and limits the system of possible conventions. Let’s look briefly at these points:

a) Bio Art—society: As expected, the emergence of Bio Art did not survive controversy. In 2004, for example, the bio-artist Steven Kurtz was accused of using biological material illegally for an exhibition of Bio Art (among other things, he was accused of stealing E. coli samples). Although the charges were finally withdrawn in 2008, this case initiated a series of bioethical debates on whether it was legal (or ethical) to use biological organisms (both living and dead) as material for artworks (Gigliotti, 2009; Kac, 2007a; Stracey, 2009; Zurr & Catts, 2002, 2008). For more information of the story of Steven Kurtz, one can visit the following pages:

http://critical-art.net/defense/press/NYT_042005.html

http://www.nonproliferation.org/art-or-bioterrorism-the-implications-of-the-kurtz-case/

Something similar happened to George Gessert, who was forced to abandon a hybridisation project that included poppy seeds of the species 'Paeony Flowered', from which it is possible to generate opium. He faced the risk of being accused of producing illegal drugs (Gesser, 2010). Also, pressured by public opinion and animal defence agencies, the laboratory in which the Alba rabbit was produced (see Figure 2.17) refused to give it to Eduardo Kac, who began a strong campaign. To date, the laboratory has refused to deliver Alba to Kac. On the other hand, complaints by animal rights organisations like PETA against artists and samples of Bio Art are not uncommon (see also: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4791467/).

b) Bio Art—formal resources: For both technical and ethical reasons, the number of possible manipulations that a bio-artist can perform legally with his materials is limited.

c) Bio Art—themes: Some recurring themes and concerns among bio-artists include reflections on the impact of man in the evolution and selection of species, the possibilities and risks of genetic manipulation, the definition of an organism (or individual) in the age of genetic manipulation ('an organism whose genome has been artificially modified, is it still a natural organism or is it now a nature-culture hybrid?'). The boundaries between the natural and the artificial and between science and art, the bioethical problems of genetic manipulation and human interference in the processes of natural selection, and so on are just some of the most common themes in Bio Art (Gessert, 2010; Kac, 2007a; Tomasula, 2002, 2016).

d) Bio Art—habitat: As Eugene Thacker pointed out, in the case of Bio Art, the selection of the exhibition context is crucial (Thacker, 2007). Not all galleries are equipped to make Bio Art samples, either for technical or social reasons. In the case of technical limitations, the artworks of Bio Art require great technical effort, in large measure because many of the works comprise living beings that require special care. For example, the sample of Natalie Jeremijenko 'Paradise Now' consists of cloned planting trees, which, though genetically identical, showed clear phenotypical differences with which the artist (also an engineer) wanted to show how the conditions (in this case, those of an art gallery) influence genetic expression.

2.7.1 Art, materials and habitat

As one can imagine, samples like these demands great care from the exhibitors (curators, cleaning staff, botanists, etc.). Gessert pointed out that a serious problem he had to solve was to find an art gallery in which the flowers could survive (Gessert, 2010, p.113). Not all art galleries can afford the expenses of equipment and remodelling that a sample of Bio Art demands.

In the case of social constraints, I have already mentioned the pressures of animal rights activist groups to prevent such artistic exhibits from being displayed.

It can be argued that in the case of visual or auditory artistic systems, the reference to the materials is understandable. But in the case of literary artistic systems, to speak of materials may seem to be in the best of cases a trivial concern, since almost by definition the only material belonging to literature is the language.

However, far from being a triviality is the choice of some important resources or techniques, and this applies even in the case of literary artistic systems. For example, it is easy to see that many formal resources available for written literature cannot be used in oral literature, such as the use of capital letters to reify abstract entities (e.g. love, liberty, etc.), or, in the case of English literature, the case of visual rhymes (eye-rhymes, e.g. cough/dough). We also have cases of poetry from Herbert George (Figure 2.26) to Mallarmé, E. E. Cummings, and the Brazilian concretism (Figure 2.27), among many others, who/which have used the layout of the letters on a sheet to create patterns or visual images. Moreover, the disposition of the letters in the sheet evokes expectations that influence the strategies of reading—think of the sonnet, for example. Even these expectations can be used to create different effects. An example is the case of the experimental poet Scott Helmes and his use of the traditional form of 'haiku' to suggest new ways of reading (Figure 2.28).

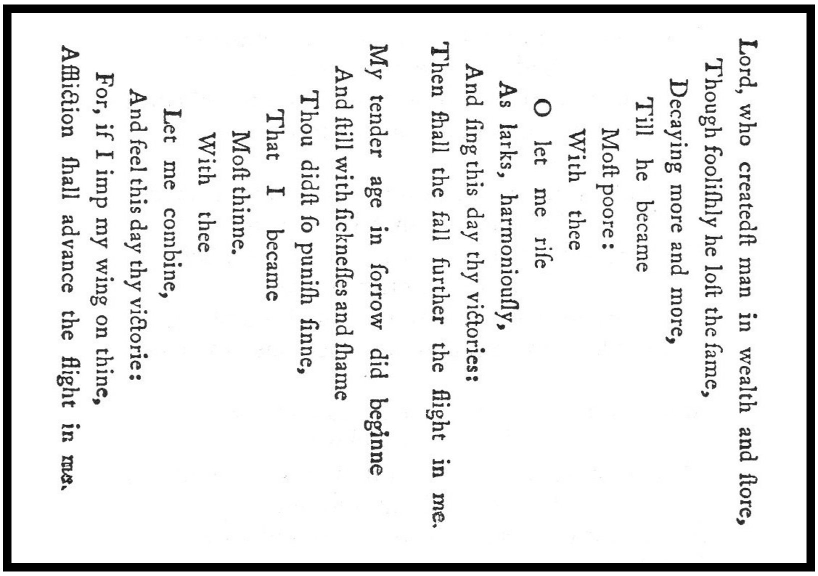

Figure 2.26 Herbert George, 1633, 'Easter Wings' (from: Hiraga, 2005).

Figure 2.27 Ronaldo Azeredo, 1957 'Velocidade' (from: https://fontsinuse.com/uses/11071/velocidade-by-ronaldo-azeredo-1957-8-and-1968).

This tendency to incorporate visual images or patterns into poetry is extreme by experimental poets like Scott Helmes (Figure 2.28), Valery Oisteanu (Figure 2.29), Ian Hamilton Finlay (Figure 2.30), Alejandro Thornton, and Ay-O, among others, to the point where the boundaries between poetry and painting become blurred.

Figure 2.28 Scott Helmes, 'Haiku' (from Vasillakis, 2012).

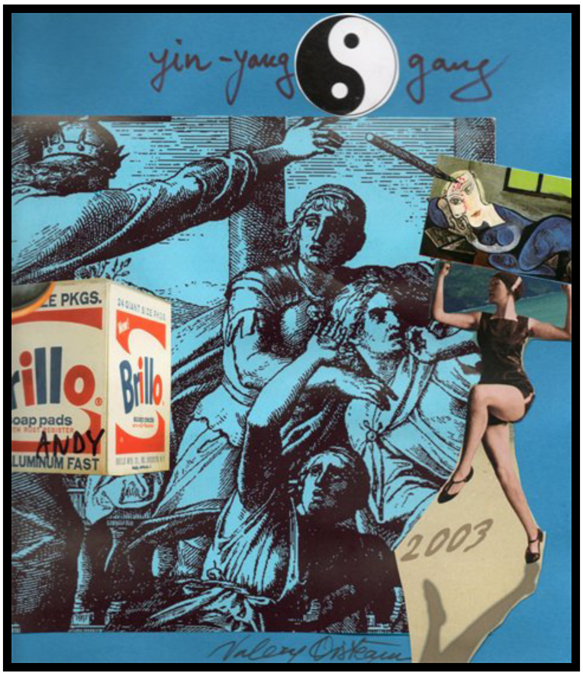

Figure 2.29 Valery Oisteanu, 'Brillo in Purgatory'. Note the recurring use of gloss boxes in contemporary art (from Oisteanu, 2017).

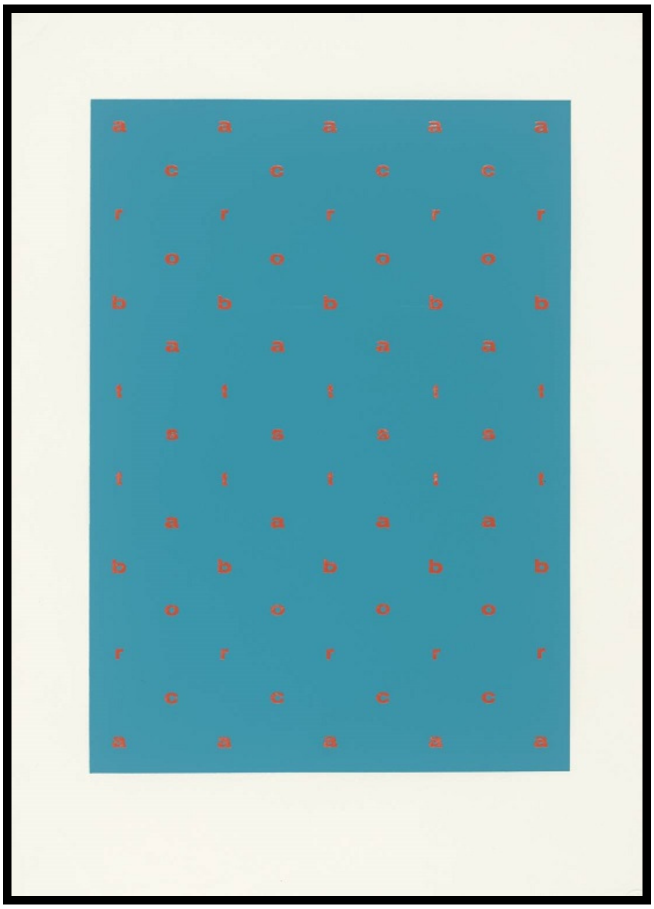

Figure 2.30 Ian Hamilton Finlay,1966, 'Acrobats' (from: Williams, 2014).

An interesting contemporary phenomenon is the recent emergence of literary artistic systems such as digital poetry, collage poetry, web art, mixed media poetry, and so on, which make up the artistic complex called media poetry (Kac, 2007b).

This complex is characterised by the abandonment of paper as the 'material form' of poetry, using digital media and installations instead. It is interesting to highlight two developments introduced by media poetry. The first is that media poetry has introduced new formal resources that were previously beyond the reach of poetry (and literature in general), such as the use of hyperlinks, sounds, moving images, new forms of interaction (e.g., touch screens), among others. Second, media poetry has modified the way in which literary artworks were distributed and marketed, namely, with free (and in most cases, free of charge) access to blogs, e-books, and video and audio playback pages like YouTube and Vimeo. Media poetry artists no longer depend on traditional publishing channels (e.g., publishing houses). For example, consider the cases of Anne Carson ('Reticent Sonnet', http://www.youtube.com/watch?v=pLdAkDi5u9E), Thylias Moss ('In your face', http://www.youtube.com/watch?v=HTwZxru19r0), or Caterina Davinio ('Poem in Red', http://www.youtube.com/watch?v=H6sEv3pICnU).

H (habitat): The concept of habitat decidedly shows that various artistic systems create artworks for the intention of exhibitions (or performances) in specific spaces. In other words, it points at the fact that every artwork is actually site-specific.

The artistic system's habitat is not a minor or trivial fact since it influences almost every kind of activity of the aforementioned system. The habitat has a vast influence on the kind of artworks that can be created to how they will be exhibited, distributed, and judged. For a further illustration of this point, let's look at some examples of how habitat influences the activities of an artistic system:

1) Habitat—production: The place where artworks are supposed to be exhibited (or executed) influences the choice of materials, the formal resources, and the A- and C-themes available to the artist. This is because:
i) in the vast majority of cases, the artist is not the owner of the place where his work will be exhibited (or executed); so, the artist must conform to certain conditions imposed by the owners of these spaces (e.g. the size of the artwork)—think, for example, of medieval European art and the dependence of the artist on the Church and the King
ii) the rejection of conventionally accepted places for the exhibition (or execution) of artworks has always been an important factor in the emergence of many artistic systems, from the controversy by the Académie des Beaux-Arts, to happenings, performances, and the recent emergence of artistic systems like land and environmental art (Figures 2.31 and 2.32), street art (Figure 2.33), internet art, web art, and so on.
iii) the emergence of large spaces dedicated exclusively to the exhibition of artworks, equipped with specialised personnel and technologies and a very high budget, has opened the possibility for monumental, expensive, and technically demanding productions (Figure 2.34).

Figure 2.31 Robert Smithson, 1971, 'Broken Circle', the Netherlands (from: http://www.e-flux.com/announcements/35310/robert-smithson-s-broken-circle-spiral-hill/) .

Figure 2.32 Christo and Jeanne-Claude, 1971-1995, 'Wrapped Reichstag', Berlin, 100,000 m2 of fabric Aluminium and 15 km of rope, 1995 (from: http://christojeanneclaude.net/projects/wrapped-reichstag).

Figure 2.33 Bansky (Untitled), A street in London (from: https://greenthinkingsite.wordpress.com/2014/03/05/the-story-behind-banksy/).

Figure 2.34 Olaf Eliasson, 2003, 'The Weather Project', mixed media, single-frequency lights, projectors, aluminium foil, and scaffolding, 26.7 x 22.3 x 155.4 m, Turbine Hall, Tate Modern, currently dismantled (from: http://olafureliasson.net/archive/artwork/WEK101003/the-weather-project and Eliasson, 2003).

2) Habitat—exhibition: Different habitats favour different forms of exhibition/performance. For example, Smith and Smith recognised in the context of average view times that visitors at the Metropolitan Museum of Art (New York) seldom remain for some time in front of a painting. They found that the average view time in front of a painting is seldom more than 30 seconds, and that the average time is only 17 seconds (Smith & Smith, 2001).

3) Habitat—distribution: An obvious case in which the habitat of an artwork determines its possibilities of distribution is clearly the Land/Environmental Art. One certainly cannot move the German Reichstag so that everyone can appreciate the work of Christo (Figure 2.32).

4) Habitat—evaluation: Finally, this point emphasises the need to judge each artwork according to the habitat (or habitats) for which the work was intended. For example, while judging ancient Egyptian art, one cannot forget that such art was destined for the mortuary chambers of the pyramids, inaccessible to any mortal, or that medieval gestational songs were intended to be sung in public places. Of course, the same applied to contemporary art. In fact, part of the work of the French conceptual artist Daniel Buren in the 1960s consisted of interventions or performances whose purpose was to question or reveal the importance of the institutional context of modern art. Some performances organised by Buren consisted of walking the streets of Paris (or other large metropolises) holding banners with typically modernist motifs (mainly coloured lines). Outside the galleries, such objects went unnoticed by the public, which meant to Buren that the modernist aesthetic was an aesthetic of an art gallery or museum, or, that what defined modernist works as artworks was only the context (Figure 2.35).

Figure 2.35 Typical performance organised by Buren in the 1960s (from: http://www.studiointernational.com/index.php/daniel-buren-and-his-invention-trajectory) .

O (objectives): While talking about the functions or objectives of 'art', one usually has the functions or objectives of artworks in mind. But this is the first mistake that must be avoided. The functions or objectives of an artistic system are not reducible, as it is evident in the proposed definition and in the creation of artworks in particular. Another serious error to be avoided is that even when we speak of the functions or objectives of artworks, we believe that their only purpose is to provoke aesthetic (or beautiful) experiences in the spectator (or audience, reader, etc.).

Consequently, as I have contended throughout this work (see Table 2.2), every artistic system pursues at least four objectives: creating (or producing), evaluating, distributing, and exhibiting (or executing) artworks. This heterogeneity of objectives is one of the causes for the dynamics of artistic systems, partly because, as each member of the artistic world of an artistic system is specialised in the fulfilment of one of these functions, the members of a system must cooperate, agree, negotiate, and so on. The following excerpt from Gordon Burn's interview with Damien Hirst on the YBA artists illustrates very well the complex relationship between experts and artists of the same art system, who have nothing to do with the quality of the artworks:

> *The rules of art aren't so mad […] if there's anything wrong with the art world, I blame the artists. […] There's the fifty-fifty bollocks which, like, canes everyone's head. I mean, look at the great artists, they are not on fifty-fifty. [It is the general rule of contemporary dealers to take a 50 per cent commission on everything they sell.] But no one tells anyone nothing. […] Like, I'm on a sixty-forty with Jay[9], percentage-wise. I could be on ninety-ten if I totally fucking martyred myself, which would make it great for the people behind me. It's like a kind of relay race. I mean, Rachel Whiteread[10] went from sixty-forty with Karsten [Schubert][11] to fifty-fifty with d'Offray[12], which fucking slaughtered me. It just so upset me. Artists are an easy target. Basically, artists are fucking stupid" (Hirst & Burn, 2002, p. 73).*

2.7.2 Artistic values

The way in which the four objectives mentioned above are carried out, that is to say, the way in which an artistic system produces, evaluates, distributes, and exhibits artworks, is influenced by at least four values. These are the artistic, economic, cultural, and political value systems.

i) By artistic value, I mean the emotional and/or cognitive effects that the members of an art system seek to provoke with the artworks (this topic will be addressed below).

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[9] Jay Jopling, one of YBA's top merchants.
[10] See figure 2.5
[11] Merchant and owner of a well-known art gallery.
[12] Anthony d'Offray, art collector, curator, and owner of an art gallery.

ii) By economic value, I refer to the economic reasons that motivate the members of an artistic system. For example, the market is a big engine for the creation of many art systems of contemporary art.

iii) By cultural value, I refer to the cultural reasons that motivate members of an artistic system, the promotion of certain ethical values in the context of the search for prestige and authority on the part of publishers, teachers, curators, critics, and so on.

iv) By political means, I refer to the political reasons for the members of an artistic system—from being conjoined with or fighting against the political authority to the diffusion of or questioning some political ideology.

It is important to keep in mind the different objectives (or functions) of an artistic system (production, distribution, etc.), as the different values motivate the members of an artistic world to carry out these functions (artistic, cultural values, etc.), and the interaction between them (functions and values) greatly determines the dynamics of an artistic system.

Let us now look more closely at the artistic values that influence the creation of artworks. 'Artistic values' can be defined as the emotional and/or cognitive effects that members of an artistic system seek to provoke with artworks. Although rare in philosophical and artistic literature (e.g., art criticism, art history, etc.), it is not unusual in psychological or neuroaesthetic models to attribute artistic values only to the creation of aesthetically pleasing objects (e.g., beautiful). Consequently, most of the empirical research and the theoretical models, both in psychology and in neuroaesthetics, concentrate on explaining the psychological or cerebral mechanisms involved in aesthetic appreciation (of beauty). Typically, an experiment in art psychology or neuroaesthetics has the following form:
a) To present different objects to experimental subjects, b) ask the subjects to classify these objects through scales of aesthetic pleasure or beauty, c) seek to isolate those properties of objects that correlate with beauty or aesthetic pleasure scores, and/or d) observe the brain activity of the subjects (preferably those who have not participated in the scoring sessions), while observing the objects classified as beautiful or aesthetically pleasing (e.g., Kawabata & Zeki, 2004; for a critique of art psychology, see Silva, 2012). Although interesting, limiting aesthetic values to the creation of beautiful or aesthetically pleasing objects artificially restricts and provides

a totally false image of the enormous range of artistic values, especially, the range of emotions that artists seek to provoke with their artworks (Silva, 2009). It is worth reading this long citation from Paul Silva:

> *Empirical aesthetics [psychology of arts and neuroaesthetics – author's note] has become increasingly narrow in its conception of aesthetic experience. […] if aesthetic experience is merely mild pleasure then I don't think it deserves the time and resources of a whole branch of psychology. Artists hope to do much more than create a serene, mild state in their viewers. Much art aims to provoke, to confront, to inspire, to confuse, to intrigue. […] And much work has no obvious emotional target—creating a feeling in an audience is only one of many artistic goals, after all. Some of the most interesting aesthetic feelings are negative" (Silva, 2012, p. 262-263)*

In short, artists produce artworks for many other reasons besides provoking pleasure in the beholders (or readers, etc.) or creating beautiful objects. It will take just a brief visit to any gallery or museum of contemporary art to realise that artists have long since abandoned the idea that artworks must be beautiful objects. It is very unlikely that Liu intended to create a beautiful object or provoke pleasure with his sculpture 'Indigestion II' (a giant excrement of two metres, Figure 2.36) or that Gottfried Helmwein expected those who see his paintings to have a sensation of pleasure and well-being (Figure 2.37). In fact, since the second half of the 20th century (if not before), it has been difficult to find an artist or artistic system interested in provoking feelings of pleasure and beauty in the beholders (or readers). Against the backdrop of modern and contemporary art, it is impossible to overcome Gunnery's comment on Sergeant Hartman, who shouts to the poor soldier Gomer Pyle in the Stanley Kubrick film Full Metal Jacket: 'You're so ugly you could be a modern art masterpiece.'

Figure 2.36 Liu Wei, 2004, 'Indigestion II', Mixed Media, 83 x 214 x 89 cm (from: http://www.saatchigallery.com/artists/artpages/liu_wei_indigestion.htm)..

Figure 2.37 Gottfried Helnwein, 1996, 'Epiphany I (Adoration of the Magi)', mixed media on canvas, 210 x 333cm (from: http://damcollective.tumblr.com/post/113447778651/deinstalled-from-our-modern-contemporary).

2.7.3 Three contemporary trends in art

W (artworks): As already explained in the beginning of this chapter, the history of the philosophy of art, the so-called 'problem of the definition of art' has, in fact, been the 'problem of defining the artwork'. Evidently, an extensive analysis of all proposed definitions is outside the scope of this paper (for a critical review of the main definitions of artwork, see Carroll, 1999, 2000; Davies & Stecker, 2009). However, it is possible to distinguish at least three major trends in which the different definitions can be grouped: internalism, externalism, and inter-externalism.

a) Internalism: By internalism, is understood the tendency assert that what defines an object as an artwork is a set of properties intrinsic to the object regardless of the

social or cultural milieu in which the object was produced. Some representative currents of internalism are:
i) Expressionism: Artworks are characterised by an individual expression of the emotional states of its author
ii) Formalism: What makes an object an artwork is the formal properties of that object (e.g. structure-structuralism, the use of certain rhetorical figures, e.g., metaphor, etc.)
iii) Functionalism: Artworks are characterised by some specific functions they fulfil. The most widespread versions of functionalism are aestheticism, namely, the idea that artworks should evoke feelings of beauty (or pleasure), and moralism, namely, the idea that artworks must contain some moral message (Knight, 2007; Lamarque, 2010; Richards, 2004).

The problem with internalism is that despite being the mainstream in the philosophy of art since Plato and Aristotle, its different currents have failed to actually find these supposed intrinsic and universal properties, most likely because such a set of properties does not exist. Since the mid-Sixties, internalism has been almost entirely abandoned in the philosophy of art (though, unfortunately, as we have seen, internalism/functionalism is still alive in the psychology of art and in the neuroaesthetics).

b) Externalism: By externalism, is meant the tendency to postulate that what defines an object as an artwork is not any intrinsic property of the object (or set of properties) but the context of creation or reception (or consumption) of that object. The representative cases are:
i) Sociologism: What defines something as an artwork is society considered as a whole. The most widespread trends are culturalism (what defines something as an artwork is culture as a whole) and economism (what defines something as an artwork is the economic context of a society)
ii) Reception theories: What defines something as an object is the way in which an audience treats that object

iii) Subjectivism: Something is an artwork if at least one person considers this object as an artwork (Carey, 2006).

Undoubtedly, the most influential externalist trend today is the so-called Institutional Theory of Art, proposed by George Dickie (Dickie, 1974, 2000, 2004; Knight, 2007; Lamarque, 2010). Before analysing the central proposal of Institutional Theory, it is necessary to clarify the following point. Although it is common to mention Danto's (1964) notion of 'artistic world' ('artworld') as the precursor of Institutional Theory, the way in which Dickie and his followers defined what is an 'artistic world' differs greatly from the definition proposed by Danto. While an 'artistic world' for Dickie is a set of institutions that function as a framework for the presentation of artworks, for Danto, the 'artistic world' is the philosophical framework or a set of theories of art within which an artwork is created (Danto, 1964, 1998) or a set of all artworks (Danto, 2013).

Returning to the Institutional Theory of Art, it would be better to call it the Institutional Theory of Artwork because Dickie defined the concept of artwork in the following manner: 'An artwork is an artefact of a kind created to be presented to an artworld public' (Dickie, 2000, p. 96). The most serious problem with this definition is that it is very selective since it does not tell us anything about that artefact, other than that it is a certain type (of a kind). The definition proposed by Dickie implies that anything (any artefact, at least) can be considered a candidate for an artwork, and if sociology and art history show something, it is not so: at different times and in different societies exist different conventions that limit what can be presented as an artwork and what cannot be presented as such, and many of these conventions have to do with intrinsic properties of the objects in question (formal resources, themes, etc.). On the other hand, many artefacts, from chairs and glasses to catalogues and art books, are created to be presented to the public in an artistic world, and Dickie's definition does not help us know if these things are also artworks or not.

The failures of both internalism and externalism in giving a satisfactory answer to the problem of what is an artwork motivated the emergence of different currents in the philosophy of art which proposed different syntheses between these two tendencies. This new synthesis can be called 'inter-externalism'.
c) Inter-externalism: By inter-externalism is meant the tendency to assert that if it is true that the social and cultural contexts influence the categorisation of an object as an artwork, it is no less true that these external conditions favour the establishment of

certain intrinsic (internal) properties to objects considered as artworks. In other words, even though external factors determine what an artwork is and what is not, these external factors determine a set of properties of the objects which suggests that at any time (t), not any artefact can be considered an artwork.

Within the contemporary trends of the inter-externalism, we find:

i) The ‘historical functionalism’ proposed by Robert Stecker: ‘something is an artwork at time t, just in case it is in a central art form at time t and is intended to fulfil a properly specified function of that art form, or an artefact that fulfils properly specified function of art with excellence, whether or not it is in the central art form and whether or not it was intended to fulfil such a function’ (Stecker, 2000, p. 47; Stecker, 2010).

ii) The ‘aesthetic neo-functionalism’ proposed by Nöel Carroll and Seeley, who defined artworks as ‘artefacts intentionally designed to direct attention to their artistically salient features’ (Carroll, Moore & Seeley, 2011, p.49). By ‘artistically salient’ features, ‘the authors understand the aesthetic (emotional) and semantic effects that are caused by this object. What makes this proposal an inter-externalism trend is that the artistically outstanding features that seek to highlight artworks are historically determined and they change over time.

iii) Danto’s ‘neo-representationalism’, which is characterised by proposing that x is an artwork sys, a) x is an artefact, b) x ‘materialises’ or ‘embodies’ some semantic content (‘it is about something’), and c) the creation of x is framed within some aesthetic theory (Danto, 1964, 1998, 2000, 2013).

iv) Finally, we have the ‘neo-aestheticism’ proposed by Eaton, who defined artwork as follows:

‘1) x is an artefact

2) x is treated in aesthetically relevant ways […]

3) when someone has an aesthetic experience of x, he or she realises that the cause of the experience is an intrinsic property of x considered worthy of attention within the culture’ (Eaton, 2000, p.146; see also Eaton, 2004).

It is clear that all these proposals have in common the characterisation of artworks as a) artefacts, and these artefacts b) possess a set of properties, c) can fulfil some artistic function (aesthetic, emotional, or semantic), and d) are determined by external factors. The fact that only artefacts, that is, objects created by man, can be considered as artworks is one of the few agreements that exist between the different contemporary theories considered above, whether internal, external, or inter-externalism (Stecker, 2000).

Although the inter-externalism current is perhaps more acceptable than the internalists' and externalists' currents, since it incorporates aspects of both these approaches, all three approaches are still problematic at present because they are limited in their scope. First, they do not clearly specify what external factors are involved, or what internal aspects determine the artworks. Secondly, as we will see, they do not address the problem of the artwork as a whole.

2.7.4 Two different concepts of artwork

As in the case of the concept of 'artist', there are two concepts of 'artwork', which although related must be distinguished. On the one hand, we have a concept of 'artwork' that refers to all artworks, regardless of the artistic system that produced them (e.g., *x, y, z* are artworks)—this is the concept of art that refers to the different definitions of 'art'. On the other hand, we also have a concept of 'artwork' that refers to artworks produced by a specific artistic system (e.g. "*x* is an impressionist painting, *y* is a drama of the absurd, *z* a chamber concert...").

The first concept of art addresses the following issue: Are there properties common to all artworks regardless of the artistic system to which they belong? The second concept of artwork relates to the following question: What properties have the artworks produced via the artistic system? The approach to these questions suggested in this study is conventional essentialism, a trend within the current inter-externalism. According to this approach:

Artwork = the set of all φ-artworks' Φ-artwork = x is a φ-artwork sys:

a) x is an artefact;

b) x is constructed of materials m_1 ... m_n, with formal resources F_1 ... f_n and c-themes ct_1 ... ct_n,

c) x is displayed/executed (or could be exhibited / executed) in h_1 ... h_n habitats in s_1 ... s_n, and

d) x is (or may be considered an attempt to) 'Embodiment' of t-themes at_1... at_n and artistic values o_1 ... o_n.

In other words, x is an artwork sys: a) x is an artefact and b) x is constructed (intentionally or not) according to the system of conventions (F, T, M, H, O) established by a particular artistic world (A, E) (see Section 2.4).

The concept of 'φ-artwork' underlies expressions like surrealistic painting, minimalist sculpture, indigenous novels, romantic songs, and so on. A point I would like to emphasise is that these materials, formal resources, themes, habitats, and objectives are those which define a φ-artwork in particular. These depend purely and exclusively on the conventions established by a particular artistic world.

The proposal outlined above is best called '*conventional essentialism',* it is essentialist because it states that the concept of 'φ-artwork' defines the essential properties of objects considered as artworks, that is, properties that an object must possess to be considered an artwork, and conventional because, at the same time, it posits that these particular characteristics are purely and exclusively established by convention by members of a particular artistic world. Consequently, they change from one artistic system to another, from one cultural area to another, and from one period to another.

Certainly, the problem of whether there are properties common to all the φ-artworks, regardless of the artistic system to which they belong, remains to be solved. At the moment, all we can really say about the whole artwork is that x belongs to the whole; artwork sys x is a φ-artwork. In symbols, O[13] = {x | x = φ-artwork}.

To conclude this long section on artistic systems, the definition of artistic systems proposed by this principle can now be summarised in the following way:

[13] Set of artworks

φ = <*S, A, E, F, T, M, H, O, W* > = <*S, M, C, W*>

Where,
S = society
M = artistic world (artists, institutions and 'gatekeepers')
C = system of conventions (formal resources, themes, materials, habitats, and objectives)

W = artwork

The central objective of this first part of the work was to try to answer one of the fundamental questions within contemporary aesthetics, namely, whether, as proposed by Zeki, Ramachandran, and others, aesthetics—understood as the scientific study of art—can be reduced to neuroaesthetics. In other words, is aesthetics not more than just a chapter within the neurosciences?

To answer this question, in the first sections, I analysed some of the central concepts of aesthetics and proposed my own definitions of 'art', 'artistic complex', 'artistic system', and 'artwork', among others. Now it's time to use those definitions.

2.8 Some implications: The scope of aesthetics

First, and as I have mentioned elsewhere, the object of the study of aesthetics, understood as the science of art, is not art, since it is a set, a conceptual (non-material) entity, and therefore, strictly speaking, it does not exist (Gombrich, 1995).

Aesthetics was traditionally linked to the study of the properties of artworks and the study of our emotional and cognitive responses to such objects. This limitation of aesthetics to only one component of artistic systems (e.g. artworks) can be explained to a large extent by the fact that aesthetic studies assumed the false identity of *art = artwork* promoted by the different philosophical currents, which confused 'definitions of art' with what were actually 'definitions of artworks' (see Section 2.1). This serious conceptual error artificially reduced the scope of aesthetics and favoured the emergence of psychologism in aesthetics and ultimately the idea that aesthetics could be reduced effectively to neuroaesthetics.

The proposal developed in this study shows that aesthetics has a far greater scope than the study of the appreciation of artworks. In the first place, the objects of the study of aesthetics are artistic complexes and systems, their components, relationships, functions, and so on. One of the most important aspects of the definitions presented of artistic complexes and artistic systems is that they clearly show that these concepts denote at least three ontological levels: the social, the individual, and the artefacts (see Figure 2.38 and 2.39), which are not reducible to each other (Bunge, 1979, 2010). Schematically, the definitions of artistic complexes and artistic systems can be represented in the following way (Figure 2.38):

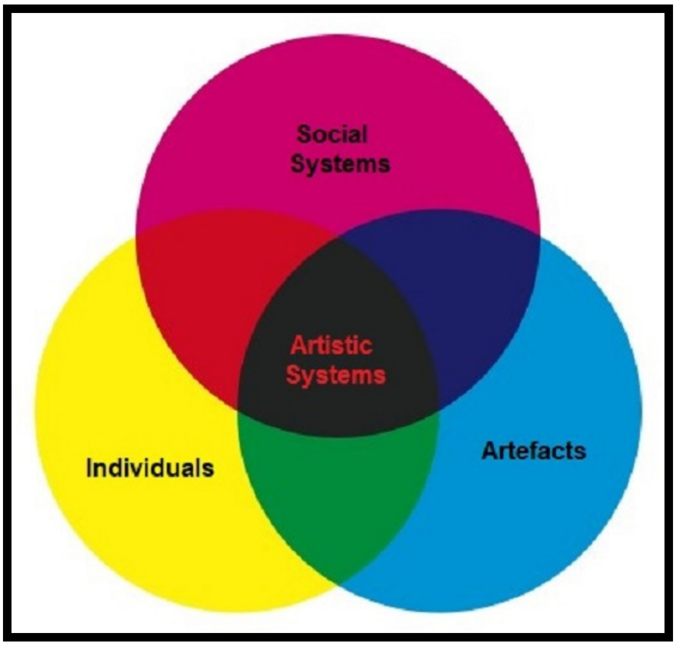

Figure 2.38 Ontological scheme of artistic systems

An important consequence of the ontological plurality that characterises the artistic systems is the existence of causal relationships at not only intra-levels (e.g., social institution-social institution), but also intra-levels, that is to say from the societies to artefacts and vice-versa. This implies that the changes in and the emergence of artistic complexes and systems involves mechanisms of all levels, from the social level passing through the level of individuals to that of the artefacts. Let’s look at some examples:

i) From <S> to <O>: A new political regime imposing restrictions on artistic practices. An interesting case in which a social change promotes changes in artistic systems is the transition from medieval religious art to Renaissance religious art. As Gombrich stated, the main function of medieval Catholic religious art was to represent biblical scenes for an illiterate audience. Emphasis was placed on the symbolic and didactic value of such scenes and not on the verisimilitude of representation. On the contrary, the purpose of religious art changed in the Renaissance period, and the emphasis was on representing the biblical scenes in such a way as to generate the illusion of seeing them as they happened (or could occur in the present context). This change of purpose of religious art was largely motivated by the emergence and expansion of the mendicant orders of preachers during the 13th century and the emphasis of these groups in vividly depicting different passages of the Bible. This change of function or purpose and the new need to represent the biblical passages more realistically promoted changes in the formal resources, themes, materials, and habitats of artworks (Gombrich, 1986, 1995; see also Baxandall, 1988; Johnson, 2005).

ii) From <O> to <S, E>: A new artistic genre (or a new artist) promotes the creation of a new social group (collectors, critics, customers, etc.). This new social group can, in turn, promote new economic subsystems (e.g., sale of artworks, auctions, conferences, merchandising, etc.).

iii) From <M> to <F, T, O>: Access to new materials promotes new possibilities and artistic problems (e.g. Bio Art and biotechnology).

iv) From <E> to <O, F>: New artistic theories can influence the search of new artistic objectives, and, in turn, promote new formal challenges (e.g. structural linguistics and literary formalism).

v) From <S> to <O, T, F>: The emergence of new cultural products—from new technologies to scientific theories—can promote changes in the objectives, themes, and procedures of artistic systems (e.g., the emergence of psychoanalysis and surrealism).

(vi) From <H> to <O, T, M, F>: The emergence of new spaces for the exhibition/execution of artworks promotes changes in objectives, themes, materials, and formal resources available for an artistic system (see Figure 2.34).

vii) From <O> to <F>: New artistic goals promote new formal resources.

Here are O = Objectives, S = Society, E = Experts, M = Materials, F = Formal resources, T = Themes, H = Habitat (see Section 2.4, 2.5, 2.6, 2.7)

This ontological complexity of artistic systems indicates that aesthetics can only be explored within the framework of an interdisciplinary science combining the sciences that study the different levels of an artistic complex and an artistic system—in other words, the sciences that study the properties and mechanisms of social systems (e.g., history, sociology, etc.), human beings (e.g. cognitive and affective neurosciences, psychology, etc.), and artefacts, particularly of artworks (from physics to humanistic disciplines, e.g., philosophy of art, art criticism, etc.). Consequently, a mature aesthetic theory must be able to interrelate social, biological (and, in particular, neuroscientific) variables, and variables related to the properties of artworks. Schematically, we could represent the epistemological system of aesthetics, as follows (Figure 2.39):

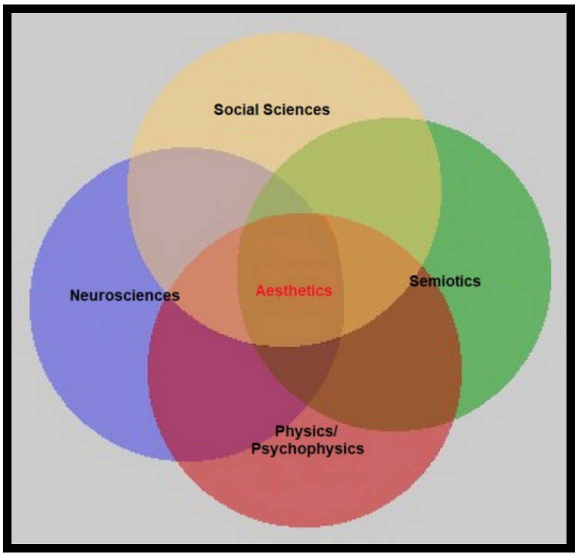

Figure 2.39 The epistemological schema of aesthetics.

A similar idea can be found in Jacobsen (2006) (Figure 2.40).

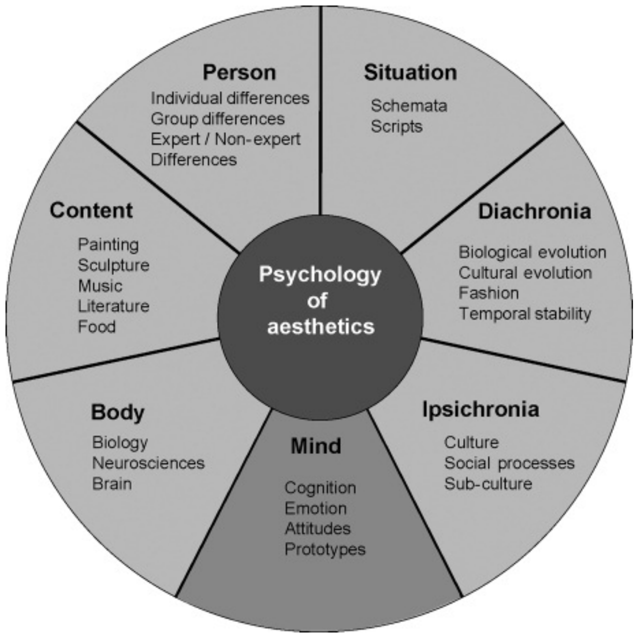

Figure 2.40 The framework of the epistemological structure of psychological (or experimental) aesthetics proposed by Jacobsen (Jacobsen, 2006).

As a result, and as shown in figures 2.39 and 2.40, not every question (problem) in aesthetics admits a neuroscientific response (though any deep aesthetic theory must contain fragments of neuroscience) (Croft, 2011; Brown & Dissanayake, 2009). For example, there are social problems related to artworks that exceed the scope of neuroscience. Some examples include:

- The classification and description of the different types of artistic genres (poetry, novel, short story, etc.).
- The properties and dynamics (history) of artistic complexes or, rather, artistic systems.
- The inter-textual relations between artworks and relations of interdiscursivity between artworks and other cultural products, scientific theories, philosophical theories, technologies, means of communication, etc.).
- Relationships between the dynamics of an artistic system and its social context (cultural, political, and economic).
- Judgement of artworks (critique).
- Dynamics of power relations or hierarchies between the different members of an artistic world.
- History of the interpretations of an author.
- Rhetorical analysis.

My definition of the artistic system has advantages over previous proposals. For example, it allows in principle to characterise any artistic system. You only have to 'fill' each of the nine components of the tuple (see Section 2.4). A very schematic example would be:

Imagism = < *S* (London 1909–1920) U *A* (Pound, Lowell, Flint, D H, McLeish, Williams, Hulme) U *E* (Hulme, Pound, Aldington[14], Monroe[15], Flint) U *W* (Des Imagistes, some imagist poets, images, etc.) U F (Free verse, visual images, informal language, brevity, etc.) U *T* ('fleeting states in the mind of the Poet' [Pratt, 2008]) U *M* (written language) U *H* (private reading) U *O* (communicate the actual content of the thought, create new images, and so on [Jones, 2001]) > (Jones, 2001, Pratt, 2008). It is not necessary to clarify that this is an extremely simplified representation, and that it only aims to give a very general idea of the type of definitions it promotes.

Another advantage of this definition is that it offers an explanation of the theoretical proposals and their failure. In particular, it offers the possibility to observe clearly that the previous theoretical proposals were concentrated on only one aspect of the artistic systems and made that aspect their essential property. Thus, the isolation of each component of my definition gives us a current theory: S = sociologism (Eagleton, 1996; Hauser, 1999; Hemingway, 2006; Jacobs & Hanrahan, 2005; Schram & Steen, 2001; Taylor, 1980; Tanner, 2003), A = romanticism, E = institutionalism (or institutional theories of art), F = formalism/structuralism, T = representationalism (or semantic theories), H = institutionalism or contextualism, O = functionalism, and so on. I do not know the existence of any theoretical current that made the materials (M) an essential component of their definition of art.

To conclude, a final semantic clarification must be offered. One might ask: why not talk about artistic movements instead of proposing a neologism as an artistic system? The reason is that artistic movements are a subset of artistic systems. It could be said that artistic movements are the artistic systems that occupy a central position within the artistic complex of a given society (see Figure 2.1). For example, an artistic movement is composed of several artists, but nothing prevents an artistic system

[14] Pound and Aldington were editors of Egoist, a literary magazine that published many of the authors of the imagist movement.

[15] Editor of Poetry, a very important literary magazine, which also promoted this artistic system.

from comprising a single artist. Also, most artistic systems lack a name that identifies them, but not artistic movements. Artistic movements are artistic systems that endure through time, while most artistic systems are rapidly extinguished. In short, while all my examples of artistic systems throughout this second part of the work were cases of artistic movements, it is important not to confuse them: artistic movements are a subset of artistic systems.

2.9 Summary of part 1

a) Neuroaesthetics is a philosophical-experimental (neuroscientific) programme with two very clear objectives:
i) Defining art in purely neural terms and concepts, and thus
ii) Reducing aesthetics (in the sense of the science of art) to the neurosciences (see Section 1.3.1).
b) Philosophically, the proposal of neuroaesthetics is a version of functionalism (or neo-functionalism). As such, it proposes to define art in terms of the specific function that all artworks can perform and that only they can perform. In the specific case of neuroaesthetics, this function is reduced to a type of brain response that only artworks can provoke (see Sections 1.3.1, 1.4).
c) The reduction of aesthetics to neuroscience is based on the assumption that if art can be defined in terms of brain responses, describing the cerebral mechanisms and systems identified with the specific function of art in general implies that neuroscience alone can explain what art is and how it works (see Section 1.3.1).
d) Both objectives—defining art in neural terms and reducing aesthetics to neurosciences—are unsustainable for several reasons:
i) Neuroaesthetics confuses the concept of 'art' with that of 'artwork'. Listing the properties that make an object an artwork is not enough to define the concept of 'art'. Functionalism (and neo-functionalism) is unsustainable, and it is impossible to define an object as an artwork exclusively in terms of a function that all, and only, these artworks can perform (see Section 1.4)
ii) Aesthetics is not reduced to the study of the associated mental responses to artworks (e.g., social factors).
e) A new theoretical framework is needed on which an understanding of aesthetics can be established. This shows the scope and limits of neurosciences for the study of

art (see Sections 2.2, 2.3, 2.4). Table 2.3 summarises the main concepts of my aesthetic proposal and its definitions.

f) The concept of art denotes at least three ontological levels, irreducible between oneself: social level, biological level (e.g., cerebral), and the level of artefacts. Then, not every problem in aesthetics can be reduced to a neuroscientific problem, and consequently, aesthetics cannot be reduced to the neurosciences (see Section 2.6).

g) This ontological scheme implies an interdisciplinary epistemological scheme.

In other words, aesthetics is, by nature, an interdisciplinary science, in which social, biological, physical, and semiotic sciences converge (see Section 2.6).

Table 2.3 Definitions of the main concepts.

Concept	**Definition**	**Extension**
'Art'	The set of all the artistic systems.	A conceptual object (set)
'Artistic complex'	The supra-system composed of two or more artistic systems in society 's' at time 't'.	A material object (cultural system)
'Artistic system'	φ = < S, A, E, F, T, M, H, O, W >	A material object (cultural system)
'Artist' 'φ-artist'	The set of all φ-artist. X is a φ-artist sys: a) x is a human being, and b) x performs the essential activity for the creation of a φ-artwork.	A conceptual object (set) A material object (human being)
'Experts'	The institutions and persons whose main functions are: a) to provide support—economic, cultural, technical, and material—and political legitimacy to artists, and b) evaluate, distribute, and exhibit the artworks.	A material object (system of people and institutions)

'Artistic world'	The system consists of artists and experts of an artistic complex or artistic system.	A material object (system of people and institutions)
'Artwork'	The set of all φ-artworks	A conceptual object (set)
'φ-artwork'	X is a φ-artwork sys: a) x is an artefact; b) x is constructed with materials m1 ... mn, formal resources $f_1 \ldots f_n$ and c-themes $t_{c1} \ldots t_{cn}$, c) x is exhibited (or can be exhibited/executed) in the habitat $c_1 \ldots c_n$ in society $s_1 \ldots s_n$; and d) x is considered an embodiment of a-themes $t_{a1} \ldots t_{an}$ and artistic values $o_1 \ldots o_n$.	A material object (artefacts)

Part II:

AESTHETICS AND NEUROSCIENCE

CHAPTER 3: ARTISTIC TASK-SETS, MENTAL IMAGES, AND EMOTIONS: KEYS FOR THE NEUROSCIENCE OF ARTISTIC APPRECIATION

3.1 Introduction

Let us recapitulate the argument developed in this thesis so far. Neuroaesthetics can be considered as a philosophical-scientific programme that seeks to answer two key questions of aesthetics, namely what is art and how do we appreciate it?

In the first part of this thesis, the focus was mostly on the philosophical part of the neuroaesthetics research programme, and in particular, on the extent to which neuroaesthetics appropriately responds to the question of what art is. This entailed a twofold answer. First, neuroaesthetics defines art in terms of necessary and sufficient properties that make an object an artwork. Second, the implication is that the necessary and sufficient properties that make an object an artwork include the specific function that the object can perform, a function that all artworks and only artworks can perform. For neuroaesthetics, this function is identified with a cognitive/emotional state or process that only artworks can provoke (see Table 1.1, p. 10).

It is important to remember this definition of art because it underlies the experimental programme of neuroaesthetics concerning artistic/aesthetic appreciation and its three core postulates:

1) Artwork = specific function.

2) Specific function = emotional/cognitive state evoked in the subject.

3) Research must elucidate how artworks perform their specific function. In other words, how do artworks evoke in subjects the emotional/cognitive state that is identified with the specific function of art?

In the third part, as in the second part of the work, I do not just attempt to describe and evaluate the experimental part of neuroaesthetics, I also try to demonstrate that the neuroaesthetic programme in its current form is untenable in light of empirical evidence. Finally, I offer my own theoretical postulate about possible cerebral mechanisms and the systems involved in artistic/aesthetic appreciation.

3.2 The experimental programme of neuroaesthetics

How do artworks evoke the identified emotional/cognitive condition through the specific function of art? In short, for neuroaesthetics, the identified emotional/cognitive condition stimulated by art is a function of the objective properties of artworks. So, if we denote the objective properties (see Section 1.3.2; 2.2) of artworks by P and the identified emotional/cognitive status stimulated by the specific function of art by A (for artistic appreciation), we have the function $f(P) = A$, where f denotes mechanisms in specific cerebral cortex areas. And where the subscript n indicated the number of possible properties (see Section 2.2).

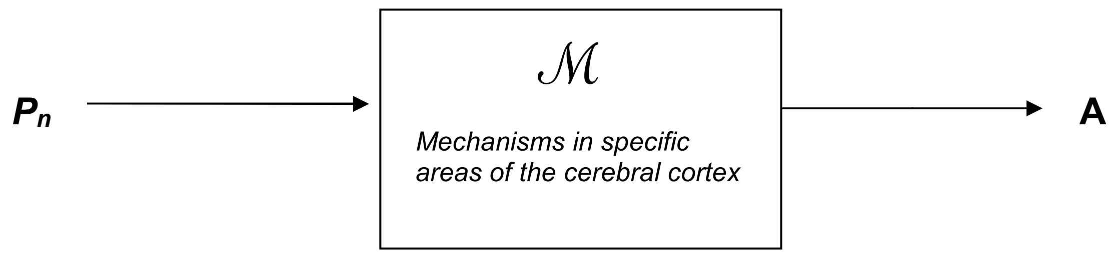

Figure 3.1 Mechanism of artistic appreciation according to neuroaesthetics.

In regard to neuroaesthetics (see Section 1.3), the mechanisms associated with artistic appreciation are essentially bottom-up mechanisms that depend exclusively on the mode in which the specific cerebral cortex areas (e.g., visual cortex, auditory cortex) respond to the objective properties of artworks (Ramachandran, 2004; Ramachandran & Hirstein, 1999; Redies, 2007; Skov & Vartanian, 2009; Zeki, 1999).

Artistic appreciation is a function of the objective properties of artworks and the systems and mechanisms of specific cortex modalities involved in the processing of these objective properties, which provide very important implications for the study of artistic appreciation. Two points, in particular, are of interest:

a) Since A (artistic appreciation) is a function of P (objective properties), each time P is given, the result is A. So, if x has the appropriate objective properties P1, P2 ... Pn, then the subject S will experience an artistic appreciation. This implies, among other things, that artistic appreciation is independent of the knowledge and expectations of subjects. In other words, artistic appreciation does not depend on 'top-down' (or 'knowledge-based') processes. It should be mentioned that some properties may be acquired by learning (exposure to art) in which case they are knowledge-based.

b) Thus, to explain it in the neuroscientific context, the processes of artistic appreciation are reduced to describe the systems and mechanisms of specific cerebral cortex areas involved in the processing of the objective properties of artworks.

As Bullot and Reber point out, the experimental programme proposed by neuroaesthetics (Ramachandran, 2011; Skov & Vartanian, 2009; Zeki, 1999) is nothing more than a continuation (or radicalisation) of the analysis of the experimental model of psychophysical aesthetics (Bullot & Reber, 2013; see also Silva, 2012). Indeed, the guiding principle of psychophysical aesthetics is that aesthetic (artistic) responses associated with artworks are a function of one or several properties of the objects of art. Thus, an experiment on psychophysical aesthetics typically involves measuring some objective responses (e.g., response times, eye movements) and/or some psychometric scale (in particular, scales of beauty or pleasure), as well as observing how these responses vary according to alterations caused by the stimulus (artwork) (Palmer, Gardner & Wickens, 2008, 2013; Quiroga & Pedreira, 2011; Samuel & Kerzel, 2013; Silva, 2012). The only difference between the experimental model of psychophysics and neuroaesthetics is that while psychophysics treats the mental mechanisms of aesthetic (artistic) responses as a black box, neuroaesthetics seeks to precisely understand these mental processes in terms of mechanisms and systems (Figures 3.2 and 3.3).

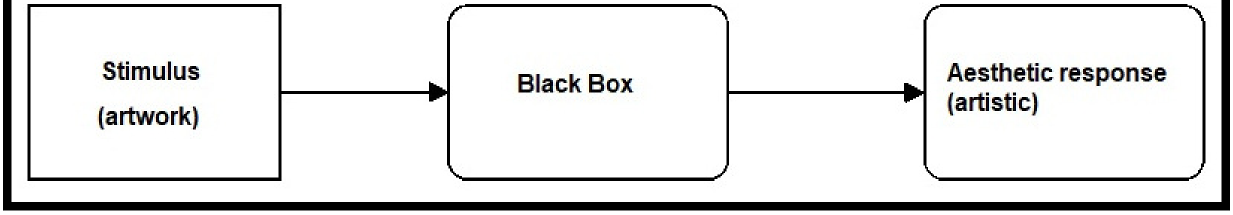

Figure 3.2 The experimental scheme of empirical aesthetics (psychophysics).
Arrows represent the causal direction of the aesthetic (artistic) response.

Figure 3.3 The experimental scheme of neuroaesthetics.
Arrows represent the causal direction of the aesthetic (artistic) response.

But is this model sustainable in light of the empirical evidence?

3.2.1 Evidence against neuroaesthetics

The experimental programme of neuroaesthetics may be unsustainable for both conceptual and empirical reasons. First of all, I briefly comment on the conceptual reasons that this programme may be considered untenable.

3.2.1.1 Conceptual evidence

The experimental programme of neuroaesthetics is based on two presuppositions. First, the definition of an object as an artwork stems from its ability to provoke a cognitive/emotional condition or process that only artworks can provoke. In other words, if x is an artwork, then the features (Pn) associated with x provoke (or is capable of provoking) the cognitive/emotional condition in a subject s. Second, the factor that causes the object x to lead to the cognitive/emotional state e in the subject s is a set of objective properties of the object x (see Section 3.1).

However, as we saw in the first (Section 1.2) and second (Section 2.5) parts of the functionalism (or neofunctionalism) on which neuroaesthetics is founded, is highly problematic. As Danto (1973) points out, one of the most striking features of modern art is that many artworks are indistinguishable from other everyday objects (non-artworks). Thus, two (or more) objects with the same objective properties can be categorised and treated differently—one as an artwork and the other as not art (Danto,1973, Figures 1.11, 1.12, and 1.13). It is also easy to find objects that can provoke those conditions that have been identified with the function of art and yet are not regarded as objects of art.

This presents an interesting problem, because if we do not know what an artwork is, we can hardly be assured that we can study the cerebral mechanisms and systems involved in the appreciation of artworks. In this thesis, I propose a new definition of artwork that I think is useful for the development of the neuroscientific study of the appreciation of art. Let us remember: x is a φ-artwork sys a) x is an artefact and b) x is constructed (intentionally or otherwise) according to the set of conventions (F, T, M, H, O) established by the artistic world (A, E) (see Section 2.4, 2.7.4; Table 2.3).

According to this definition of artwork (φ-artwork), regardless of what neuroaesthetics suggests, implies among other things that the recognition of an object as an artwork, far from being an almost reflexive action dependent on the objective properties of the object, includes a learning process. We must learn what features define an object as an artwork and distinguish it from things that are not artworks. In particular, one must learn a system of conventions sanctioned by an artistic world to determine what things constitute artworks. In other words, one must learn that the object x is an artwork if and only if it satisfies the key functions associated with systems or objects of art. Thus, it must be constructed with materials m, formal resources f, and themes t, to be exhibited (or executed) in a context or habitat h, in a society and a time t, to realise an artistic objective o. Moreover, the system of conventions not only changes with time and societies; even in the same society and time, different systems of conventions coexist, which are associated with different artistic systems and complexes. This means that a subject has to learn different systems of conventions to correctly categorise different objects and different types of artworks (φ-artwork).

Perhaps it is a little hasty, but I would like to propose the following theoretical postulate : It is the result of the definition of the proposed φ-artwork that the artistic appreciation of an object is a function of i) prior knowledge of the subject (e.g., to correctly categorise objects X as an artwork of the artistic system φ), ii) the presentation context of the object (e.g., museum), and iii) the objective properties of the object. To do this, we would have to add a variable, which is the previous emotional state of the subject. Then, we have the following scheme of artistic appreciation (Figure 3.4) (in contrast to Figure 3.1):

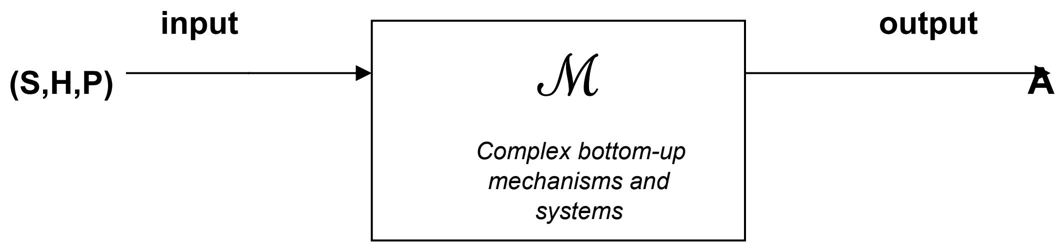

Figure 3.4 Mechanism of artistic appreciation suggested by experimental aesthetics.

where 'S' are subjective variables (e.g., prior knowledge, expectations, etc.), 'H' is the context of presentation of the object (museum, gallery, theatre, church, etc.), 'P' is the objective properties of the object, 'A' is the artistic (aesthetic) response, and $\mathcal{M}$ is a complex process involving both the bottom-up mechanisms and systems involved in the processing of the objective properties of objects and the top-down mechanisms and systems involved in complex cognitive processes (e.g., knowledge related to art, etc.) and emotional processes.

I have already stated that the experimental programme of neuroaesthetics is based on a very weak conceptual basis, to put it mildly. However, it could happen that, despite its poor conceptual basis, the neuroaesthetic programme is justified empirically. That means, that the evidence would indeed suggest that what we call artistic appreciation is reduced to processes with regard to specific cerebral cortex in response to objective properties of artworks. In conclusion, neuroaesthetics, once again, is wrong.

3.2.1.2 Empirical evidence

Neuroaesthetics—as we will see—tends to ignore relevant research in other areas of neuroscience research. For example, there is a small but very active field within experimental psychology that studies the mental processes involved in artistic perception. Although there are still more doubts than certainties, the evidence accumulated so far is very clear in one respect—artistic appreciation is a complex process that cannot just be reduced to the way specific cerebral cortices process objective (sensory) properties of the objects.

There are, in particular, two variables that without doubt effectively influence artistic appreciation. First, numerous studies clearly show that the level of artistic expertise or experience modulates or influences artistic behaviour, ranging from preference scale scores to eye movement during the observation of a painting. Second, although in this case the experiments are less numerous, there is clear evidence that the context of presentation of an artwork (e.g., museum, gallery, laboratory, etc.) also modulates or influences artistic appreciation. The following cases serve as a small example of this (for a more complete review of the influence of artistic knowledge and the context of presentation on artistic appreciation processes, see Bullot & Reber, 2013; Jacobsen, 2006; Leder, Belke, Oeberst & Augustin, 2004; Locher, Martindale, & Dorfman, 2006; Locher, 2011, 2014; Silva, 2012):

a) Providing participants with information on the style of abstract painters increases positive ratings in subjects. However, this increase in preferences is not observed in participants with a high level of artistic experience (Belke, Leder & Augustin, 2006).

b) There is a positive correlation between the evaluation of a painting ('goodness'), and the ease with which the observer can infer the author's intention in creating that painting. That means that the easier it is to attribute an artistic intention to a painting, the more positive is the evaluation of that painting (Jucker & Barrett, 2011).

c) Art experts find drawings made by artists and children (up to 11 years) more interesting and enjoyable than drawings made by adolescent (14 years) and adult non-artists. However, this tendency is not observed when drawings are being judged by non-art experts. What is significant is that the group of experts is better able to point or evaluate the drawings in a similar way. This cannot be monitored by the group of non-experts, where more inequality can be seen in the evaluations (Haanstra, Damen & van Hoorn, 2013).

d) Visitors to a museum usually evaluate those artworks more positively (in terms of beauty) that they know than artworks that they do not know (von Lindern, 2008).

e) Subjects report higher values of preference and interest in the context of the evaluation process if a painting comes with a description by the artist of the work, compared to when the same work is presented to the same recipients without the written explanation (Specht, 2008).

f) There is a positive correlation between scores of quality, value, and preference and the time available to the subject to judge the poem or painting of an artist—the longer is the evaluation time, the higher are the scores for quality, value, and preference (Kruger, Wirtz, Van Boven & Altermatt, 2004).

g) Eye movements differ between art experts and non-experts. While experts pay more attention to general patterns and relationships between the different elements of a painting, non-experts tend to focus on the individual elements of the painting (Pihko et al., 2011; Quiroga & Pedreira, 2011; Nodine, Locher & Krupinski, 1993). In other words, experts and non-experts look at a painting in different ways.

h) Participants award higher scores for interest and aesthetic enjoyment when paintings are presented with title than when they are presented without title, as long as the title facilitates the processes of comprehension (Millis, 2001; see also Leder, Carbon, & Ripsas, 2006).

i) The titles in the paintings influence the patterns of ocular movements used to explore the painting and the duration of the eye fixations (Kapoula, Daunys, Herbez & Yang, 2009).

j) The presentation of artworks as copies ('fakes') of original works, independently of their true status (i.e. regardless of whether the work is effectively a copy or whether it is an original) negatively modulates, in non-experts, variables such as perceptual quality, emotional value, pleasure of inspection, the desire to possess the work, and the opinion about the artistic talent of the creator of the work (Wolz & Carbon, 2014; see Huang, Bridge, Kemp & Parker, 2011).

k) Among the experts, the originality of an artwork determines how they aesthetically evaluate it (e.g., the quality they attribute to it); this is not so among non-experts. In particular, experts, unlike non-experts, prefer paintings that are complex and non-figurative (Pihko et al., 2011, Hekkert & van Wieringen, 1996).

l) Experts and non-experts differ in their assessments of popular art and 'high' art. While the former prefer high art and justify their preferences in terms of the objective properties of the works and cognitive challenges, non-experts prefer popular art and justify their preferences in terms of emotional responses (Winston & Cupchik, 1992; see also Augustin & Leder, 2006).

m) Observing an original artwork or its digital reproduction (computer or slide) modulates the hedonic value (pleasant/unpleasant, interesting/non-interesting) associated with the work. However, the original difference/reproduction does not affect the values associated with the qualitative properties of the works, suggesting that the hedonic value associated with a work does not depend exclusively on the objective qualities of the works but also on the context of presentation (Locher, Smith & Smith, 2001).

n) Among the visitors to a museum, the intensity of the aesthetic experience of an artwork is modulated by the ability to interpret the social value of that artwork in the context of one's own culture and general culture (López-Sintas, García-Álvarez & Pérez-Rubiales, 2012).

Although it is still very interesting and relevant that most of this evidence is replicated in neuroscientific experiments, it is nevertheless a reason why the neuroscientific study of aesthetic appreciation should not be confused with neuroaesthetics:

i) To assess whether the presentation context effectively modulates aesthetic appreciation, Kirk and colleagues selected a total of 200 abstract (nonfigurative) paintings. Half of these works were presented to the subjects as belonging to a museum of modern art (Louisiana Museum of Modern Art); the other half were presented as works done by experimenters with a computer program (Adobe Photoshop). The subject’s task was to judge on a scale of 1 to 5 the appealing and aesthetic value, while their brain activity was recorded by a functional magnetic resonance imaging scanner (fMRI). The results confirm that the subjects give a higher score to works attributed to a museum of modern art and that this modulation of the context on artistic appreciation correlates to the differences in the activation levels of the prefrontal cortex (PFC), particularly in the medial orbitofrontal cortex (mOFC) and the ventro-medial PFC (vmPFC).

The authors attribute these differences to the different reward expectations generated by a painting in an art gallery and those generated by a computer-generated image by a non-artist (Kirk, Skov, Hulme, Christensen & Zeki, 2009b).

ii) In order to assess whether there are differences between adopting an 'aesthetic' attitude towards painting and adopting a 'pragmatic' attitude towards the same work, Cupchik and colleagues presented the same works to two groups of people, with the difference that some had to adopt an aesthetic attitude and the other group a pragmatic attitude towards the art works. Aesthetic attitude, according to the authors, requires the viewer “to approach the paintings in a subjective manner, experiencing the mood of the work and the feelings it evokes, and to focus on its colours, tones, composition, and shapes" (Cupchik, Vartanian, Crawley & Mikulis, 2009, p. 86). On the other hand, pragmatic attitude requires the viewer “to approach the images in an objective and detached manner to obtain information about the content of the painting and visual narrative" (Cupchik et al., 2009, p. 86). In comparison to a pragmatic attitude, adopting an aesthetic perspective on painting increases activity in the insula (a key area in the processing of emotions) and in the left lateral PFC (llPFC) (a key area in the top-down processes of cognitive control). The authors of the study conclude by stating: “our results suggest that aesthetic experience is a function of the interaction between top-down orienting of attention and bottom-up perceptual input” (Cupchik et al., 2009, p. 90).

iii) Huang et al. (2011) divided the experimental subjects into two groups. Both groups were presented a series of 53 portraits by Rembrandt—25 categorised as authentic, 25 as forgeries, and three as computer-generated images. Both groups observed the same portraits; the difference was that if one picture was categorised as authentic for one experimental group, the other group observed the same picture categorised as forgery. What they found is that assuming that a picture is a falsification—regardless of the true status of the picture—leads to an increase in activity in the right frontopolar cortex (rFPC) and the precuneus, also in the right hemisphere. There is also an increase in functional connectivity between the PFC and the lateral occipital complex (LOC). In the case of works presented as copies, the participants generated several hypotheses about what distinguished the copies from the authentic works.

If a work is assumed to be authentic, there is an increase in activity in the medial orbitofrontal cortex (mOFC; see Kirk, Skov, Christensen & Nygaard, 2009a).

The authors of the study conclude: "The brain areas which we find are activated by assignment of authenticity, emphasize the cognitive element of viewing artwork" (Huang et al., 2011, p. 6).

iv) One of the major challenges of aesthetics is to explain the great variability of responses existing between individuals—what one individual finds artistically exciting may leave another individual indifferent at best. In order to evaluate this situation, Vessel and colleagues designed the following experiment: 16 subjects had to evaluate a series of paintings (109) on a scale of 1 to 4 according to the emotional impact ('gut response') that each painting evoked in them. This evaluation was to serve as a recommendation for the curator of a museum regarding which of the 109 paintings to buy for the museum. A score of 4 meant that the image had drawn a strong emotional response from the observer, who had strongly recommended the purchase of the artwork.

In the first place, they were able to confirm the great variability of response in relation to the emotional impact associated with a painting: few paintings received the same evaluation by the subjects. Second, perhaps the most interesting point, is that they found that the intense aesthetic experiences linked to artworks involve the activation of a set of areas associated with the so-called Default Mode Network—a system of brain areas involved, among other things, in mental processes of self-referencing through the integration of sensory (perceptual), emotional, cognitive (particularly of goals and expectations), and autobiographical information (Sheline et al., 2009, Spreng & Grady, 2009; Figure 3.5). In particular, they found that intense aesthetic experiences correlate with the activation of the anterior medial PFC (aMPFC), posterior cingulate cortex (PCP), left superior frontal gyrus (LSFG), left inferior frontal gyrus, pars triangularis (IFGt), and left orbitofrontal cortex (LOFC).

As the authors of the study point out: "Aesthetic experience involves the integration of neurally separable sensory and emotional reactions in a manner linked with their personal relevance" (Vessel, Starr & Rubin, 2012, p. 1). Furthermore, they postulate:

> *"Such experiences are universal in that the brain areas activated by aesthetically moving experiences are largely conserved across individuals. However, this network includes central nodes of the DMN [Default Mode Network-author´s note]*

that mediate the intensely subjective and personal nature of aesthetic experiences, along with regions reflecting the wide variety of emotional states (both positive and negative) that can be experienced as aesthetically moving" (Vessel et al., 2012, p. 11).

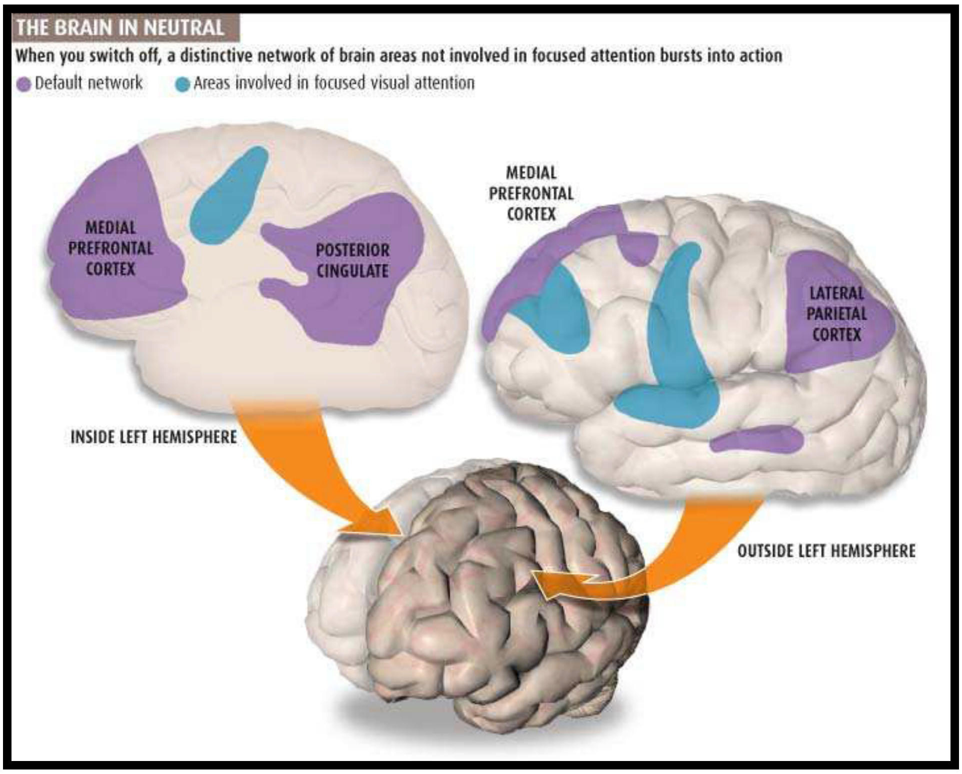

Figure 3.5 Schematic representation of the main areas that make up the Default Mode Network (from: http://www.iqmindware.com/wiki/focus-mind-wandering).

v) Continuing the study by Belke and colleagues (see Belke et al., 2006), Lengger and colleagues found that providing subjects with information on the styles used in both figurative and abstract (non-figurative) pictures facilitates the understanding results in a decrease in the activity in the cortex of the left hemisphere (Lengger, Fischmeister, Leder & Bauer, 2007).

vi) Wiesmann and Ishai (2010) show that a short introduction to cubism prior to the experiment facilitated the recognition of objects in cubist paintings by subjects (compared to those who did not receive the training); this facilitation is correlated with an increase in activity of the parahippocampal cortex—an area related to the processing of spatial relationships between objects (context). This suggests that knowledge about an artistic style modifies the processes involved in the perception of artworks (Wiesmann & Ishai, 2010).

vii) Finally, Bhattacharya reports differences in the oscillations of the theta band in the PFC (bilateral) between artists and non-artists, both when subjects were asked simply to observe works of art and when they were asked to mentally visualise the same works (Bhattacharya, 2009).

3.3 Psychological models of artistic appreciation

Based on these studies and other research evidence, different psychological models of artistic appreciation have been proposed that seek to account for the various individual (e.g., experts vs non-experts), contextual (e.g., museum versus reproductions), and social factors that modulate artistic appreciation.

Without doubt, two of the most influential models are those proposed by Bullot and Reber (2013; Figure 3.6) and by Helmut Leder and colleagues (Leder et al., 2004, Figures 3.8 and 3.9).

The model proposed by Bullot and Reber (2013) distinguishes three moments during the artistic appreciation of an artwork: a) basic exposure ('basic exposure'), b) the design perspective ('design stance'), and c) the artistic understanding ('artistic understanding') (Figure 3.7).

Basic exposure means the first perceptual and semantic elaboration of the work and the automatic emotional responses it provokes. At this point, the artwork is not distinguished from any other visual (or auditory, textual, etc.) stimulus. Categorising this stimulus as an artwork corresponds to the second stage—the design perspective. This second stage is characterised by a more cognitive processing of the work, involving artistic and historical knowledge related to the properties of the work and its creation process.

Finally, artistic understanding is characterised by a theoretical elaboration of the work and its artistic-historical context. In this stage, the work is contrasted with artistic-historical theories (hypotheses) relative to art in general (and to the work in particular). The experienced emotions are related to this cognitive ('epistemological') process of testing.

The psycho-historical model of art appreciation proposed by Bullot and Reber (2013) is depicted in figure 3.6 below.

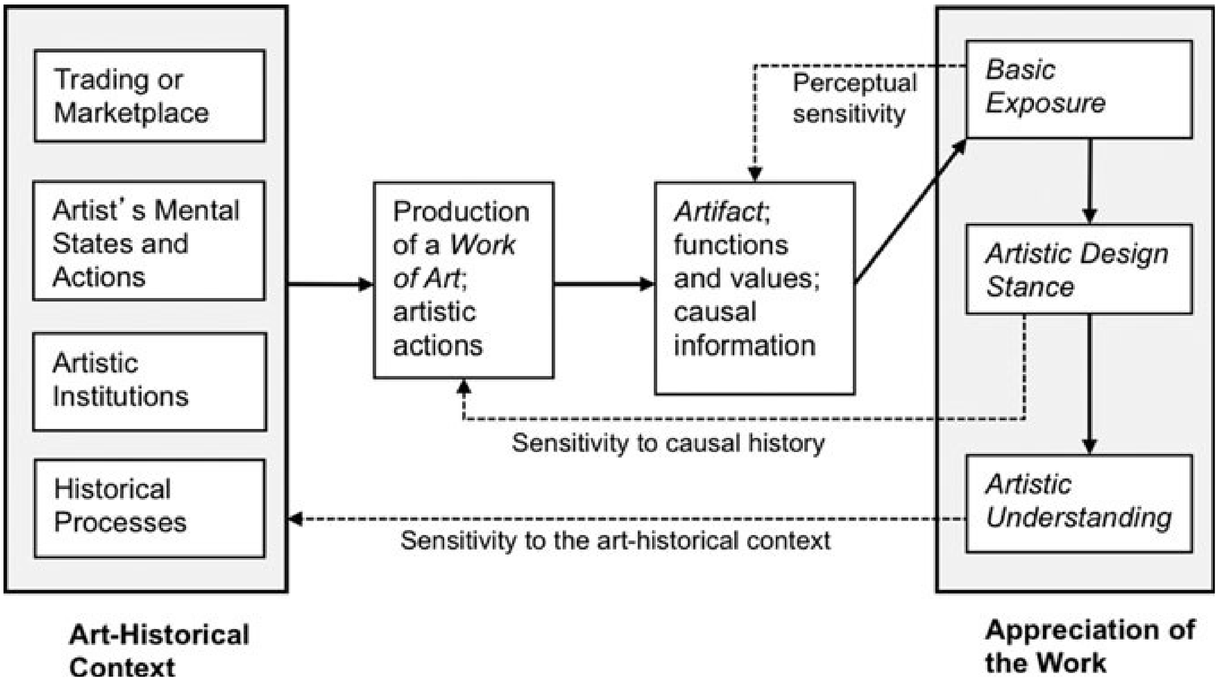

Figure 3.6 The psycho-historical framework for the science of art appreciation.

In the figure above "solid arrows indicate relations of causal and historical generation. Dashed arrows indicate information-processing and representational states in the appreciator's mind that refer back to earlier historical stages in the production and transmission of a work" (Bullot & Reber, 2013, p.126).

The three modes of art appreciation suggested by Bullot and Reber's (2013) model are indicated in figure 3.7 below.

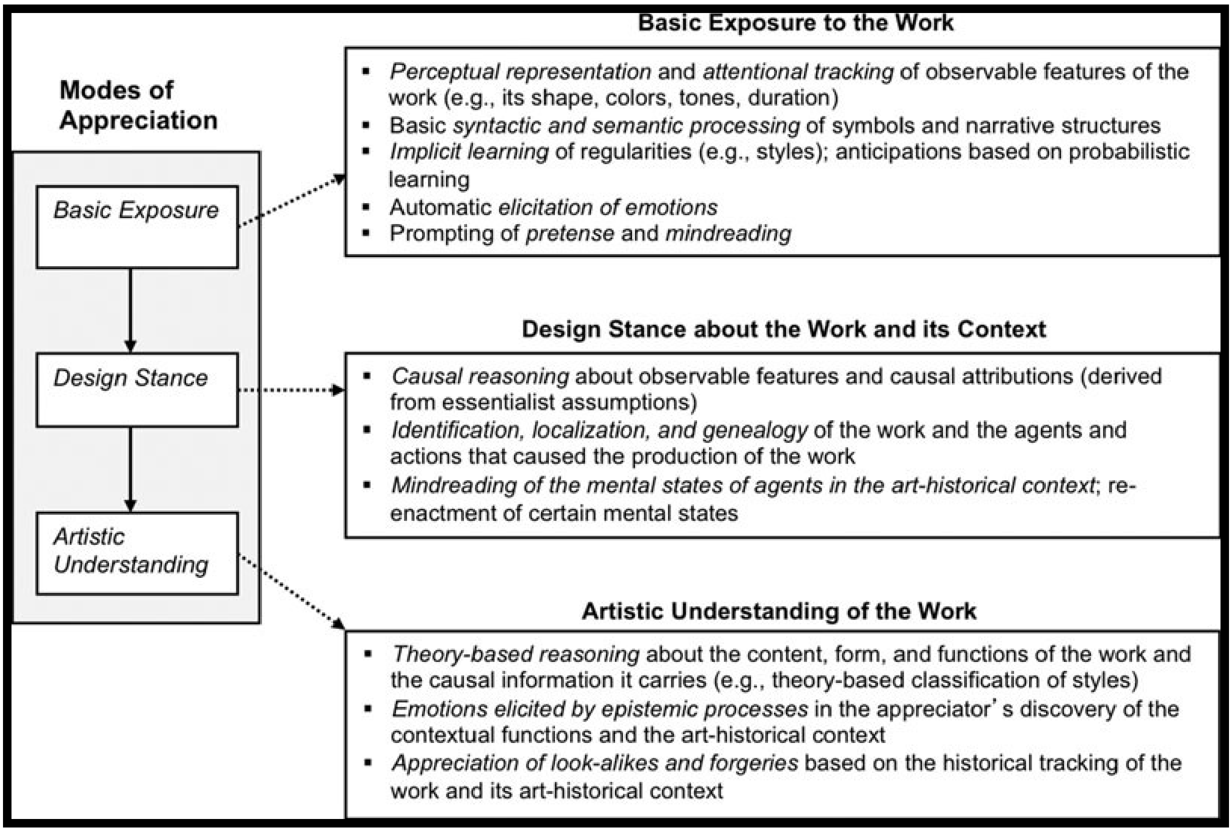

Figure 3.7 The three modes of appreciation of an artwork posited by the psycho-historical framework (from: Bulot & Reber, 2013).

In this figure solid arrows depict necessary conditions. Dashed arrows specify typical mental activities elicited by each model. The model of aesthetic experience that Leder and colleagues have proposed, are shown in the figure 3.8 below.

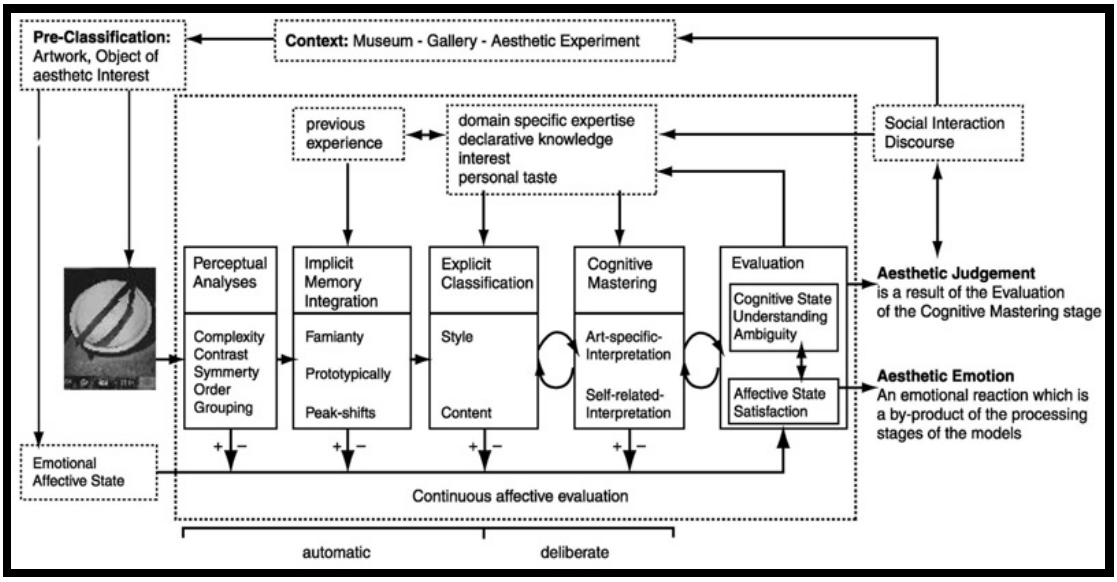

Figure 3.8 The model of aesthetic experience proposed by Leder, Belke, Oeberst and Augustin (2004).

The other model that is influential in experimental aesthetics is the one developed by Helmut Leder and his team. In contrast to the model proposed by Bullot and Reber, Leder and colleagues identify five stages or processes involved in artistic appreciation: a) perceptual analysis, b) implicit classification, c) explicit classification, d) cognitive mastering, and e) evaluation. In turn, these processes give rise to two different results—aesthetic (artistic) judgments and aesthetic (artistic) emotions. In other words, for Leder and colleagues, what we call artistic appreciation is the conjunction of aesthetic (artistic) judgments and emotions (Leder et al., 2004, Figures 3.8 and 3.9).

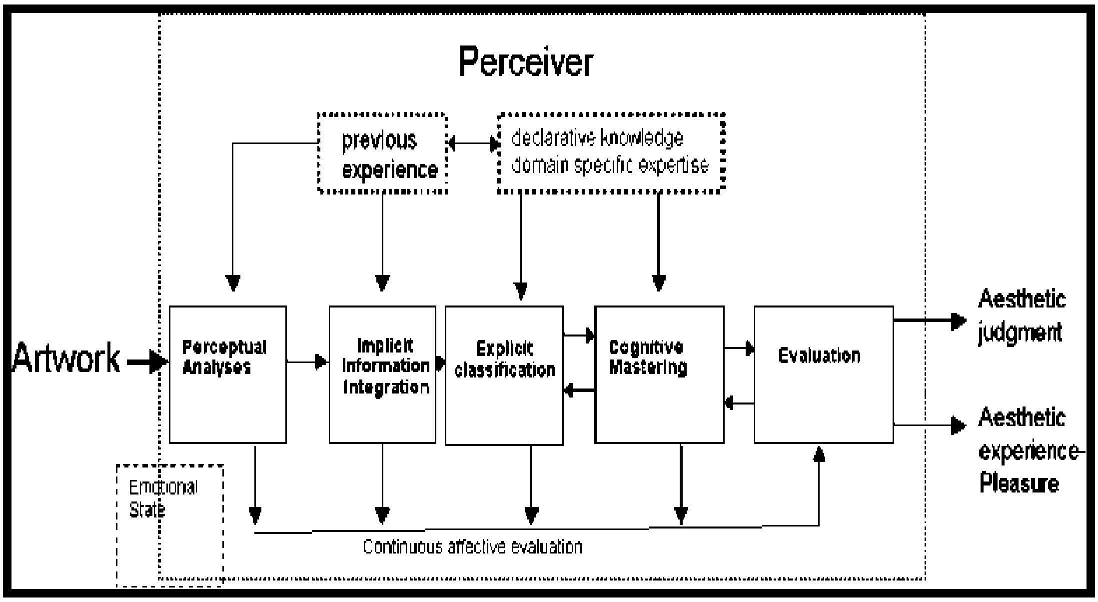

Figure 3.9 Processing stages in aesthetic experiences (adapted from Leder et al., 2004).

Apart from the differences between the models, both propose that artistic appreciation—far from being a function of the objective properties of objects and how they modulate activity in modality-specific cortices—is an extremely complex process involving both physical stimuli and subjective (e.g., expertise, emotional state, etc.), contextual (e.g., museum vs graphic reproduction), and social variables. In particular, both models presuppose that artistic experience implies a prior knowledge by the 'appreciator' that allows him to effectively recognise an object as an artwork: "Aesthetic experiences often require a pre-classification of an object as art" (Leder et al., 2004, p.493). Both models assume that appreciating an object artistically implies possession of an explicit (implicit) domain-specific knowledge about the properties (intrinsic and contextual) that characterise the objects we call artwork and what their function is. In other words, the models specify what kind of experiences (cognitive and emotional) these objects must provoke in viewers or 'appreciators' to qualify as works of art. Summarising, in both models, it is assumed that artistic appreciation is a complex process that is basically the result of two factors:

a) a specific knowledge that allows the subjects to correctly classify an object as an artwork and, b) a process of contrast between (i) the set of expectations learned about what is an artwork (properties) and what we should have to experience (functions) in front of an artwork and ii) our concrete experience with a particular artwork.

Likewise, both models abandon the idea of beauty as the only criterion to evaluate the aesthetic experience and incorporate, as possible artistic effects, cognitive processes and 'negative' emotions such as anger, displeasure, sadness, and so forth (Bullot & Reber, 2013; Leder et al. 2004; Silva, 2012).

In Section 3.3, I propose a possible brain mechanism involved in artistic appreciation, and I also derive two epistemological implications of the models and psychological evidence reviewed above that seem to be relevant for the development of a neuroscience of artistic appreciation:

a) As we have seen, one of the most consistent findings in experimental aesthetics is the degree of art-related ('domain-specific') expertise ('expertise'), because the specific knowledge of the 'expert' is an important factor in the modulation of the artistic experience. Consequently, it is important for neuroscientists to control the level of specific knowledge of the experimental subjects. One way to control this knowledge is to provide the experiment subjects with a small pre-experiment training session in which they are given information about the artwork (style, content, function, etc.) that they are about to witness (Augustine, Defranceschi, Fuchs, Carbon & Hutzler, 2011). The neuroscientific articles that report having offered this type of training to experiment subjects, although few in number, actually show both behavioural and brain-triggering differences between subjects who received training and those who did not (Lengger et al., 2007; Weismann & Ishai, 2010).

b) From my definition of artwork (φ-artwork) (see Section 2.7.4; Table 2.3) and the analysis of experimental literature, it can be concluded that a neuroscientific theoretical postulate about artistic appreciation should contain at least the following variables: R = f (P, S, A, C, T, B),

where:

The φ-artwork provokes an (aesthetic) reaction R, and R again is determined by a number of variables. Thus, R is a function of at least the following, the:

P = physical ('objective') properties of artworks (e.g., symmetry, luminosity, etc.)

S = semantic properties of artworks (e.g., themes)

A = antecedents of the subjects (e.g., artistic knowledge, age, sex, socioeconomic levels, etc.)

C = context of the viewing experiment (e.g., laboratory)

T = task (e.g., levels of preference, beautiful/not beautiful, etc.)

B = brain systems and mechanisms underlying the art appreciation process (e.g., dorsolateral PFC (dlPFC), orbitofrontal cortex (OFC), insula, etc.)

In summary the probalistic model underlying this theoretical approach can be specified as follow:

R_Aes (aesthetic reaction) given φ-Art is a probalistic function (f) of the variables (P, S, R, C, T, B).

In other words:

The φ-artwork (stimulus) x, with physical (objective) P properties (e.g., luminosity, brightness, contrast, etc.), and semantic properties S (e.g., portrait, landscape, etc.) is going to provoke in the subject with background A (woman, student of art history, etc.) and doing task T ('press the key "1" if it seems like a good artwork, otherwise press the key "2"', etc.) in context C (laboratory, etc.) an activity in the brain system (or area) B (orbitofrontalcortex (OFC), intercalated cells (ITC), etc.).

Of course, this can be improved, as some variables can be deepened. In particular, it is possible to identify several components in B (cerebral mechanisms and systems).

For example, a wide range of literature shows the influence of the levels (gradients) of serotonin and dopamine on different cognitive and affective processes (Amin et al., 2005; Cools, 2008a; Cools, Roberts & Robbins, 2007; Dayan & Huys, 2009). In this regard, the evidence shows that cognitive flexibility ('task-switching flexibility')—that is, the ability to change between different rules or cognitive strategies according to the way the demands of a task change—depends in particular on the activity of the D2 dopaminergic receptors of the prefrontal cortex (von Holstein et al., 2011; Cools, 2008b; Roberts, 2008).

I believe that by uncovering the variables involved in the neural and cognitive process of artistic appreciation, the formulation of new hypotheses about how these variables are related is encouraged and the current issues and limitations associated with neuroaesthetic research into art appreciation becomes clear. For example, from the proposed formalisation, it is clear that neuroscientific research regarding the processes involved in artistic appreciation suffers from at least three methodological limitations that are insurmountable at the present time:

i) *Time*: Certain works and artistic genres need a lot of time to be appreciated. It is imposible, both technically and analytically, to record the brain activity of a subject as he or she listens to an opera or symphony, reads a novel or story, watches a play, etc.

ii) *Materials*: Although the materials used to create an artwork constitute an essential criterion for the classification of an object as an artwork and therefore also influence our cognitive and emotional responses (Locher, Smith & Smith., 2001). In the visual arts (e.g., paintings), neuroscientists are often restricted to reproductions of digitally processed works, and in cases where brain activity is recorded with PET, fMRI, or MEG, these images must be presented through the reflection of mirrors.

iii) *Context*: Not only is the context in which an artwork is presented an essential criterion for defining an object as an artwork, but the context of presentation also modulates our cognitive and emotional responses to artworks (Kirk et al., 2009b; von Lindern, 2008). However, for obvious reasons, the vast majority of neuroscientific experiments are carried out in laboratories. Next, I suggest the existence of a cerebral mechanism and system involved in artistic appreciation in general, regardless of the artistic work under consideration.

3.4 A brain system for artistic appreciation: the 'artistic task-set'

One of the most important implications of my definition of φ-artwork is that in order to correctly categorise an object x as an artwork, it is essential to know the conventions (F, T, M, H, O) established by the artistic world (A, E) (see Section 2.5, 2.6, 2.7, Table 2.3) for the production of the works. In other words, the process that allows us to categorise an object as an artwork is mediated by a system of learned knowledge, and not—as postulated by neuroaesthetics—a process guided by the objective properties of objects.

This difference is not trivial since, as we have seen, one of the most consistent findings in experimental aesthetics is that artistic knowledge effectively modulates the artistic (aesthetic) responses of the subjects. Not only does this system of conventions allow subjects to categorise an object as an artwork, but it is also based on that knowledge (implicit or explicit) that subjects evaluate and respond to concrete works (Bullot & Reber, 2013; Leder et al., 2004).

Thus, the perceptual and semantic processing of an artwork is preceded by a set of knowledge and expectations that modulate how the object (the artwork) is processed, both perceptually and semantically.

In this sense, Lisa and Jeffrey Smith present the hypothesis that every act of artistic appreciation is a function of the artistically specific knowledge possessed by the appreciator—what they call 'aesthetic fluency'.

> *Aesthetic fluency is the knowledge base concerning art that facilitates aesthetic experience in individuals. It can be acquired through direct instruction, but it can also be learned through experience. This experience occurs primarily in art museums, but it also occurs by reading books, visiting galleries, and on the Internet (Smith & Smith, 2006, p.50).*

Summarising the above, we could schematically represent the process of artistic appreciation in the following way (Figure 3.10, to be compared with Figures 3.1 and 3.2).

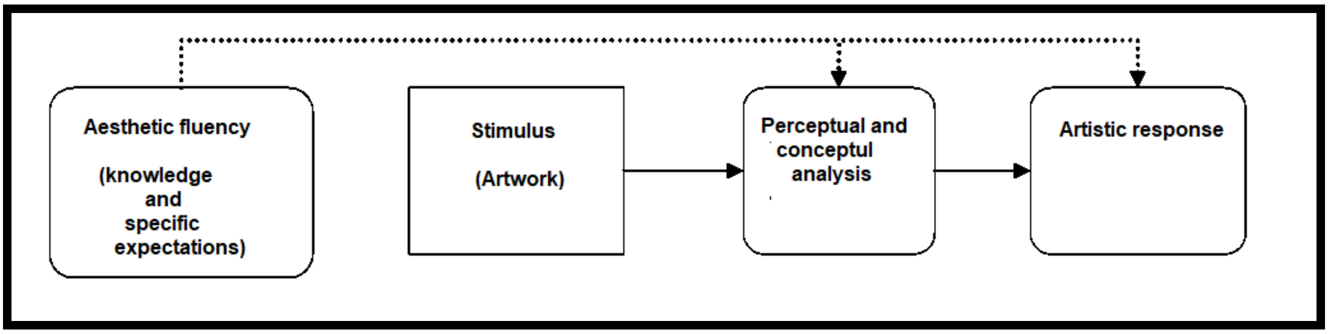

Figure 3.10 Schematic representation of artistic appreciation. The dotted arrow indicates 'modulation'. This is undoubtedly a schematic representation and should be considered for illustrative purposes only.

However, the models of Bullot and Reber (2013) and the hypothesis of the 'aesthetic fluidity' proposed by the Smith couple are both models and psychological hypotheses about a 'black box'. Is it possible to translate them in neuroscientific terms? Although highly speculative, I would like to propose the following theoretical postulate on the cerebral mechanisms of artistic appreciation (Figure 3.11).

Theoretical postulate*: "Artistic appreciation is a mediated process (directed) by the efferent projections ('top-down') from the 'artistic task-sets' to the areas of perceptual, emotional and semantic processing."*

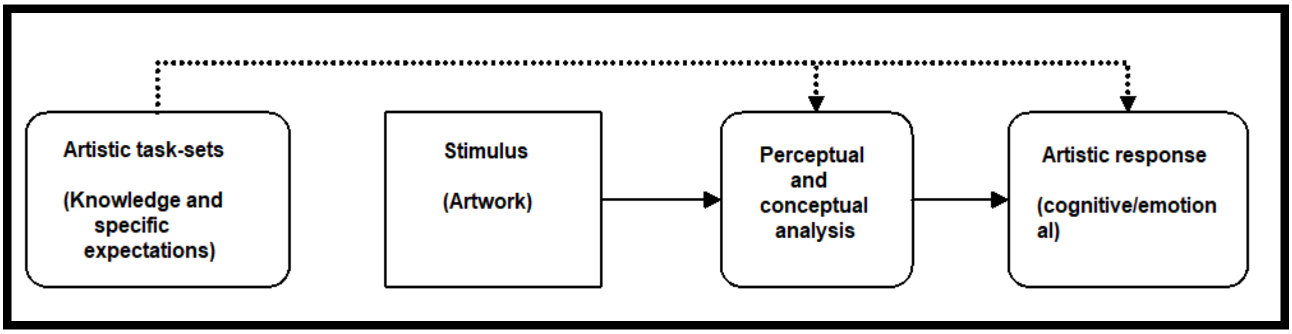

Figure 3.11 Artistic appreciation as a function of artistic 'task-sets'. The dotted arrow indicates 'modulation'.

The task-set "consists of information about which stimulus attributes to attend to, and the important conceptual criteria, goal states, and condition-action rules. It reflects not only which items are subject to process, but also how the subject plans to process the items and the rules of the to-be-performed task" (Bunge & Wallis, 2008, xv). In other words, task-sets are a set of abstract rules, explicitly (e.g., via education) and/or implicitly (e.g., by virtue of experience) learned, which coordinate and control the moment-to-moment implementation of cognitive (attention, memory, perception, etc.) and emotional resources, according to the demands and objectives of a task and the context and expectations (Bunge & Wallis, 2008; Dosenbach et al., 2006; Sakai, 2008a, 2008b).

The 'task-sets' are probably the specific function of a system consisting of prefrontal, parietal, and temporal areas, each one involved in a different type of processing. Evidence suggests that: a) regions of the lateral dorsal PFC are involved in the creation, implementation, and online maintenance ('working memory') of abstract rules; b) regions of the medial PFC are involved in the control and actualisation ('update') of the task-set; c) regions of the parietal cortex are involved in executive control and attention processes related to the implementation of the rules; and d) regions of the temporal cortex are the locus of storage (Monsell, 2003; Sakai, 2008a, 2008b; Stoet & Snyder, 2008; Wallis, 2007b). Dosenbach and colleagues propose the following model of the system involved in the implementation of the task-set, but the authors themselves acknowledge that other models can be equally consistent with the empirical evidence (Dosenbach et al., 2006, Figures 3.12a and 3.12b):

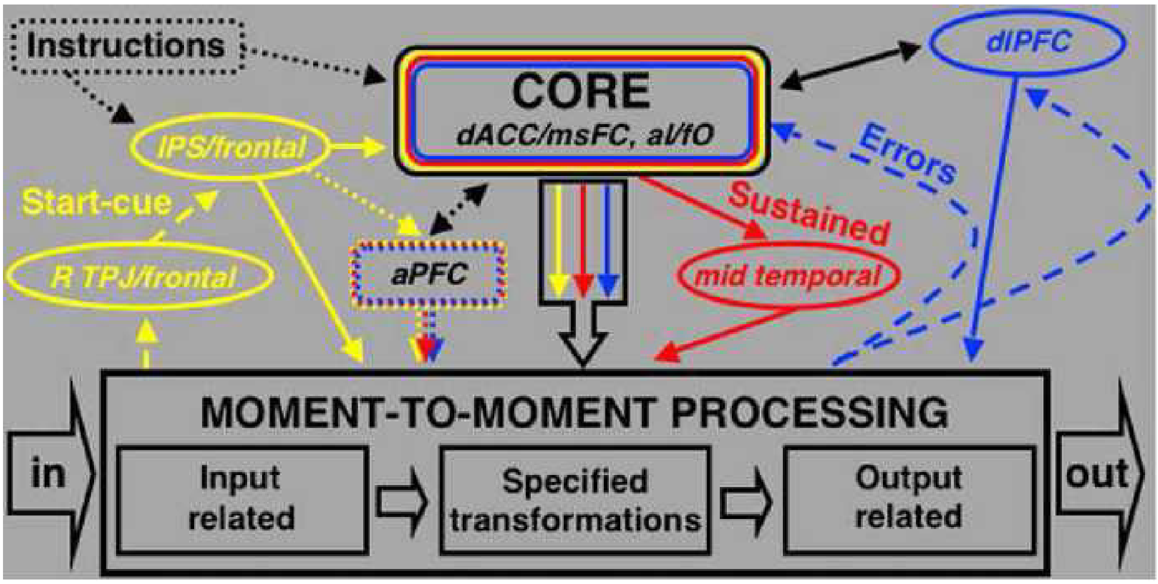

Figure 3.12a Model of the brain system responsible for the task-set.

Areas and brain systems involved in the implementation of task-sets. (Dorsal lateral PFC), IPS (intraparietal sulcus), aPFC (anterior PFC), aI (anterior insula), fO (frontal operculum), dlPFC, rTPJ (right temporoparietal junction). The yellow signals are involved in the implementation of the task-set; red colour; maintenance; in the blue colour, the feedback signals (control of error) (from: Dosenbach et al., 2006).

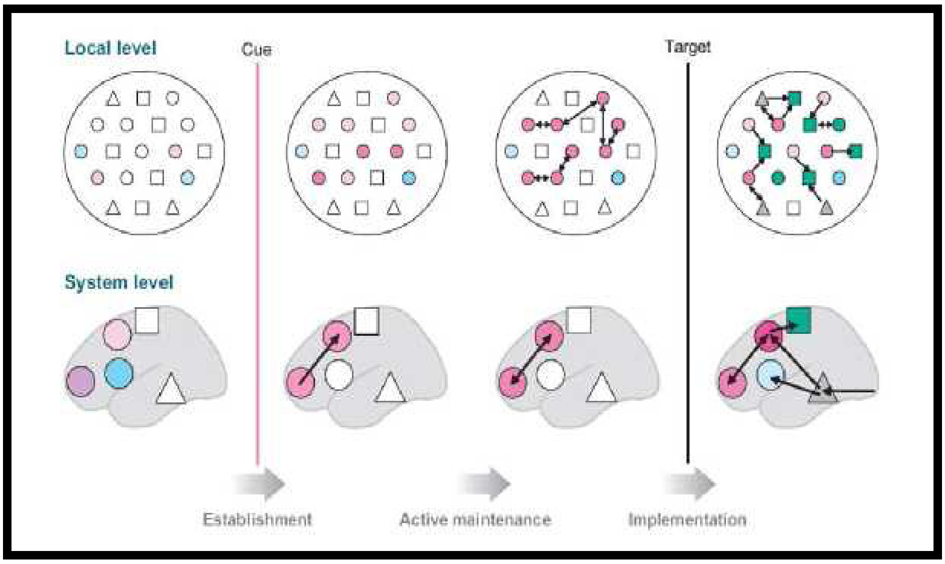

Figure 3.12b Representation of the task-set dynamic. During the delay, the task-set will be updated dynamically based on the afferent projections (bottom-up) (from: Sakai, 2008a).

The available evidence suggests that a) the implementation, maintenance, and moment-to-moment control of the task-set depend on efferent signals (top-down) from the frontal, prefrontal, and parietal regions towards the modality-specific cortices, and those dedicated to emotional and semantic processing; and b) the moment-to-moment update of the task status (e.g., errors) depends on bottom-up projections from the cortices of specific, emotional, and semantic modalities to the frontal, prefrontal, and parietal regions (Benoit, 2008; Dosenbach et al., 2006; Rowe, Hughes, Eckstein, & Owen, 2008; Sakai, 2008a, 2008b).

Finally, Sakai proposes a model of the dynamics of task-set (Figure 3.12 b), of which I would like to highlight two points: a) that the establishment (or institution) of the task-set occurs before the presentation of the stimulus (Brass & Cramon, 2002) - which is consistent with the idea of 'aesthetic fluency' as a modulator of artistic appreciation (see figures 3.10 and 3.11); and b) that the implementation of the task-set, although 'guided' by the efferent projections from the frontal and prefrontal regions, also depends on the afferent connections from the emotional and semantic modal-specific cortices (Sakai, 2008a).

Likewise, Koechlin and colleagues identify different regions within the PFC, each one involved with the modulation of stimulus processing according to different types of information (previous experiences, presentation context, etc.). The regions in the

PFC are activated at different times, and the time-line of the activations suggest that some processing relating to previous experience and the presentation context occur even before the actual presentation of the stimulus (Koechlin; Ody & Kouneiher, 2003; see Figures 3.13, 3.14, and 3.1).

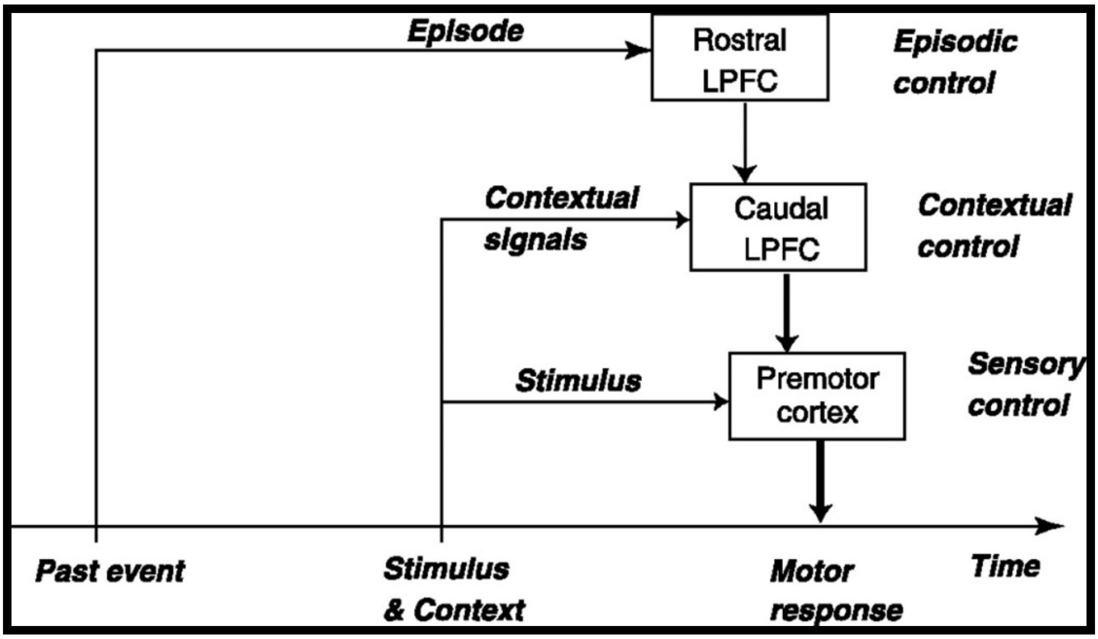

Figure 3.13 The prefrontal cortex and cognitive control (from: Koechlin et al., 2003).

The figure illustrates the systems in the prefrontal cortex that are involved in cognitive control during the presentation of a stimulus in a particular context and episode as suggested by Koechlin and colleagues.

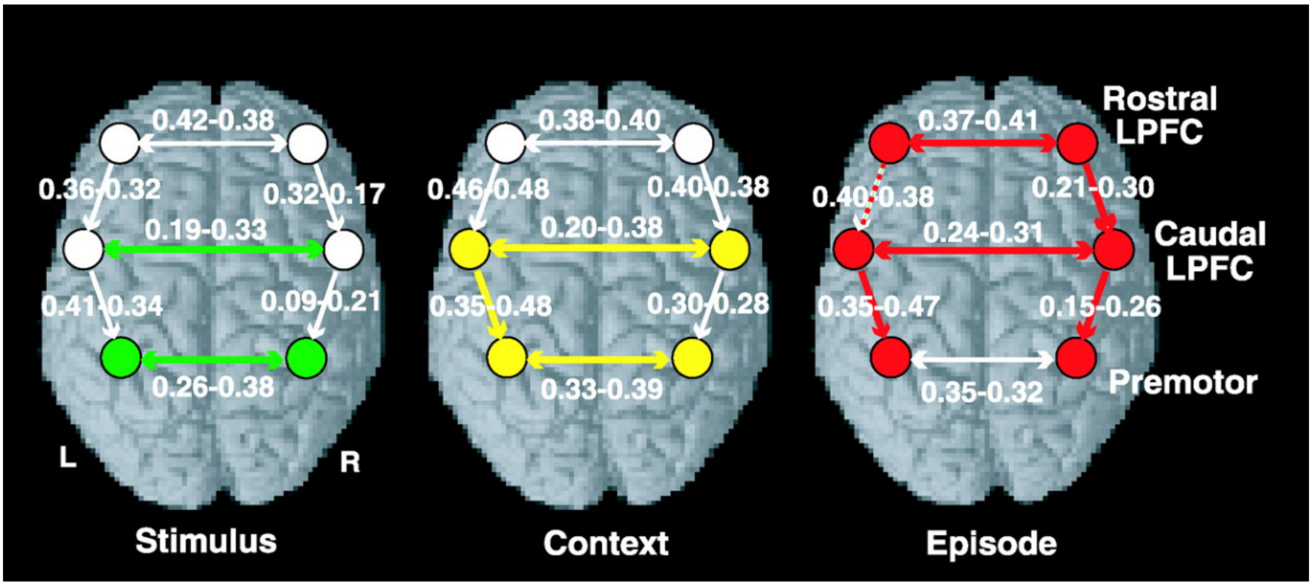

Figure 3.14 The prefrontal cortex and cognitive control (from: Koechlin et al., 2003).

In summary, the task-set is a set of functions that could influence the mechanisms for cognitive control in general, and those for the cognitive control involved in the artistic appreciation ('aesthetic fluency') in particular.

In the specific case of artistic appreciation, I propose the existence of a sub-class of task-sets that I call the artistic 'task-set'. In the case of this particular class of task-set, the information they contain, which guides both the processes of categorisation—"x is a φ-artwork"— a well as the cognitive and emotional expectations associated with that kind of stimulus (the function of x is to provoke cognitive/emotional states), can be grouped into two sets: i) the system of conventions F, T, M, H, O and ii) information relating to the artistic world (A, E) (see Section 2.5, 2.6, 2.7). In other words, the artistic task-sets contain the following information: a) if x is an artwork, then x is composed of the materials m, formal resources f, topics t, in habitat h, and its objective is to provoke cognitive/emotional states and b) x is the product of the artistic world a.

Depending on the artistic task-set, we could define an artistic experience as the result of the process of contrasting the knowledge and expectations activated by an artistic task-set (top-down process) with the perceptual, semantic, and emotional processes evoked by the presentation of a particular stimulus (φ-artwork) (bottom-up process) (Figure 3.15).

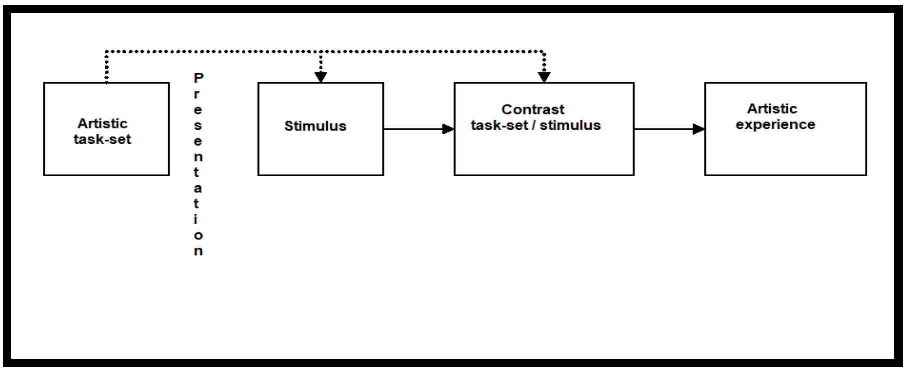

Figure 3.15 The artistic experience—schematic representation of the processes involved in artistic appreciation (experience).

As we have seen, the artistic expertise of a subject is one of the most consistent modulators of artistic experience. Leder and colleagues define the expertise in relation to specific information (about 'art') possessed by a subject, on which the cognitive processes are based, which enable the correct classification of an object x as an artwork (Leder et al., 2004). The idea of 'artistic task-sets' suggests an alternative definition. An artistic task-set is composed of the system of conventions necessary to categorise and respond to an object x as an artwork. Thus, we could define artistic expertise as a continuum—at one extreme, we would have the ideal expert with a specific artistic task-set for each artistic-system (Figure 3.16), while at the other extreme, we would have the inexperienced novice who has not received a formal education in art or who does not have much experience in art (e.g., he does not regularly attend art museums). The novice possesses a single artistic task-set and applies it indiscriminately to different objects (Figure 3.17). Thus, we can define the degree of artistic expertise ('expertise') of a subject as the number of specific artistic task-sets that the subject possesses.

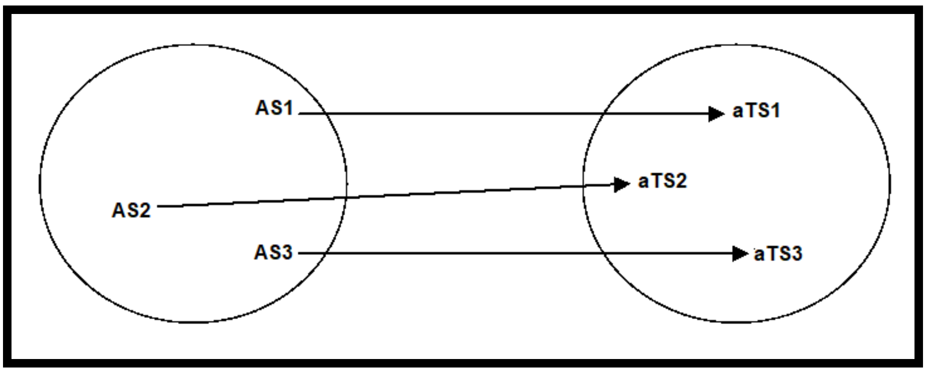

Figure 3.16 Artistic task-set relation (ideal expert); AS (artistic system), aTS (artistic task-set).

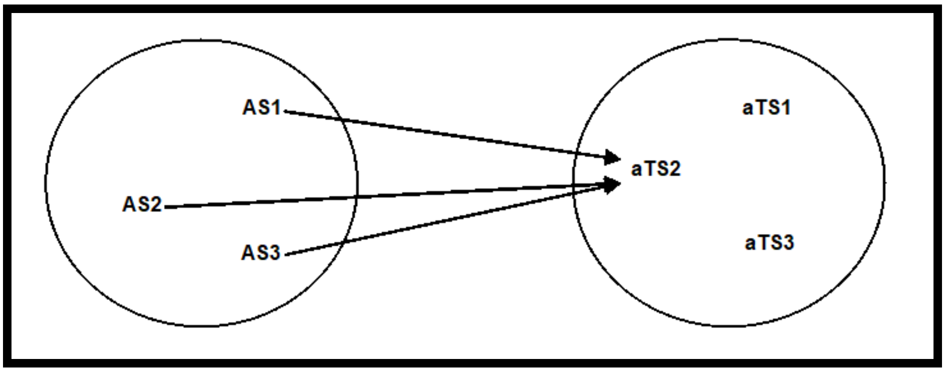

Figure 3.17 Artistic task-set relation (inexperienced ideal); AS (artistic system), aTS (artistic task-set).

3.4.1 Evidence in favour of the 'artistic task-set'

Although there is no direct neurocognitive evidence in favour of or against the existence of artistic task-sets, there is indirect evidence that gives plausibility to the theoretical postulate of artistic task sets. First, as we have already seen (Section 3.2.1.2), there is evidence that artistic expertise, the context of presentation, and how an artwork is categorised (original vs. copy), modulate the artistic experience, and that this modulation is correlated with differences in the activity of regions of the frontal, prefrontal, and parietal cortices identified as components of the system involved in the task-sets (Bhattacharya, 2009; Huang et al., 2011; Kirk et al., 2009b; Wiesman & Ishai, 2010). In particular, Cupchik and colleagues show that the same stimulus can evoke different attentional and emotional responses, depending on the demands of the task that a subject has to perform (aesthetic attitude vs pragmatic attitude) (Cupchik et al., 2009).

An interesting experiment was carried out by Hoefel and Jacobsen (2007), in which subjects were divided into two groups. The first group simply had to observe a series of geometric figures and were asked to respond whether or not the figure contained a circle ('viewing condition'). The second group had to perform the same task as the first group, with the difference that they were asked to adopt an aesthetic attitude towards the figures—that is, they contemplated the beauty of the figures ('contemplation condition'). This aesthetic contemplation did not require any explicit evaluation of the subjects.

The brain activity of both groups (evoked potentials or EVP) was recorded with an electroencephalogram (EEG) of 32 channels. The stimuli used in Hoefel and

Jacobsen's experiment are shown below.

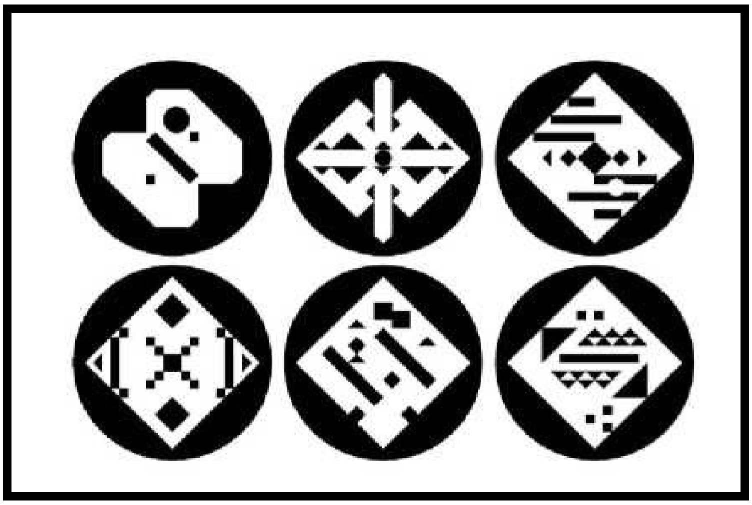

Figure 3.18 Example of figures used by Hoefel & Jacobsen. The figures in the top row contain a circle, while the figures in the bottom row do not (from: Hoefel & Jacobsen, 2007).

The analysis of the evoked potentials reveals a late positivity (500 to 770 ms after the stimulus presentation) lateralised in the right hemisphere, but only in the participants who received the instruction to contemplate the figures aesthetically ('contemplation condition'). This Late Lateral Positivity (LLP) is characteristic of processes that require some type of evaluative categorisation of the stimulus (Cacioppo, Crites & Gardner, 1996; Schupp et al., 2000) and is associated with activity in the PFC (Cunningham, Espinet, DeYoung & Zelazo, 2005).

In summary, this work basically shows that a) brain activity associated with aesthetic categorisation processes does not occur spontaneously but requires a deliberate intention on the part of the 'appreciator', and b) the activity associated with aesthetic categorisation processes is correlated with activity in the PFC (see Cupchik et al., 2009).

Although they have not yet generated many scientific hypotheses or theoretical postulates in art or aesthetics, there is extensive literature on the role that task-sets play in a wide variety of tasks, especially in tasks involving the relevant processes for artistic appreciation, such as visual perception, eye movements, and emotional responses. Here are a couple of examples (for more complete reviews, see Bunge & Wallis, 2008; Sakai, 2008a):

Visual perception: Certainly, one of the problems that provokes the most debates in the neuroscience of vision ('visual neuroscience'), is whether:

- The initial coding of visual information in the visual cortex is a process guided exclusively by afferent projections ('bottom-up'), with efferent processes associated with 'higher' functions ('top-down', e.g., attention) being only involved in later stages of processing; or
- The initial coding of visual information is influenced by the cognitive and behavioural objectives of the subject.

To answer this question, Ansorge, Kiss, Worschech and Eimer (2011) used an experimental visual search design with two stimuli—'cue' and 'target'—both composed of five geometric figures, four of them grey and the rest in one of five colours (red, green, yellow, purple, and turquoise). In the case of the 'target' stimulus, the geometric figures were bars that could be oriented horizontally or vertically. The relationship between the 'cue' and 'target' stimuli was organised around two parameters: a) colour of the coloured figures: the non-grey figure in both the 'cue' stimulus and the 'target' stimulus could be the same colour (e.g., both coloured figures in yellow—'matching') or of different colours (e.g., red in the 'cue', yellow in the 'target'—'non-matching'); and b) spatial location of the coloured figures: the location of the coloured figure in both stimuli could be i) random, ii) same location (SP), or iii) diagonally opposite (DP) (see Figure 3.19).

The subjects had to keep their eyes fixed on the central point and report the orientation of the coloured bar of the 'target' stimulus, while the evoked potentials ('event-related potentials') were revoked with a 23-channel EEG. In particular, the signal N2pc was analysed, which is an increase in the negative signal in the posterior electrodes that appears very early after the appearance of the stimulus (200 ms) and that is believed to reflect selective attention processes (Eimer, 1996).

Prior to each session, the subjects were informed whether the colour of the 'cue' stimulus was the same as that of the 'target' stimulus ('matching' or 'non-matching'), as if the location in the 'cue' stimulus of the coloured figure was used to predict the location of the coloured figure in the stimulus 'target' (random, SP, or DP).

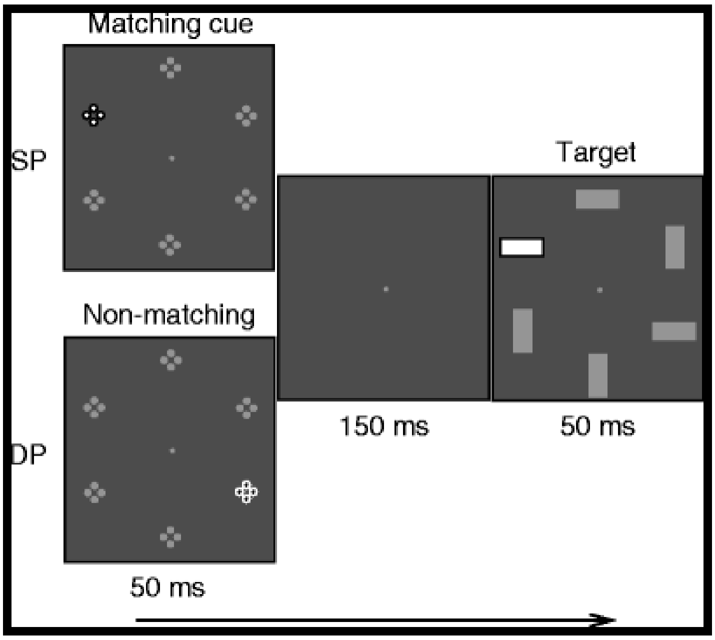

Figure 3.19 Example of the sequence of events in an SP (same cue-target position) trial with target-colour matching singleton cue (top) and in a DP (different cue-target positions) trial with non-matching colour singleton cue (bottom) (from: Ansorge, Kiss, Worschech & Eimer, 2011).

In the figure above, the cue and target arrays contain one colour singleton among the grey items. The target-colour matching and non-matching colour singletons are shown in white with a black outline and in black with a white outline, respectively.

The behavioural analysis revealed that the subjects took longer to respond and made more errors about the orientation of the bar when the colours of the stimulus 'cue' and the stimulus 'target' differed ('non-matching'). In turn, the analysis of the evoked potentials revealed that this worse performance in the 'non-matching' cases correlated with a decrease in the N2pc signal. This shows that the perceptual saliency of a stimulus (colour vs non-colour) is not enough to capture the attention of a subject if that property is not relevant to the task being performed. The authors conclude:

> *the current findings demonstrate that feature-specific task sets have a strong impact on the rapid selection of salient visual objects. Attentional capture by these objects is not primarily determined by bottom-up salience, but by whether or not they match a currently active setting for target features. This task-set contingent attentional capture is rapid and involuntary and precedes subsequent strategic mechanisms such as the active disengagement of attention (Ansorge et al., 2011, p. 122).*

Eye movements: A set of particularly important results show the influence of the task-set on the pattern and duration of the eye movements since, as we have seen, the recording of eye movements during tasks of aesthetic appreciation is a technique widely used in experimental (aesthetic) psychology (Kirk et al., 2009a, Massaro et al., 2012, Pihko et al., 2011, Quiroga & Pedreira, 2011). For example, Mills and colleagues used a series of digital images of natural or everyday scenarios (Figure 3.20). The participants had to observe these images under four different experiment conditions: free view, memorisation, placidity evaluation (pleasantness), and visual inspection (visual search). It is important to mention that these experiment conditions only prescribed a general objective and did not impose any object of the image on the subject.

What they report is that both the spatial patterns of eye movements (e.g., the amplitude of saccades or rapid eye movements) and the duration of eye fixations were modified depending on the objective of the task to be performed (Mills, Hollingworth, Van der Stigchel, Hoffman & Dodd, 2011; for similar data, see Castelhano, Mack & Henderson, 2009)

Figure 3.20 Examples of the images used by Mill et al., 2011.

Perception of emotion: Both empathy and the so-called 'theory of mind'—that is, the competence to infer the mental (inner) states of other humans, particularly their emotional states—are proposed as necessary mechanisms for aesthetic and artistic appreciation (Keen, 2007). In particular, Di Dio and Gallese (2009) as well as Freedberg and Gallese (2007) propose that the system of mirror neurons—believed to be a critical neuronal system in the processes of attribution and understanding of mental and emotional states in other individuals (Rizzolatti & Sinigaglia, 2008)—is a necessary component in the processes of artistic appreciation (Di Dio & Gallese, 2009, Freedberg & Gallese, 2007). While the role of mirror neurons in artistic appreciation is by no means clear, it is clear that to enjoy certain φ-artworks, the ability to perceive emotional states in other individuals is fundamental.

Zaki and colleagues show that the way in which the emotional state of another individual affects us depends on the task we are performing (Zaki, Weber & Ochsner, 2012). In this experiment, the experiment subjects had to observe a series of videos in which people talked about autobiographical events of different emotional valence (cheerful (marriage), sad (death of loved one) etc.) with different emotional expressivity (from little expressive to very expressive). An experiment group had to watch these videos while paying attention to the emotional states of the subjects appearing in the video (‘emotional expressivity task'). The other experiment group had to observe the same videos while paying attention to the direction of the look (right or left) of the subjects appearing in the videos (‘eye-gaze task’).

What they found is that, in the experimental subjects of the 'emotional expressivity task', the emotional expressivity of the subjects appearing in the videos was correlated with a greater activity in the medial PFC and in the cingulate cortex—both regions associated with our ability to infer emotional states in other individuals (also the regions associated with the task-set).

On the other hand, in the experimental subjects of the 'eye-gaze target’, the level of expressivity of the subjects appearing in the videos was correlated with an increase in the activity in the “somatosensory cortex, fusiform gyrus, and the motor cortex—regions associated with monitoring sensorimotor states and biological motion” (Zaki et al., 2012, p.1) of other individuals (Figure 3.21). As the authors point out, “perhaps the most striking finding of the current study is that perceivers’ task set strongly determined the neural correlates of target expressivity, and that expressivity effects recapitulated the main effect differences between top-down and bottom-up social information processing” (Zaki et al., 2012, p. 7).

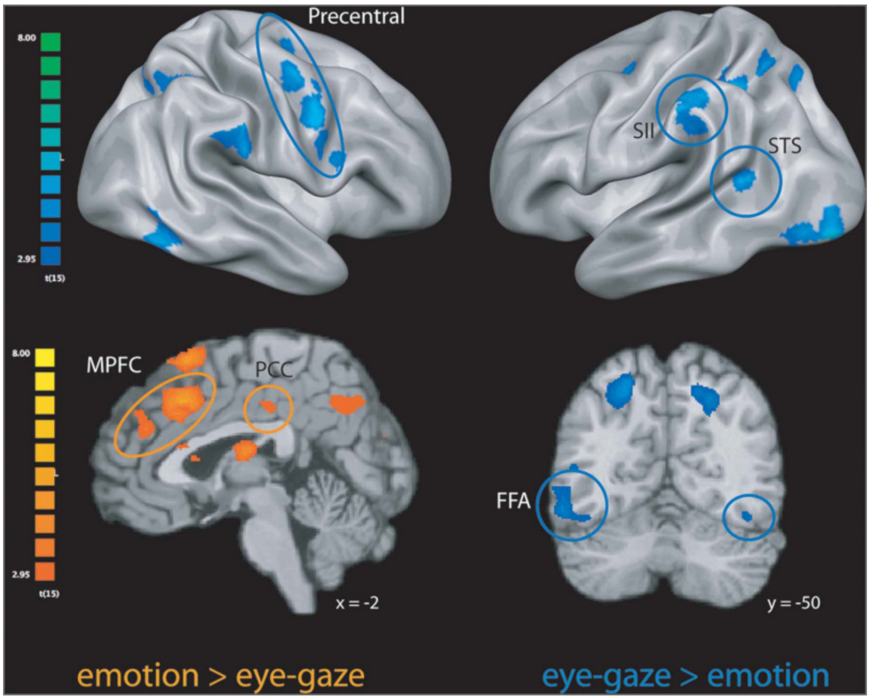

Figure 3.21 Differences in the active areas during the 'emotional expressivity task' (orange) and the 'eye-gaze taskt' (blue). MPFC (medial PFC), PCC (posterior cingulate cortex), FFA (fusiform face area), SII (secondary somatosensory cortex), STS (superior temporal sulcus), Precentral (precentral motor cortex) (from: Zaki et al., 2012).

Switching: To conclude, a common practice in experimental aesthetics is to present to the subjects a series of stimuli (images) of different artistic movements (impressionism, expressionism, realism, etc.). However, I would like to suggest that the appreciation of φ-artworks is an operation managed by artistic task-sets; thus, presenting to the experimental subjects in the same session a variety of φ-works of art belonging to different artistic systems can cause in the experimental subject a series of changes (*switch*) between different artistic task-sets, with associated implications. For example, Monsell showed that controlling task-set changes—that is, our ability to reconfigure our cognitive and emotional capacities—leads to costs in response times and increases the error rate (Monsell, 2003, Monsell, Yeung & Azuma, 2000, see Piguet et al., 2013, Stoet & Snyder, 2008). Undoubtedly, these costs associated with task-set changes should be taken into account in experimental designs and even in the design of museums and art exhibitions.

Finally, I would like to propose two simple experiments that would help us to contrast the hypothesis of the artistic task-sets. Needless to say, other (possibly even better) designs are possible. These experiments are explained with reference to literary works of art, but their experimental designs can easily be adapted to other artistic stimuli as well (Figure 3.22):

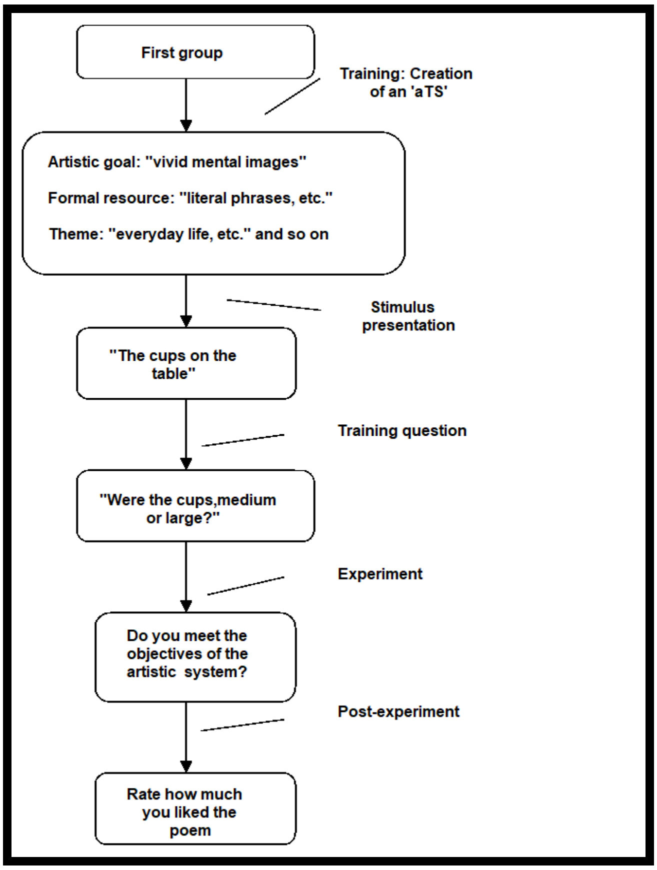

Figure 3.22 Schematic representation of the experiment design. Only one of the experiment groups is displayed.

a*) Experimental subjects*: Two groups.

b) *Stimuli*: Short poems (e.g., four verses). The two groups are evaluated using the same poems.

c) *Task*: To evaluate the extent to which the poem meets the objectives of the artistic system or to evaluate the extent to which they find the poem artistically satisfactory.

d) *Pre-experimental training*: The objective of this training is to create a new artistic task-set in the experiment subjects. The content of the artistic task-sets will differ in the two groups:

i) Group A: the artistic aim of the poems is to create vivid visual images;

ii) Group B: the artistic objective of these poems is to propose a novel idea.

The objective is that the subjects of the first group should focus on generating mental images to evaluate the poems while the subjects of the second group should focus on the semantic content of the poems. To ensure that the subjects in both groups perform the task, after the presentation of the poem, each participant would be asked a question. For example, suppose the poem has the following verse: "the cups on the table." The first group would then be asked: "Were the cups large, medium, or small?", and the second group would be asked: "Are the cups metaphors of loneliness?" The questions would continue in this way, and will only occur during the training phase, not during the experiment (this method has been adapted from Holmes et al., 2008).

e) *Experiment:* The participants of both groups evaluate the poems according to the assigned task while their brain activities are recorded. This experiment can be adapted to different methods of recording brain activity—from potential evoked to brain-imaging techniques (FMRI, PET, MEG, etc.).

f) *Data*: This experiment enables the measurement of the brain activity before presentation of the stimulus (to see if there are differences between the different artistic task-sets), during the presentation of the stimulus (to see if there are differences in stimulus processing), and post-presentation (to see if there are differences in stimulus evaluation processes).

g) *Post-experiment*: The poems are shown again to the participants and they are asked to judge each poem according to how much they liked it, feel excited, and so on (without record of brain activity).

If the theoretical postulate of the artistic task-set does not deviate much from the target, it has interesting epistemological implications, of which two can be highlighted:

1) Most experiments in experimental aesthetics are based on the reports of so-called 'naïve' subjects (without formal training or with little artistic experience), or focus on a comparison between experts and naïve subjects. However, as I have been saying, the idea that artistically naïve subjects exist is at least misleading, especially if one considers that the so-called 'naïve' subjects are mostly university students. Most

likely, each of these 'naïve' subjects has an implicitly acquired artistic task-set (Smith & Smith, 2006) based on which he responds/processes (cognitively and emotionally) and evaluates works of art presented to him. This suggests that the results obtained with naïve subjects should be considered critically and that, in order to avoid these drawbacks, subjects participating in this class of experiments should receive some type of prior training (Leder et al., 2004).

2) The neuroscience of artistic appreciation would gain considerably if different laboratories would focus on the appreciation of φ-works of art of the same artistic system to discover the similarities and differences in the processes involved in the appreciation of φ-works of art of different artistic systems, and if different laboratories would focus on different perceptive modalities (e.g., vision, hearing, smell, etc.), in order to discover similarities and differences in how the brain processes different types of sensory information. One example is the work of the neuroscientist Alumit Ishai and his colleagues and the artist Robert Pepperell on the mechanisms involved in the appreciation of what they call 'Indeterminate Art' (Fairhall & Ishai, 2008, Ishai, Fairhall & Pepperell, 2007; Pepperell, 2006, 2011; see also cubistic works by Wiesmann & Ishai, 2010).

So far, I have been concerned with showing that the processes involved in the appreciation differ greatly from neuroaesthetic mechanisms. However, in the following section, I review the best research results that the methodology of neurosaesthetics has so far offered and propose a neuronal theoretical approach that attempts to explain some of the functions that the mental images can have in the processes of appreciation of literary works of art.

3.5 Mental images and emotions. Towards an understanding of a literary phenomenon

Poem 'Daffodils' by William Wordsworth:

"I wandered lonely as a cloud/ That floats on high o'er vales and hills, / When all at once I saw a crowd,/ A host of golden daffodils;/ Beside the lake, beneath the trees,

Fluttering and dancing in the breeze. / Continuous as the stars that shine/ And twinkle on the milky way, / They stretched in never-ending line/ Along the margin of the bay:/
Ten thousand saw I at a glance, / Tossing their heads in sprightly dance.

The waves beside them danced, but they/ Out-did the sparkling waves in glee:/ A poet could not but be gay, / In such a jocund company:/ I gazed—and gazed—but little thought/ What wealth the show to me had brought:

For oft, when on my couch I lie/ In vacant or in pensive mood, / They flash upon that inward eye/ Which is the bliss of solitude;/ And then my heart with pleasure fills,/ And dances with the daffodils" (Wordsworth, 1807, Rpt. in 1994).

Both authors and reviewers have emphasised the meaning of mental images in literary artistic appreciation—in particular, in the relationship between mental imagery and emotional arousal. For example, in a recent essay, Nobel Prize winner for Literature Orhan Pamuk described the distinctive experience of reading a literary work as follows:

> *For me, to read is to create one's own mental film version of a text. We may raise our heads from the page to rest our eyes upon a picture on the wall, the scene outside the window, or the view beyond, but our minds do not take these things in: We are still occupied with filming the imaginary world in the book. To see the world imagined by the author, to find happiness in that other world, one must bring one's own imagination into play. By giving us the impression of being not just spectators of an imaginary world but in part its creators, a book offers us the creator's bliss in seclusion (Pamuk, 2008, p. 111-112).*

Examples of similar expressions by writers certainly abound (Eliot, 1932). The creation of vivid and novel mental images was even the central axis of the literary system called *Imagery* (Jones, 2001; Pratt, 2008).

Moreover, there is evidence to show that the use of mental imagery (e.g., visual, auditory, olfactory, etc.) by amateur poets correlates with the expression of different emotions; for example, the expression of sexual emotions correlates with the use of olfactory and tactile imagery.

This emphasis on the relationship between mental images and emotional impact of works of art is certainly not new. For Plato, for example, the capacity of imitation of poetry (*mimesis*)—that is, the ability of poetry to generate ornamental images that simulate real perceptions in readers (or listeners)—is the mechanism by which poetry provokes emotional responses (Plato, 2000, 602c).

Unfortunately, there is no direct evidence that the generation of mental images increases the emotional impact of a literary work, but there is some indirect evidence. For example, Holmes and colleagues present verbal descriptions of potentially dangerous events (e.g., being in the sea with a shark) to two groups of experimental subjects. One group had to simply process the text semantically; the other had to make the extra effort of mentally imagining the situation described. What they found is that the emotional impact (reports of anxiety levels) of a text is indeed greater if the one reading it makes the effort to mentally imagine the content of the text, in comparison with those who read the same text but only process it semantically (Holmes & Mathews, 2005; see also Holmes, Mathews, Mackintosh & Dalgleish, 2008b) Similarly, when subjects are asked to judge the emotional value of a combination of a photograph and a word (e.g., the photograph of a staircase with the word 'fall'), subjects who claimed to have imagined the scene to judge the emotional value of the stimulus reported higher values of emotional impact than those who verbally (semantically) analysed the relationship between photography and speech (Holmes et al., 2008b).

The authors of the study claim: "The results provided the clearest evidence of which we are aware that imagery does indeed have a significantly stronger impact on emotion, relative to verbal processing" (Holmes & Mathews, 2005, as cited in Holmes et al.,2008b, p. 406). In other words, authors and reviewers may be right when they emphasise the role of mental images in the emotional impact of certain literary works on readers. Now, what are mental images and why do they exert a greater impact on our emotions than the verbal (semantic) processing of a text? First, we take the time to define mental images and then, we try to determine how they can interact with emotions.

3.5.1 Mental imagery

Consider the following poem by Thomas Hardy:

“That was once her casement, / And the taper nigh,/ Shining from within there,/ Beckoned, ‘Here am I!’

Now, as then, I see her/ Moving at the pane;/ Ah; 'tis but her phantom/ Borne within my brain! -

Foremost in my vision/ Everywhere goes she; Change dissolves the landscapes, / She abides with me.

Shape so sweet and shy, Dear, / Who can say thee nay?/ Never once do I, Dear,/ Wish thy ghost away" (Hardy, 2006, p. 203).

Let us start with some definitions:

a) *Perceptual mental imagery* $=_{def.}$ *the experience of a perceptual (visual, auditory, olfactory, etc.) phenomenon in the absence of a sensory ('external') stimulus.*

b) *Mental affective imagery* $=_{def.}$ *the experience of feeling in the absence of emotional stimuli.*

It is important to clarify that by feeling is meant the conscious experience of an emotional response (see below). In this sense, the relationship of feeling/emotion is similar to that between sensation/perception.

Metaphorically, a perceptual mental imagery corresponds to the experience of 'seeing with the eyes of the mind', 'listening with the ears of the mind', and so on.

Although there are doubts about the brain mechanisms responsible for the generation of mental perceptual imagery as well as mental affective imagery, neurocognitive evidence suggests that the following theoretical postulate can be proposed:

i) Theoretical postulate*: A perceptual mental imagery occurs when the neuronal pattern of a perceptual property (e.g., colour, shape, taste, tone, etc.) is activated in the specific cortex area (e.g., visual, auditory, etc.) in the absence of a sensory stimulus* (Kraemer, Macrae, Green & Kelley, 2005; Kosslyn, Thompson & Ganis, 2006; Hubbard, 2010; Zatorre & Halpern, 2005).

The implication is that generating the perceptual mental imagery of an object (or a property of an object) and perceiving that same object (or that same property) involve the same neural substrate.

ii) Theoretical postulate*: An affective mental imagery occurs when the neural pattern of a feeling is activated in the barks responsible for generating feelings in the absence of an emotional stimulus or even a genuine emotional response (Damasio et al., 2000; Jabbi, Bastiaansen & Keysers, 2008).*

This implies similarly that generating the affective mental image of a feeling and experiencing the same feeling involve the same neural substrate. In the following section, in order to illustrate the evidence concerning the systems and mechanisms responsible for perceptual mental imagery, I dwell on the phenomenon of visual mental imagery (VMI), since this has received the most attention in neurocognitive research.

3.5.2 The eyes of the mind: the visual cortex and the mechanisms of VMI

Consider the following excerpt from Macbeth which illustrates the primary role that visual perception plays in human experience, Macbeth's soliloquy, act 2 scene 1 (Shakespeare,1606, Rpt. in 2016, p. 21):

Is this a dagger which I see before me, *The handle toward my hand? Come, let me clutch thee!* *I have thee not, and yet I see thee still.* *Art thou not, fatal vision, sensible* *To feeling as to sight? or art thou but* *A dagger of the mind, a false creation* *Proceeding from the heat-oppressed brain?* *I see thee yet, in form as palpable*	*As this which now I draw.* *Thou marshall'st me the way that I was going,* *And such an instrument I was to use.* *Mine eyes are made the fools o' th' other senses,* *Or else worth all the rest. I see thee still,* *And on thy blade and dudgeon gouts of blood,* *Which was not so before. There's no such thing.* *It is the bloody business which informs* *Thus to mine eyes.*
	(Macbeth Act 2, Scene 1—Shakespeare)

Primates—both human and non-human—are predominantly visually-based organisms. The visual cortex of monkeys, for example, is composed of approximately 40 anatomically and functionally distinguishable regions occupying about half (52%) of the whole cortex. In humans, the visual cortex accounts for 27% of the total surface of the cortex; in comparison, only 8% of the cortex is predominantly auditory, 7% somatosensory, and 7% motor. The remaining half is associated with emotional, cognitive, and linguistic processing (Kandel et al., 2013; van Essen, 2004; van Essen et al., 2001) (Figure 3.23; see Figure 1.14).

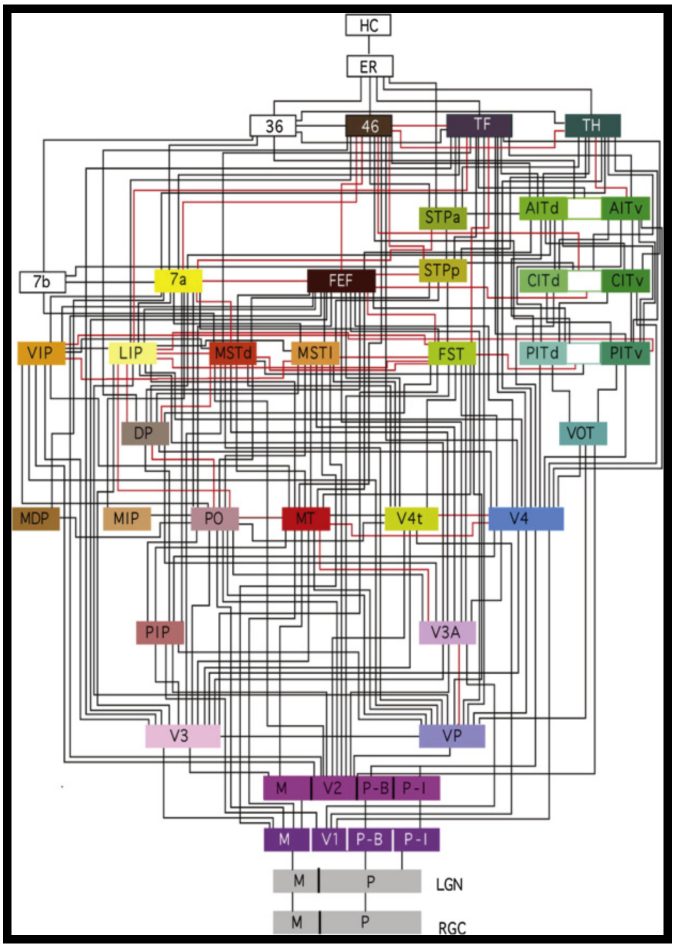

Figure 3.23 Hierarchical organisation of vision-related areas in the macaque cerebral cortex (from Felleman & Van Essen, 1991).

In this section, I briefly outline some of the properties of the visual cortex that are relevant for understanding the properties and mechanisms of mental imagery (for more information on the visual cortex, see Chalupa & Werner, 2004; Farah, 2004; Kandel et al., 2013; Milner & Goodale, 2006).

1) *Functional specialisation*: The different visual attributes (e.g., colour, shape, movement, texture, orientation, etc.) are processed in regions segregated anatomically from the functionally specialised visual cortex for the processing of each of the different visual attributes. For example, movement is processed in the MT/V5 area (Bartels, Logothetis & Moutoussis, 2008), colour in the sub-regions of the area V4 (Zeki & Marini, 1998), and the visual form of an object in the area IT (Tanaka, 2003). It is interesting that this anatomical and functional segregation is observed

early in the projections from the lateral geniculate nucleus of the thalamus to the visual cortex V1 (Casagrande & Xu, 2004; Sherman & Guillery, 2001).

2) Hierarchical processing: The visual cortex can be functionally divided into low-level, intermediate-level, and high-level processing areas (Farah, 2004; Ullman, 1996). Each level is defined by the ability of each area to process increasingly complex properties (abstract and global), probably through the integration and transformation of inputs from lower-level areas (Rolls, 2004, 2007). Basically, the low-level areas are responsible for processing the local attributes of objects such as local contrast, orientation, presence of edges and angles, and so on. The intermediate processing areas are responsible for processing surfaces, figure-ground contrasts, contours, and so on. Finally, high-level areas are responsible for the global form of objects and are involved in the processes of object recognition (Farah, 2004; Palmer, 1999) (Figure 3.24). The neural areas ('layers') of inputs and outputs of the cortex provide an anatomical criterion for determining the hierarchy of processing, since the afferent connections (feedforward) typically originate in the supragranular layers (Layers 2 and 3) and terminate in Layer 4, while the feedback connections originate in the infragranular layers (Layers 5 and 6) and terminate in the nongranular layers (Batardière et al., 2002; Bullier, 2004; Rockland, 2004; Ungerleider, Galkin, Desimone & Gattass, 2008).

3) *Feedforward and feedback processes*: A very interesting property of the visual cortex is that almost every area, at the same time that it sends out afferent projections ('feedforward'), receives efferent projections ('feedback') from the areas with which it is connected (Felleman & Van Essen, 1991; Kaas, 2004; Rockland, 2004). In other words, the projections between the areas of the visual cortex are reciprocal.

4) *Parallel Processing*: By parallel processing, we basically understand two characteristics of the visual cortex: a) the different visual properties of objects (e.g., shape, colour, movement, etc.) are processed in parallel systems of the visual cortex (Casagrande & Xu, 2004; Nassi & Callaway, 2009); and b) there are at least two large 'streams' of visual processing operating in parallel: i) the current dorsal or 'occipitoparietal' (Ungerleider & Pasternak, 2004), also called "vision-for-action" (Milner & Goodale, 2006) or "where and how" (Kravitz, Saleem, Baker & Mishkin,

2011), specialising in the necessary visual-motor transformations to 'translate' the visual information in motor programs and in the processing of the special location of visual stimuli; (ii) the ventral stream “occipitotemporal” (Ungerleider & Pasternak, 2004), also called “vision-recognition” (Milner & Goodale, 2006), specialising in the processing of visual attributes necessary for the visual recognition of objects (for evidence in favour of a subdivision of these currents into sub-currents, see Kravitz et al., 2011). Milner and Goodale claim that what distinguishes these two currents is not the type of information (e.g., visual properties versus spatial information), but rather the transformations carried out on the visual inputs (Milner & Goodale, 2006). In support of this hypothesis, there is evidence that populations of neurons in the IT temporal area (the key system for visual object recognition) process spatial information from the stimulus (Hung, Kreiman, Poggio & DiCarlo, 2005; Schawrzlose, Swisher, Dang & Kanwisher, 2008).

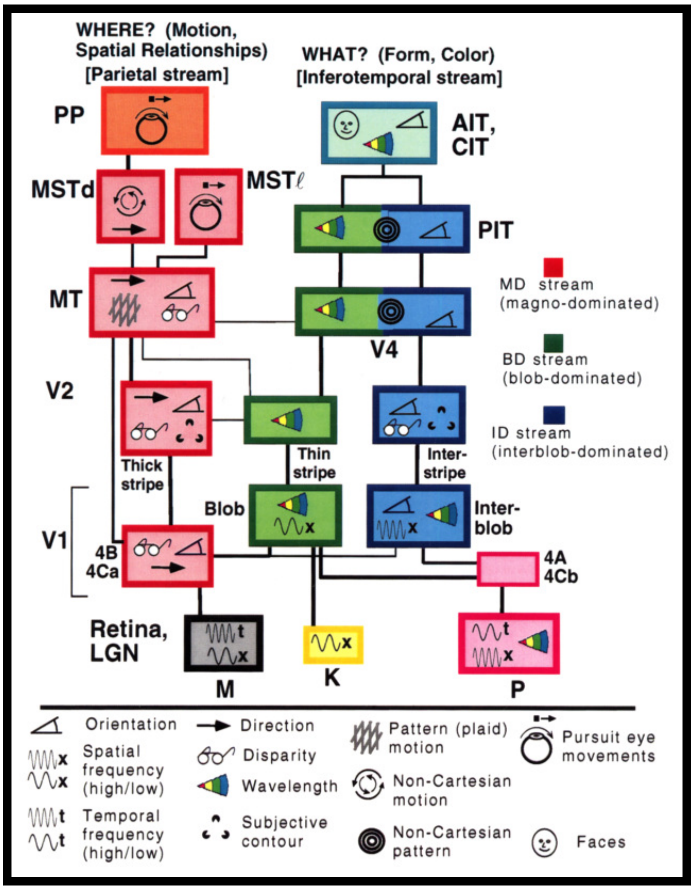

Figure 3.24 Schematic representation of the most representative areas of dorsal and ventral currents with their main properties (from: van Essen & Gallant, 1994).

5) Domain specificity: There is evidence that certain visual categories like faces, bodies, and places are processed along the ventral stream in specialised regions of the cortex. Specifically, recognition of an object as a face critically depends on a) the so-called 'fusiform face area' (FFA) and the 'occipital face area' (OFA), b) bodies in the so-called 'extrastriate body area' (EBA) and 'fusiform body area' (FBA), and finally c) the places in the 'parahippocampal place area' (PPA) and 'transverse occipital sulcus' (TOS) (Kanwisher & Yovel, 2006; Reddy & Kanwisher, 2006; Schawrzlose et al., 2008) (Figure 3.25).

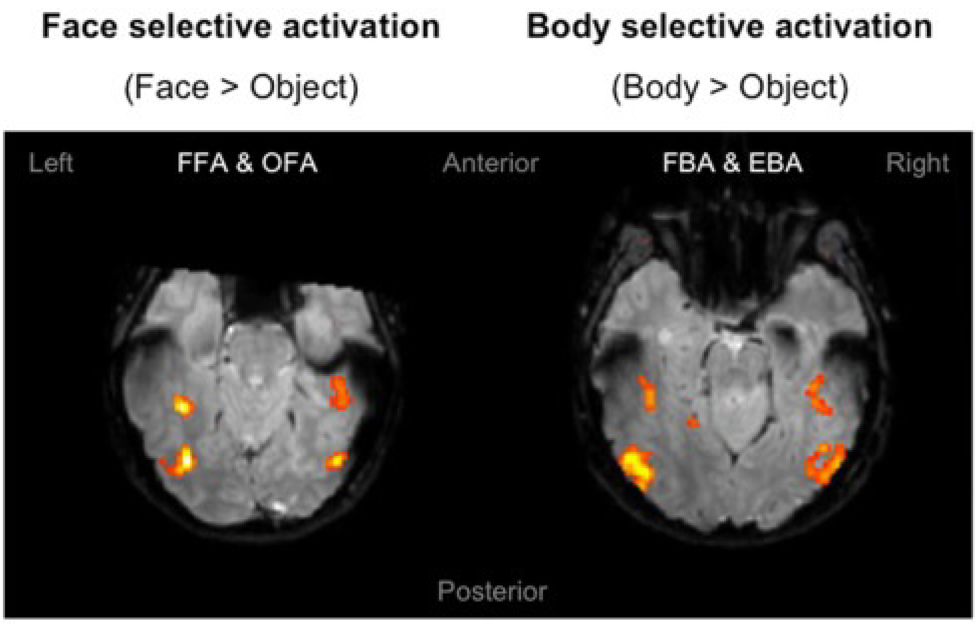

Figure 3.25 Cortex areas selectively activated by faces (FFA & OFA) and by bodies (FBA & EBA) (from: Schmalzl, Zopf & Williams, 2012).

Activity in these areas of specialised categories of objects contrasts with the activity in the so-called LOC and the 'posterior fusiform area' (PFA), which is specialised for the processing of the shape of an object regardless of the semantics category to which it belongs (Grill-Spector & Mallach, 2004; Schawrzlose et al., 2008; Vuilleumier, Driver & Dolan, 2002) (Figure 3.26).

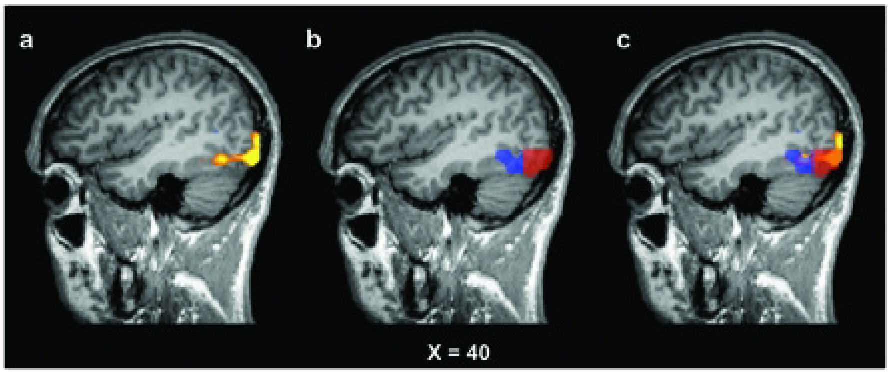

Figure 3.26 Panel B shows the LOC in red and the PFA in blue (from: Kim & Biederman, 2011).

6) Processing areas are also storage areas; the information about the different visual properties are stored in the same areas that process them (Slotnik, 2004). It is interesting that even some forms of non-declarative memories are stored in such areas as early as the first visual cortex V1 (Squire & Kandel, 2000).

7) Processing areas are areas of perception—that is, the perception of the different visual characteristics occurs in the areas of the specialised visual cortex in terms of processing each of the visual properties. In other words, the conscious experience of the various visual attributes of an object is distributed among the different processing areas with respect to the different visual properties (Koch, 2004; Rees, 2007; Zeki, 2003).

Although this is a very schematic and simplified representation of the anatomical and functional complexity of the visual cortex, I believe that it is adequate for interpreting some of the most interesting results of the neurocognitive research of mental imagery.

Neurocognitive research on mental imagery is a very active research field; the PubMed search for the term 'mental imagery' returns 3,280 items—even limiting the search to the last 10 years generates 1,466 articles (the same Google Scholar search results in approximately 1,260,000 and 173,000 articles respectively). Obviously, a revision of this literature is beyond the scope of our study. In the following sections, the discussion is limited to presenting some of the most relevant evidence showing that, in fact, the generation and experimentation of mental imagery depends on the same neuronal substrate as visual perception.

3.5.2.1 The eye of the mind: behavioural evidence

The first source of evidence suggests that there are systems and mechanisms common among visual perception and VMIs that come from psychology and psychophysics. Research shows, among other things, that a) reading VMI has a 3-D structure and can therefore be mentally rotated (Shepard & Metzler, 1979); b) the time it takes to scan visual elements in a map is (almost) identical to the time taken to scan the same map mentally (Borst & Kosslyn, 2008; Kosslyn, 1994); c) maintaining a VMI interferes with the processes of visual perception but not with the perceptual processes in other modalities (Segal & Fusella, 1970); d) maintaining a VMI can facilitate the visual recognition of degraded (or low-quality) images but not recognition in other modalities (Ishai & Sagi, 1997); e) VMIs can be inspected for implied image properties (e.g., analysing symmetry) (Thompson, Kosslyn, Hoffman & van der Kooij, 2008) (for a review of psychophysical and psychological evidence, see Cattaneo & Vecchi, 2011; Kosslyn et al., 2006; Ishai & Sagi, 1997).

Perhaps the most convincing psychological evidence comes from the research conducted by Pearson and colleagues, who have shown that the VMI can affect processes of 'binocular rivalry'. Binocular rivalry occurs when two different images are presented simultaneously to each of the eyes. In a contra-intuitive way—the subjects do not perceive an image that is a combination of the two stimuli, but report that they perceive one and the other stimulus separately. Pearson and colleagues show that the generation of VMI with regard to one of the stimuli before presenting both stimuli, facilitates the perception of previously presented stimuli. What is more interesting is that this effect depends so much on the position in which the stimulus is presented and its orientation (the phenomenon disappears if one imagined the stimulus in a particular spatial location with a specific orientation and the stimulus is presented in another spatial location and with another orientation). This strongly suggests that VMIs activate retinotopically organised visual areas (Pearson, Clifford & Tong, 2008).

However interesting and suggestive this evidence may be, it cannot by itself establish that the systems and brain mechanisms of the generation and maintenance of the

VMI are the same as those of visual perception. Fortunately, convergent evidence exists showing that this is indeed the case. Evidence stemming from the study of brain lesions that affect the processes of imagination and perception are first reviewed, and after this the evidence obtained through techniques that allow the recording of brain activity during generation tasks of VMI are discussed.

3.5.2.2 Injuring the eye of the mind: neuropsychological evidence

The neuropsychology of VMI is a research field with many controversies. While well-documented cases show that lesions in the visual cortex affect visual perception as well as VMIs (Grüter, Grüter, Bell & Carbon, 2009; Farah, 1999, 2000), there is also evidence from cases in which lesions in the visual cortex affect processes of perception but not of VMI and vice versa (Bartolomeo, 2002, 2008; Dulin, Hatwell, Pylyshyn & Chokron 2008; Moro, Berlucchi, Lerch, Tomaiuolo & Aglioti, 2008). This situation requires a few comments. First, in cases where dissociations are reported between the effects of an injury on the perception and VMI processes, these differences are based almost exclusively on the subjective reports of the patients and not on objective measurements, which complicates the analysis of the evidence. Second, the mechanisms involved in the generation of VMI depend on the task being performed by the subject as Kosslyn et al. (2004) have shown, and this aspect is rarely taken into account in neuropsychological reports. Figure 3.27 shows this relationship between the different visual areas and the nature of the actual VMI task performed by the experimental subjects.

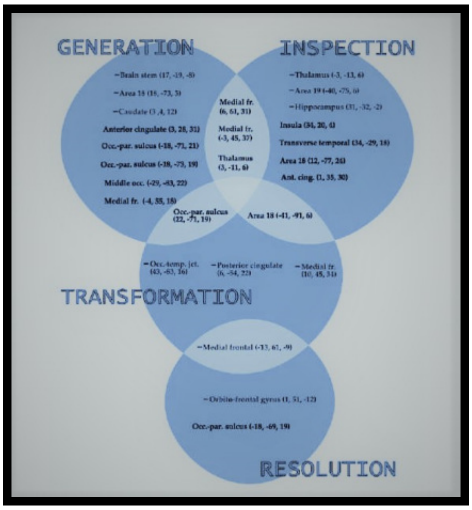

Figure 3.27 Common and specific brain areas involved in the generation, inspection, transformation, and resolution of the VMIs (from: Kosslyn et al., 2004).

Finally, differences between brain systems and the mechanisms involved in visual perception and VMI are expected for several reasons—in particular because visual perception is a process affected by retinal inputs and involves a large number of processes that are not necessary for the generation of VMI, such as local information processing (e.g., depth, orientation, luminance, etc.), figure-ground segregation, colour extraction, movement and form, and so forth. The generation of VMI is a process guided by the projections from the PFC to the visual cortex and is dependent on processes of extraction, reconstruction, and transformation of long-term visual memories (Kosslyn et al., 2006). Mechelli and colleagues, for example, by applying a dynamic causal modelling to obtained data with an fMRI of both visual perception tasks and VMI generation tasks, show that, while visually perceiving an object and mentally imagining it involve the same system of brain areas, the activity during the tasks of perception is determined by the afferent signals (bottom-up) from the visual cortex to the PFC, while the inverse occurs during the tasks of VMI generation, where the brain activity is determined by the efferent signals (top-down) from the PFC and posterior parietal cortex (PPC) (Mechelli, Price, Friston & Ishai, 2004).

Beyond the controversies surrounding the relationship between the effect of lesions in the visual cortex in the processes of visual perception and VMI generation and visualisation, there is no doubt that lesions in the visual cortex affect the properties of the VMI (Farah, 1999, 2000).

3.5.2.3 Spying on the eye of the mind: neuroimaging evidence

Undoubtedly, evidence from images obtained by fMRI strongly supports the hypothesis that a VMI occurs when the neuronal pattern of a visual property (e.g., form) is activated in the visual cortex in the absence of a sensory stimulus.

For example, in a study by Ganis and colleagues, subjects mentally visualised or observed a series of simple drawings (Figure 3.28) while their brain activity was recorded by an fMRI research team.

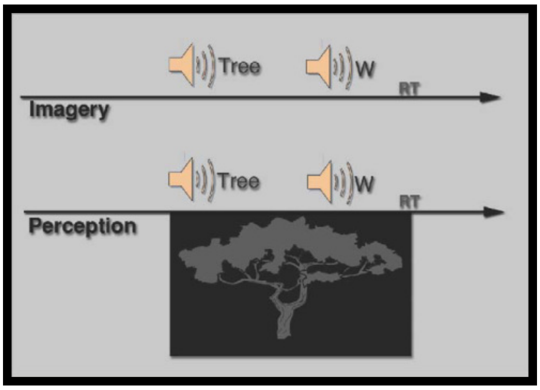

Figure 3.28 Example of stimulus used by Ganis et al., 2004.

They reported that 92% of the brain areas that showed increased activity during the visual perception task also showed increased activity during the mental visualisation task (Ganis et al., 2004). The authors conclude:

> *…the present results further document that visual imagery and visual perception draw on most of the same neural machinery. However, the overlap is neither uniform nor complete; visual imagery and visual perception appear to engage frontal and parietal regions in more similar ways than occipital and temporal regions. This finding may indicate that cognitive control processes function similarly in both imagery and perception, but—perhaps counter-intuitively— at least some sensory processes may be engaged differently by visual imagery and perception (Ganis et al., 2004, p. 239).*

However, there is evidence that the occipital regions can be involved in a more similar way than Ganis and colleagues suggest. An experiment designed by Stokes, Thompson, Cusack, and Duncan (2009) simply involved observing and imagining the letters 'O' and 'X' in capital while brain activity was recorded by a team of fMRI researchers (Figure 3.29).

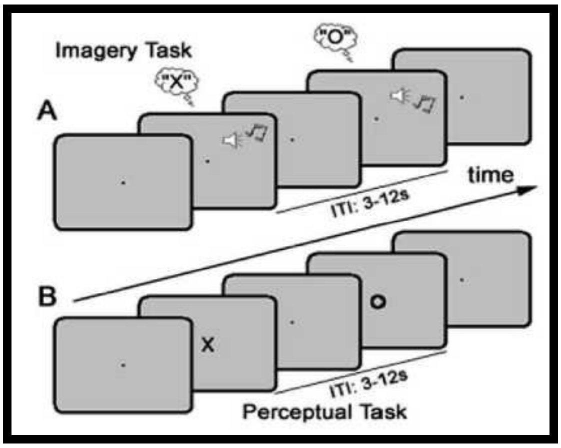

Figure 3.29 Representation of the task suggested by Stokes et al. (2009).

First of all, they reported that both mental visualisation and perception of 'O' and 'X' were correlated with increased activity in a region of the occipital cortex known as LOC, which is specialised for the processing of visual forms regardless of the semantic category to which the stimulus belongs. After that, they analysed how much brain activity overlapped in the LOC due to the tasks of perception and mental visualisation. For this, Stokes and colleagues designed a program ('linear classifier') to distinguish between the activities caused by the perception of the letter 'O' and that by the perception of the letter 'X'. It is important to note that during the training phase of the program (classifier), they only used the data obtained during the perception task. Once the linear classifier had correctly discriminated between the activity associated with the letter 'O' and that with the letter 'X' obtained during the perceptual sessions, the data obtained during the mental visualisation sessions were introduced. Contrary to what one might have expect based on the results obtained by Ganis et al. (2004), the linear classifier also correctly discriminated between the activity corresponding to the visualisation of the letter 'O' or that of the letter 'X'. This evidence indicates that not only do the processes associated with the VMI involve regions of the visual cortex associated with the processes of perception, but the VMI uses the same neural codes that were employed in the actual visual perceptions (Stokes et al., 2009).

There is also evidence that the activity on the visual cortex during tasks of mental visualisation is specific to the semantic domain (or category) of the stimulus. For example, the mental visualisation of faces or buildings is correlated with activity in the corresponding areas of the visual cortex specialised for the processing of these stimuli—namely the FFA and the PPA respectively (O'Craven & Kanwisher, 2000; see Figure 3.25). Ishai and colleagues also report that mentally visualising faces, houses, and chairs activates a system of extra-striated visual cortex areas similar to those activated during the perception of images of the same categories of objects (Ishai, Ungerleider & Haxby, 2000). These results are not only replicated but further extended by Reddy, Tsuchiya, and Serre (2010) and by Johnson and Johnson (2014). In the first of these experiments, subjects had first to observe a series of images of objects belonging to four semantic categories: food (fruits and vegetables), faces of famous people, tools, and famous buildings, after which they had to mentally visualise the same objects.

As expected, they report that a) different semantics categories are each processed in different specialised sub-regions of the 'ventral visual cortex' (FFA for faces, PPA for buildings, and different regions of the ventral cortex—'object-responsive' (OR)—for food and tools (Figures 3.14, 3.25, and 3.26) and (b) both the perception and the mental visualisation of objects of the same semantic category activate the same sub-regions of the ventral visual cortex specialised in the visual processing of that category. For example, both the perception and the visualisation of famous faces are correlated with activity in the FFA.

However, Reddy et al. (2010) go beyond this. Following Stokes et al. (2009), they trained a linear classifier with data obtained in both the perceptual and mental visualisation sessions. They report that only with the data obtained during the sessions of perception was the classifier able to correctly discriminate from the data obtained during the sessions of mental visualisation between the four categories of objects. Similarly, only with the data obtained during the mental visualisation sessions was the classifier able to correctly discriminate from the data obtained during the visual perception sessions between the four categories of objects (Reddy et al., 2010) (Figure 3.30).

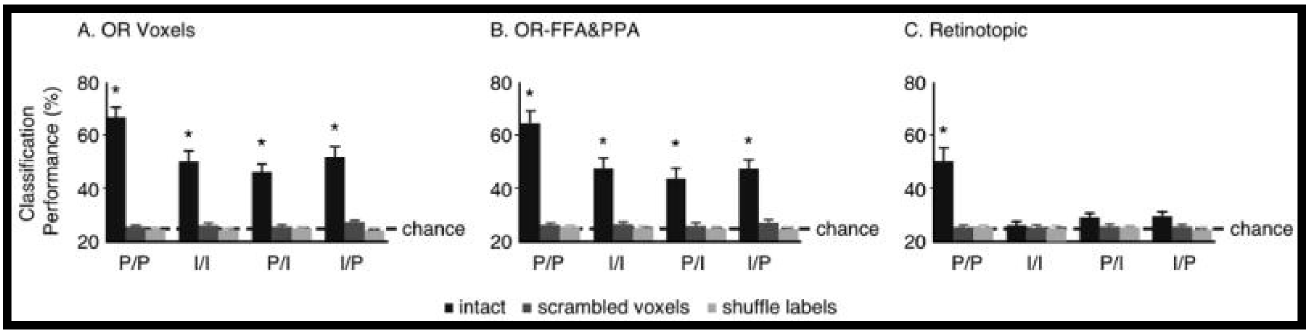

Figure 3.30 Data on the performance of the linear classifier when in function of the data obtained during the sessions of perception (from: Reddy et al., 2010).

In Reddy *et al's* (2010) study the linear classifier was required to classify the data obtained during the mental visualisation sessions (P/I) in terms of the categories OR = object-responsive; FFA = fusiform face area; PPA = parahippocampal place area

These results confirm that visual perceptions and VMI share the same representations at the level of the visual cortex. As the authors point out, the result

> *indicates that feedback signals in the absence of bottom-up input can be sufficient to evoke category-specific representations in ventral temporal cortex. Although these 'mental imagery' representations do not induce the same vivid percept as during actual viewing, they were still reliable enough to be decoded with multi-voxel pattern analysis techniques (Reddy et al., 2010, p. 824).*

Johnson and Johnson obtained similar results by comparing brain activity during the visual presentation of images of natural scenes (a beach, a desert, a field, and a house), and those occurring during the mental visualisation of the same scenarios. The results showed that both the perception and the visualisation of these scenarios involve the same system of visual areas—namely the 'occipital place area' (OPA), PPA, 'retrosplenial cortex' (RSC), and a portion of the precuneus/intraparietal sulcus selective to 'precuneus/intraparietal sulcus' (PCu/IPS). Following the methodology proposed by Stokes and colleagues and by Reddy and colleagues, Jonson and Johnson also found that a classifier trained with data obtained during the perceptual sessions can discriminate between the four scenarios when given the data obtained during mental visualisation sessions (Johnson & Johnson, 2014).

The novelty of this work is that the stimuli all belonged to the same semantic category, which shows that the activity in the visual cortex evoked by VMI is specific not only to categories, but also to individuals within the same category (Figure 3.31).

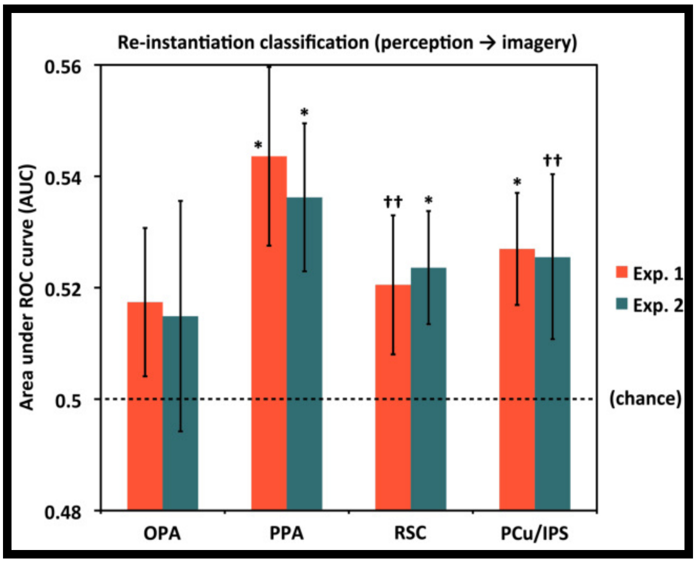

Figure 3.31 Performance of the classifier during scenario discrimination during mental visualisation sessions in each of the selected areas of the visual cortex (the second experiment is similar to that described with slight modifications in the presentation of the stimuli) (from: Johnson & Johnson, 2014).

An interesting fact is that the similarity between the neuronal activity evoked by visual perception tasks and that evoked by mental visualisation task is also observed at the level of individual neurons in non-specific (or multimodal) cortex regions. Thus, Kreiman, Koch, and Fried (2000) discovered that a subset of the neurons of the medial temporal lobe (MTL) that responded to the presentation of facial images is also activated selectively when the same subject mentally visualises the same face. The same effect was observed with other visual categories (food, cars, spatial patterns, animals, famous faces, etc.; see Figure 3.32).

Table 1 Number of responsive and selective neurons

	Amygdala	Entorhinal cortex	Hippocampus	Parahippocampal gyrus	Total
n	89	78	91	18	276
Visual responsive	12 (13%)	16 (21%)	17 (19%)	4 (22%)	49 (18%)
Visual selective	9 (10%)	14 (18%)	17 (19%)	4 (22%)	44 (16%)
Imagery responsive	8 (9%)	11 (14%)	9 (10%)	5 (28%)	33 (12%)
Imagery selective	4 (4%)	8 (10%)	8 (9%)	3 (17%)	23 (8%)
Both selective	3 (75%)	6 (75%)	5 (63%)	2 (67%)	16 (70%)

Figure 3.32 The 'both selective' category represents the neurons that responded in both the perception and the visualisation tasks. The percentage of this category is based on the number of selective neurons in visualisation tasks (Kreiman et al., 2000).

Likewise, they found that the 'firing rate' of the neurons that responded to both the presentation of the visual stimulus and the visualisation of the same stimulus is almost identical during the two tasks (Kreiman et al., 2000).

Finally, there is evidence—albeit controversial—that the generation of VMI, which requires a high special resolution (e.g., many fine spatial details), arouses activity in the retinotopically organised visual areas, including the primary visual area (V1) (Klein et al., 2004; Kosslyn & Thompson, 2003; Slotnik, Thompson & Kosslyn, 2005). The repeated application of transcranial magnetic stimulation (TMS) in the occipital cortex prevents the generation of VMI with high spatial resolution (Kosslyn et al., 1999). Cui and colleagues observe that the differences between subjective reports on VVI intensity or vividness are correlated with activity levels in the occipital cortex (Cui, Jeter, Yang, Montague & Eagleman, 2007).

The evidence presented so far focuses on the similarities at the cerebral level between VMI and visual perceptions in the so-called ventral stream of the visual cortex (Ungerleider & Pasternak, 2004). However, there is also a lot of evidence showing that the similarity between VMI and perceptions also occurs in the dorsal stream of the visual cortex. For example, Trojano and colleagues have shown that the mental representation of clock hands in various positions and the assessment of the amplitude angle selectively activate regions of PPC involved in the processing of spatial information (Trojano et al., 2004).

Kaas, Weigelt, Roebroeck, Kohler, and Muckli (2009) further found that moving objects in the region known as hMT/V5 + (the human homologue of the V5 or MT region in non-human primates) are mentally visualised in moving objects—an area specialising in motion processing (Vetter, Grosbras & Muckli, 2013). In conclusion, Mazard and colleagues reviewed the literature available on VMI obtained through PET equipment and report that the tasks that require the transformation or spatial manipulation of VMI consistently activate the regions of the dorsal stream of the visual cortex (Mazard, Tzourio-Mazoyer, Crivello, Mazoyer & Mellet, 2004).

The presented evidence strongly suggests that regions of the visual cortex necessary for experiencing a VMI are the same (or very similar) to those necessary for experiencing a visual perception. In other words, mentally visualising the object x activates the same areas of the visual cortex that are activated during the perception of x.

However, knowing which brain systems are activated during a VMI is not enough to understand how VMIs are produced—that is, what mechanism/mechanisms is/are responsible for the generation of VMIs?

Although it is a controversial issue, we have seen that there is a clear consensus in attributing of efferent (top-down) projections from the PFC to the areas of the visual cortex, thus demonstrating their predominant role in the process of generation of VMI.

3.5.2.4 Visual working memory: a model for the VMI mechanism

According to Baddeley (1996, 2012) the visual working memory is a mechanism responsible for the temporary storage and processing of visual information, which, according to the author, is also responsible for the manipulation of visual information such as visual mental imagery. The mechanism is believed to depend on efferent (top-down) connections from the PFC to the motor cortex and modality-specific cortex (Henson, 2001; Fuster, 2008; Squire & Kandel, 2000).

Neurocognitive research on visual working memory is relevant to VMI research because it shows how the visual cortex can maintain visual representations in the absence of external stimuli. For example, Harrison and Tong (2009) used a delayed orientation discrimination task. The same subjects were presented with two similar stimuli and a key that informed the subjects which of the two stimuli they had to remember. After a 11-second delay, the subjects were presented with a third target and asked to indicate whether the third stimulus was rotated compared to the stimulus they had to remember (Figure 3.33).

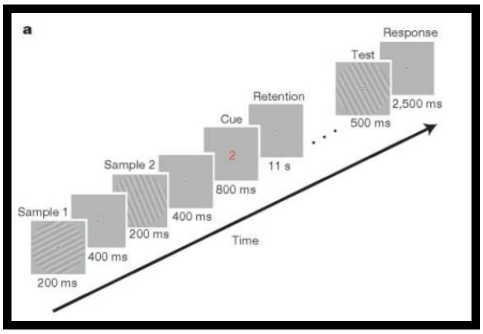

Figure 3.33 Representation of the task used by Harrison and Tong (2009).

Harrison and Tong have shown that it is possible to identify a stimulus by the pattern of processing in a subject's visual working memory (the visuospatial sketchpad). Using fMRI they studied the neural patterns obtained during the retention time in the visual areas V1 and V4—in other words when that stimulus is no longer present (Harrison & Tong, 2009). These results indicate that specific information about the identity of a visual stimulus in its absence is presumably provided from the prefrontal cortex to different regions of the visual cortex. The interesting aspect in the context of their study is that there was evidence of a specific activity of a stimulus in the visual area of IT (a high-level visual area; see Section 3.5.2 and Figure 3.3) (Ranganath, Cohen, Dam & D'Esposito, 2004). However, this was the first study showing stimulus activity in visual areas organised in a retinotopic way at middle and low levels.

An advantage of neurocognitive research on the visual working memory regarding the VMI can be seen in the possibility that it can be studied in animals, especially non-human primates, even when there is no evidence that animals can produce VMIs. Perhaps the strongest evidence for the visual working memory mechanism and the ability of the prefrontal cortex to maintain visual representations without external stimulation comes from a series of experiments conducted by Tomita and colleagues on non-human subjects.

Tomita and colleagues trained two monkeys (Macaca fuscata) in such a way that they memorised a series of 20 associations between image pairs/ abstract geometric figures). During the task, the monkey had to hold down a lever while visually presenting one of the already learned images. If, after a delay of 600 to 1500 ms, the second picture that appeared to coincide with some of the associations the monkey had to remember, it should release the lever (Tomita, Ohbayashi, Nakahara, Hasegawa & Miyashita, 1999).

The novelty of this experiment is that after the training session, a surgical intervention was performed on monkeys, in which the posterior region of the corpus callosum and the anterior corner were sectioned so that the visual cortices of both hemispheres could not communicate with each other. However, the anterior region of the corpus callosum, which interconnects with the PFCs of both hemispheres, was left intact.

During the task, the first visual stimulus ('cue') was presented to only one eye while recording the activity of individual neurons of the temporal inferior visual cortex (IT) of the same hemisphere as the stimulated eye. For example, if the left eye was stimulated, the activity of the left hemisphere was recorded. Remember that visual stimuli are processed in the hemisphere opposite to the stimulated eye—the stimuli of the left eye are processed in the right hemisphere and vice versa. The second stimulus (‘target') was presented exclusively to the opposite eye (Figure 3.34). For example, if the stimulus 'cue' was presented to the left eye, the 'target' stimulus was presented to the right eye.

The interesting thing about this is that although both stimuli ('cue' vs 'target') were processed in different visual cortices, and the surgical intervention made the communication between important regions of the brain impossible, the monkeys could nevertheless execute the task correctly.

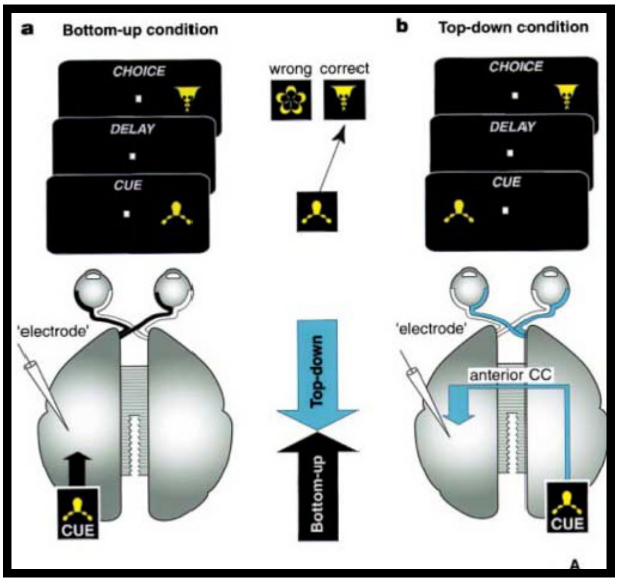

Figure 3.34 Schematic representation of the experiments of Tomita and colleagues (Tomita et al., 1999)

Although in this study the 'cue' and 'target' stimuli were processed in the visual cortices of hemispheres that were ‘incommunicado’ with each other, the monkeys could still perform the task correctly. As the image in figure 3.34 suggests, this is possible thanks to the projections from the PFC to the visual cortex.

What is surprising in the context of the experiment is that during the delay period, researchers could decode the identity of the 'cue' stimulus based exclusively on the activity of the IT neurons of the hemisphere that did not process the stimulus even though the connections between the visual cortices of both hemispheres had been severed (Figure 3.34).

These results strongly suggest that the activity observed in the IT of the hemisphere opposite to the stimulated one is due to projections from the PFC and not due to connections between the visual cortices of the two hemispheres. It should be noted that the connections between the prefrontal cortices of the two hemispheres remained intact, so that information from the left hemisphere could reach the right hemisphere only through reciprocal connections between prefrontal cortices (the same is true for the opposite case). In summary, Tomita and colleagues were able to show that: a) in the absence of visual stimuli, signals from the PFC can activate the neurons in IT in a stimulus specific way, and b) given the absence of connections between the cortex visual effects of the two hemispheres, the activity in the IT neurons of the hemisphere is the result of the projections from the PFC and not that from interhemispheric-cortical connections (Tomita et al., 1999; for similar results see Meyers, Freedman, Kreiman, Miller & Poggio, 2008).

Zimmer (2008) made a compilation of the information available on the neural mechanisms of visual work memory and summarised it in the following model (Figure 3.34; for a similar model see Ranganath (2006) and Ranganath et al., (2004).

Although these research studies had been conducted on the visual working memory and not on the ability to generate VMI, the fact that the PFC can effectively cause activity in the visual cortex in a specific way (maintaining the particular identity of the absent stimulus) suggests to many researchers the existence of a similarity between the visual working memory and the mechanisms of the VMI (Cattaneo, Vecchi, Pascual-Leone, A, & Silvanto, 2009; Kosslyn & Thompson, 2003; Ranganath, 2006; Ranganath & D'Esposito, 2005). The cerebral mechanisms and systems implicated in these visual processes are shown in Figure 3.35 below.

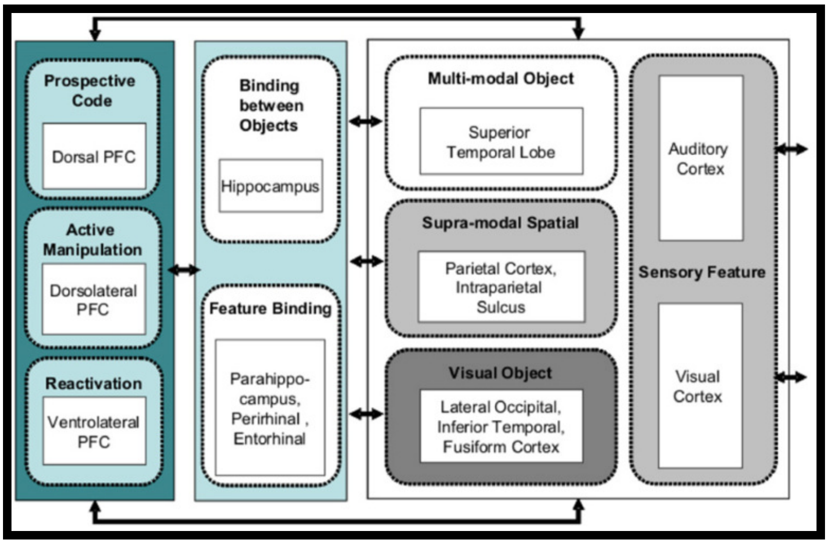

Figure 3.35 Cerebral mechanisms and systems involved in the maintenance and transformation of visual information into visual working memory (Zimmer, 2008).

Although I limit myself to the neurocognitive evidence on the VMI in this section, there is evidence that similar mechanisms are involved in the processes responsible for auditory mental imagery (Hubbard, 2010; King, 2006; Kraemer et al., 2005; Zatorre & Halpern, 2005) olfactory (Bensafi et al., 2003), and motor (Porro, Cettolo, Francescato & Baraldi, 2000).

In this section, evidence have been given in favour of the theoretical postulate that VMI occurs in the same brain areas that are involved in the generation of visual perceptions and that a mechanism of generation of possible VMI is similar to one that allows the storage and transformation of visual information in the visual working memory in the absence of visual stimuli. Furthermore, evidence was also provided to show that this applies not only to VMI but to all perceptual mental imagery.

Now, if we assume the above as true, it is possible to propose a solution to the problem of how mental imagery can influence our emotional states—namely, through the anatomical connections between the areas of the visual cortex and the areas responsible for emotional processing (Figure 3.36).

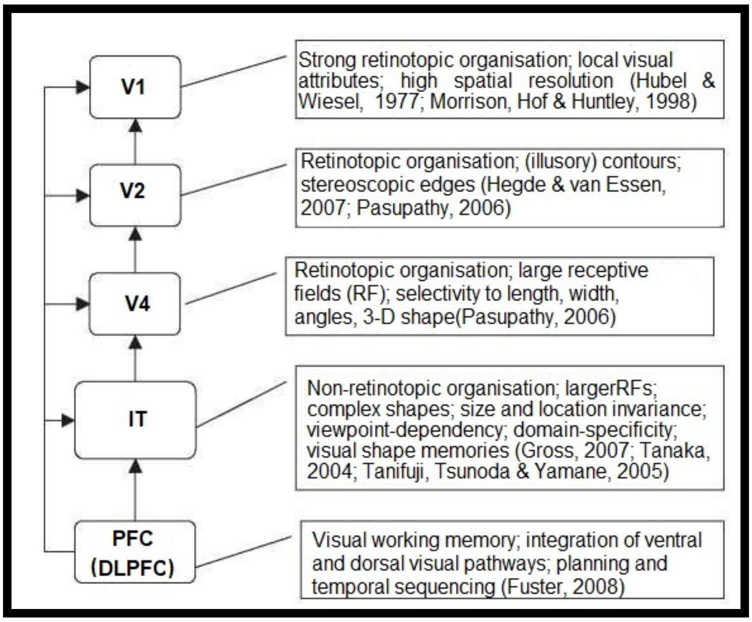

Figure 3.36 Schematic representation of the brain areas of the ventral visual stream involved in the generation of visual mental imagery (VMI). DLPFC = 'dorsolateral PFC'.

3.5.3. A theoretical approach of interaction between VMI and emotions

The main objective of Section 3.5 is to offer a theoretical postulate concerning the role of mental images in the emotional processes associated with the reading of literary works.

I would like to briefly state my theoretical postulate. The perception of mental imagery enhances or amplifies emotional reactions associated with the semantic (conceptual) content of a literary text, and this amplification is partly due to the anatomical (and functional) connections between the modality-specific ('substrate' of perceptual mental imagery) and emotionally associated areas of the brain.

It should be noted that Holmes proposes a similar model to demonstrate the relationship between VMI and emotions related to emotional disorders, particularly bipolarity. Holmes suggests that in cases of bipolarity, a stimulus (internal or external) classified as threatening by the subject is triggered by anxiety states, which in turn results in the visualisation of aversive images that leads to more anxiety, and so on. The same applies to stimuli that are classified as positive (Holmes, Geddes, Colom & Goodwin, 2008a; Holmes & Mathews, 2010).

In the previous paragraphs, it was argued that VMIs do indeed occur in the modality-specific cortices. In this section, some of the brain areas involved in the processing of emotions will be discussed briefly.

Unfortunately, the neuroscientific research of emotions, though rapidly growing, is less developed than research on our perceptual systems. For example, there is still no majority consensus on 'what' emotions really are.

Although we do not know what emotions are, there are certain points of agreement concerning the study of particular emotions, especially the study of the so-called basic or primary emotions (e.g., fear, anger, surprise, disgust, sadness, and happiness). Among these points of agreement, the following stand out:

a) Each type of emotion can be characterised according to a system of corporal responses (e.g., autonomic, motor) and brain responses (from hormonal responses to cognitive states) (Damasio, 2003, 2012; Ledoux: 1996, 2003, 2012; Panksepp, 1998). In other words, all emotions can be characterised as a function of the following 'scheme of emotion':

Emotion Scheme: An emotion is a complex process that consists of at least the following sub-processes: a) an appraisal process by which the stimuli are categorised according to their relevance to the welfare of the organism and/or its value for survival; and b) a coordinated system of corporal (i.e. visceral and motor) and brain (e.g., hormonal and neuronal responses) responses, which establishes a more or less stereotyped repertoire of behaviours (both motor and cognitive) (Adolphs & Heberlein, 2002), (Figure 3.37).

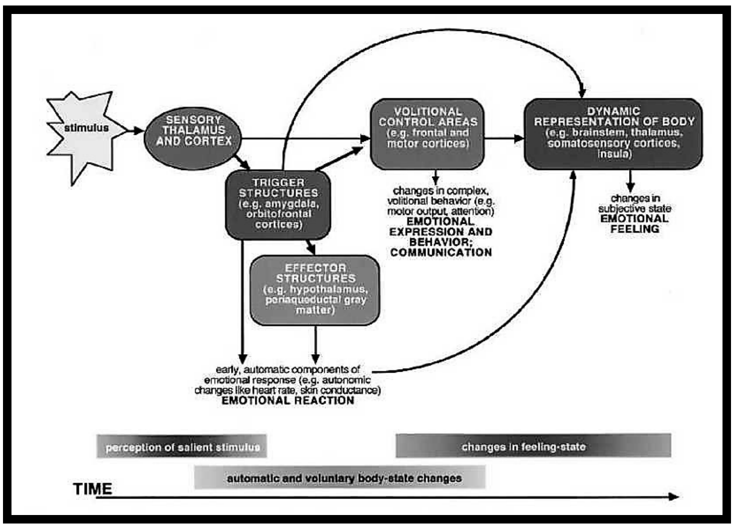

Figure 3.37 Schematic representation of the processes involved in emotional responses (scheme of emotion) (Adolphs & Heberlein, 2002).

b) It is necessary to distinguish between an emotional response (e.g., the system of corporal and brain responses) and their conscious perception. In other words, one must distinguish between an emotional response and a feeling:

Definition: A feeling is the conscious perception of an emotional response (Adolphs & Heberlein, 2002; Damasio, 2003; LeDoux, 1996, 2012; see Figure 3.37).

This distinction between emotion and feeling—analogous to that between sensation and perception—has been confirmed experimentally on multiple occasions. For example, there is ample evidence of both a behavioural and a neuroscientific nature that subjects respond emotionally to emotionally charged stimuli (e.g., faces expressing some intense emotion) even when the subjects are not aware of the emotional stimulus (e.g., masking) and do not consciously experience any emotional feeling (Dimberg, Thunberg & Elmehed, 2000; Etkin et al., 2004; Vuilleumier et al., 2002).

There are also some brain structures that are necessary to trigger an emotional reaction but are not necessary for experiencing a feeling. For example, while the amygdala is a key structure for danger detection (Freese & Amaral, 2009) and the triggering of responses associated with fear (LeDoux: 1996, 2003), there is evidence that the amygdala is not necessary for the feeling of fear and that one can experience other emotions, such as anxiety, through the activity in the amygdala (Anderson & Phelp, 2002; Damasio et al., 2000).

c) Emotions are the emerging properties of complex brain systems (Lindquist, Wager, Kober, Bliss-Moreau & Barrett 2012). Therefore, the tendency of some people to characterise the amygdala as the 'centre/organ of fear', or the nucleus accumbens as the ‘centre/organ of pleasure’ is not only misleading but also false. For example, Figures 3.38 and 3.39 represent the brain systems involved in hedonic or pleasurable responses and fear responses respectively.

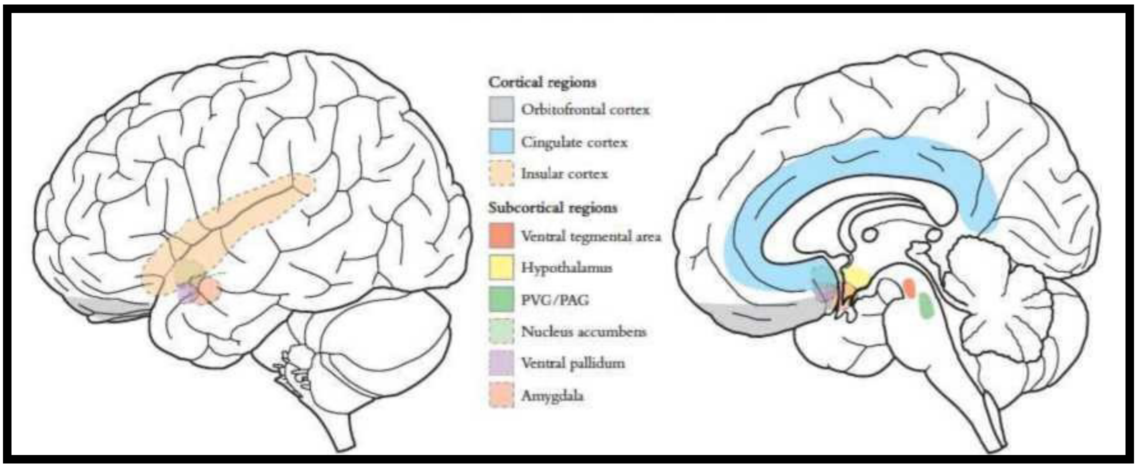

Figure 3.38 Representation of the brain areas involved in hedonic/pleasurable responses. In the image (A), the cortical areas are represented and in the image (B) the subcortical areas (from: Kringelbach, 2009; see also Berridge & Kringelbach, 2008).

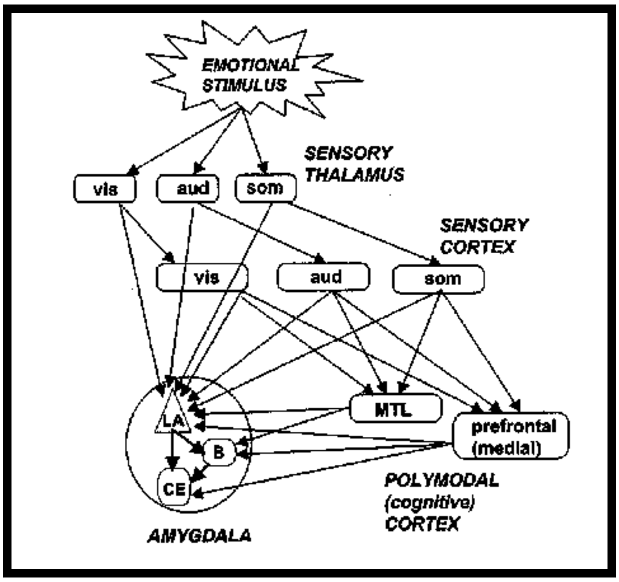

Figure 3.39 Schematic representation of the brain system involved in fear responses (some areas involved in the autonomic responses are not represented, e.g., the hypothalamus); MTL = medial temporal lobe; LA = lateral amygdala; B = basal amygdala; CE= central amygdala; vis. = visual; aud. = auditory; som. = somatosensory (from: LeDoux, 2003).

It is important to keep in mind the systemic nature of the emotional responses in extrapolating areas involved in an emotional response—particularly for another emotion. For example, while the insula is necessary for the feeling of disgust (Ibañez, Gleichgerrcht & Manes, 2010) and for recognising response associated with disgust in others (Wicker et al., 2003), it is not necessary for recognising other types of emotions (Adolphs, Tranel & Damasio 2003).

Returning to the scheme of emotion (see Figure 3.37), what does seem to be true is that all emotions together can be thought of as a system with a vertical hierarchical organisation, composed of lower-level areas (midbrain: brain stem) involved in simple automatic responses, areas of intermediate level (diencephalon: thalamus and hypothalamus) involved in somatic and visceral control and complex stereotyped behavioural responses, and higher-level areas (cortex and neocortex) involved in complex processes of learning, memory, control, feelings, and so on (Liotti & Panksepp, 2004; Tucker Derryberry & Luu, 2000).

In general, some of the major brain areas involved in emotional processes are[16] the:

a) *Amygdala*: involved in the detection of potentially dangerous stimuli, in triggering responses associated with fear, and in the formation and consolidation of unconscious emotional memories primarily associated with fear/danger (Dalgleish, 2004; Fellous, Armony, & LeDoux, 2003; Hamann, 2009; LaBar & Cabeza, 2006; LeDoux, 1996, 2003; LeDoux & Sciller, 2009).
b) *Hypothalamus and brainstem nuclei*: involved in the triggering and regulation of autonomic responses, both visceral and motor, through hormonal and neuromodulatory influences (Adolphs & Heberlein, 2002; Amin, Canli & Epperson, 2005; Blessing, 2002; Cools, 2008a; Cools et al., 2007; Damasio, 1999, 2003).
c) *Anterior cingulate cortex*: integration of the motivational value of a stimulus as a function of the body and the cognitive state (e.g., objectives) of the individual; involved in pain perception, conflict resolution, emotion-cognition, error detection, and processes related to perceptual and sentimental mental images (Beckmann, Johansen-Berg & Rushworth, 2009; Price, 2002)

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[16] Although I do not dwell on the problem of lateralisation of functions, some comments are necessary. According to popular belief, the right hemisphere is the emotional hemisphere, while the left hemisphere is the rational hemisphere; even Kane (2004) proposes the emotional nature of the right hemisphere—poetic language is just a faculty of this hemisphere (Kane, 2004; see also Holland, 2009). Although not entirely false, this conception of the right hemisphere as the emotional hemisphere is a simplification. Emotions are processes that involve the entire brain, and as such involve both hemispheres. What is certain is that different aspects or processes of emotional (and sentimental) responses are more or less lateralised (Demaree, Everhart, Youngstrom & Harrison, 2005). For example, the right hemisphere appears to be likely to process negative emotions (e.g., sadness) while the opposite is true for the left hemisphere, which more easily recognises faces with emotional expressions and participates more in excitement and motivation processes (Liotti, & Panksepp, 2004).

d) *Insula*: integration of complex (multimodal) sensory information related to a stimulus with all the visceral and autonomic responses produced by this stimulus. Also involved in interoceptive processes (e.g., perception of organ and viscera status), self-regulation and emotional control, feeling of disgust, control of autonomic responses, and the generation of moods (Damasio, 2003, Ibañez et al., 2010, Jabbi et al., 2008, Modinos, Ormel & Aleman, 2009; Mufson, Sobreviela & Kordower, 1997). Craig states that this heterogeneity of functions can be understood if the insula is thought of as the interoceptive cortex with a caudal-rostral organisation—with the more caudal regions composed of the primary and secondary interoceptive areas and the more rostral regions composed of interoceptive areas of association, similar to modality-specific cortices (Craig, 2010).
e) *Somatosensory cortex*: involved in proprioception (e.g., perception of state of muscles and skeletons) and in processes associated with feelings (Adolphs et al., 2003)
f) *Orbitofrontal cortex*: integration of complex (multimodal) sensory information and corporal responses based on some task or objective. Involved in the regulation of autonomic responses, decision-making processes, short-term emotional memory, and hedonic/rewarding feelings (Kringelbach, 2005, Wallis, 2007a). It is important to note that the orbitofrontal cortex is the only area of the neocortex with reciprocal connections with the midbrain, making it a key region for the regulation and control of autonomic responses associated with emotional events (Damasio, 2003).

It is important to note that all these areas are anatomically and functionally connected to the modality-specific cortex and/or different areas of the PFC (Bloom, Björklund & Hökflet, 1997, 1998); therefore, they can influence the processes of mental visualisation (e.g., mental imagery), either directly (cortico-cortical connections) or indirectly, through the action of neuromodulators (e.g., hormones, neuropeptides, etc.).

In the discussion above evidence was provided that the mental visualisation of an object x in the absence of the object evokes brain activity in the same areas of the visual cortex as those that are involved in the actual perceiving of x. To a lesser extent, there is neurocognitive evidence that mental simulation of a feeling (i.e. generation of an affective mental imagery) evokes activity in the same brain areas as the actual generation of that feeling.

For example, Damasio and colleagues asked experimental subjects to mentally visualise in the greatest detail possible personal situations in which they experienced sadness, joy, anger, or fear, and to report with a hand movement the moment at which they experienced the feeling associated with that experience—while their brain activity was being recorded with a PET scanner.

They report that the generation of affective mental imagery—that is, feelings in the absence of external emotional stimuli—activates the same areas that are involved in the actual experience of those feelings. The surprising thing is that the generation of affective mental imagery evokes activity in both the subcortical nuclei involved in the autonomic responses associated with emotional events (e.g., pons, mesencephalon, and hypothalamus) and in cortical and neocortical areas involved in the integration of multimodal, conceptual information and executive information on corporal condition (e.g., insula, cingulate cortex, orbitofrontal cortex, secondary somatosensory cortex, and basal forebrain) (Damasio et al., 2000).

Jabbi and colleagues asked experiment subjects to taste a liquid with unpleasant taste, observe another person experiencing an unpleasant taste, and imagine an unpleasant taste experience, while recording the brain activity with an fMRI.

They report that the three experiences are activated the same region of the insula that is involved in the experience of disgust (see above) and the adjacent frontal operculum, which is involved in cognitive control tasks, representation of facial movements associated with emotions and speech, and as a member of the mirror neurons involved in the perception of faces (Haxby & Gobbini, 2011; Higo, Mars, Boorman, Buch & Rushworth, 2011). An interesting result is that although all three experiments activated the insula and the frontal operculum in the same way, these areas are embedded in slightly different brain systems, suggesting that the differences between experiencing, observing, and simulating a feeling are perhaps present not at the level of individual areas but at a systemic level (Jabbi et al., 2008).

As we see in the case of VMIs, Cui and colleagues report a correlation between the level of details of a VMI ('vividness') according to reports subjective, and the intensity of the signal obtained with fMRI in the primary visual cortex (Cui et al., 2007). In the case of affective mental imagery, subjective reports also indicate the existence of degrees in the intensity of the mentally evoked feelings (Damasio et al., 2000). What is unclear is whether the intensity of the mentally evoked feeling is a function of the actual state of the body (e.g., activity of the sympathetic nervous system and the gastrointestinal system) or whether it depends on activity in areas associated with cerebral corporal representation (real or simulated) (Vianna, Naqvi, Bechara & Tranel, 2009).

The following theoretical approach of the interactions between mental imagery (MI) and emotions can now be proposed (see Figure 3.40). It is important to clarify that although the emphasis is placed on the areas and brain mechanisms involved in VMI, this theoretical approach is also applicable to perceptual mental imagery of other modalities (auditory, olfactory, gustatory, etc.).

i) *From the MI to the emotions*: This is the excitation route. Activation of the modality-specific cortex through the projections of the PFC leads to activity in emotional areas through the afferent connections between modal-specific cortices and the different areas involved in emotional processing.

ii) *From the emotions towards the mental imagery*: This is the modulatory route. The different emotional states of an organism modulate (i.e. facilitate or inhibit) the processes in the modality-specific cortex. In particular, both the quality (e.g., accuracy of details) and content (e.g., ease of retrieving visual memories) of an MI are modulated by the emotional state of the organism. This modulation can be performed through at least three parallel processes:

a) direct projections from the amygdala, the orbitofrontal cortex, and the ventromedial PFC to the dorsolateral PFC (involved in the processes of visual working memory—Section 3.5.2.4), the inferior frontal convolution (involved in semantic/conceptual processes), and ventral visual cortex (LeDoux & Sciller, 2009; Kensinger, 2009; Vuilleumier, 2009); b) direct projections from the insula to the visual association areas (particularly the anterior inferior temporal cortex or aTC) and the

PFC (Mufson et al., 1997), and c) diffusive modulatory projections from monoaminergic nuclei (e.g., serotonin) towards the PFC and the modality-specific cortex.

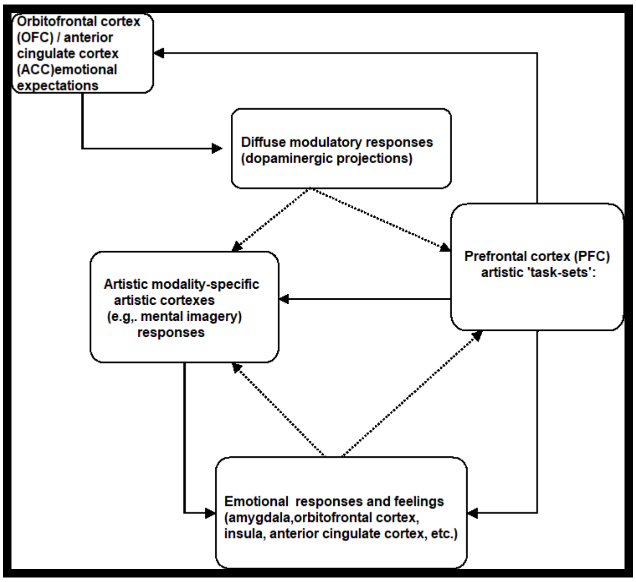

Figure 3.40 Schematic representation of the loop 'mental imagery-emotions' in the context of artistic experiences. Continuous lines represent excitatory connections while dotted lines stand for modulating connections.

3.5.3.1 Empirical approaches in the context of the model of the interactions between mental imagery (MI) and emotions

Unfortunately, neuroscientific research regarding the processes involved in the reading of literary works is non-existent; hence, it is impossible to test the proposed theoretical approach with direct evidence. However, there is indirect evidence, particularly on the influence of mental imagery on emotional processes (the excitatory path of the approach) and—to a much lesser extent—on the influence of emotional processes on mental imagery (the modulatory path of the approach).

An interesting source of evidence for our theoretical approach comes from studies on the influence of emotional valence of a stimulus on the so-called 'startle response'. The startle response is an automatic reaction to the sudden and unexpected presentation of an intense stimulus; it is commonly studied through the measurement of blinking after the surprise application of a breath of air in the eye. It is known that the magnitude of the response is modulated by several factors, including the attentional and emotional state of the subject, the context, and the task (Herbert, Kissler, Junghöfer, Peyk & Rockstroh, 2006); In addition, there is evidence to suggest that the modulation of this response is the function of a system composed of the thalamus, the anterior cingulate cortex, the orbitofrontal cortex, the cerebellum, and the secondary somatosensory cortex (Neuner et al., 2009). Interestingly, Miller and colleagues show that the magnitude of the startle response can also be modulated by the emotional content of a VMI (Miller, Patrick. & Levenston, 2002).

In this experiment, the subjects had to mentally visualise two types of images—aversive (fear and anger) and non-aversive (neutral and pleasant). A breath of air was applied over a period of 2–11 seconds after each sign indicating the subjects who were to generate the VMI. The results show that, compared to neutral images, the magnitude of blinking is modulated by the emotional value of the VMI, the images of fear being those with the highest modulating value. Also, in contrast to the neutral VMIs, emotional VMIs (fear, anger, and pleasure) effectively modulate certain autonomic responses in subjects, such as heart rate and electrical conductance of the skin (Miller et al., 2002). These results suggest that VMIs indeed have a causal effect on the activity of areas of emotional processing, inclusive of all levels of autonomous responses.

That VMIs can modulate autonomic responses has been explained by Han and colleagues and Ritz and colleagues, who report that the generation of aversive content (associated with objects or situations that may evoke fear) causes changes in respiration rate, suggesting that VMI can modulate physiological responses (Han et al., 2008; Ritz, Alatupa, Thöns & Dahme, 2002). Moreover, Holmes and colleagues show that subjects report higher levels of anxiety when asked to mentally visualise the content of a text describing stressful situations compared to subjects who are only asked to semantically analyse the same text (Holmes & Mathews, 2005; Holmes, Mathews, Mackintosh & Dalgleish, 2008b; see Section 3.5).

In their records of individual neurons in the MTL, Kreiman and colleagues report that mental visualisation of faces expressing emotions (but also VMI of objects) produces activity in the amygdala (Kreiman et al., 2000; see Figure 3.32).

These results suggest that VMI can alter the emotional state of the subjects, as proposed by the 'excitatory path' of the approach (Holmes & Matthews, 2010).

In relation to the 'modulatory path' of the Borst and Kosslyn model, they offer direct evidence in this regard. In their experiment, subjects were asked to mentally visualise or perceive the overall form of a written word presented on a screen, or to mentally visualise or perceive details of the written word. In both cases (visualisation and perception of global form and details), in half the tests, the subjects had to answer whether the global form of the word increased from right to left, while in the rest of the tests, the subjects had to report whether the first and last letters of the word contained closed spaces (e.g., dog). Milliseconds prior to the presentation of the stimulus—whether to initiate the process of visualisation or to perceive the word—images of human faces expressing fear were briefly presented. The subjects were not aware that these images appeared on the screen ('visual masking').

The results indicate that in the cases in which the subjects had to mentally visualise or perceive the overall form of the word, this task was facilitated by the brief (and unconscious) presentation of the aversive face. In other words, they were less inclined to perceive or visualise the word and made fewer mistakes. In contrast, when subjects were asked to visualise or perceive details of a word, the presentation of the aversive stimulus hampered the task—that is, subjects took longer to complete the task and made more mistakes. The authors suggest that the facilitation of the task is because the brief presentation of the aversive stimulus—although too short to evoke a conscious experience—is sufficient to activate the amygdala, which sends efferent projections to regions of the visual cortex ordered to process low-level spatial frequencies (e.g., global); in turn, these connections have an inhibitory effect on the regions of the visual cortex in charge of processing high-level spatial frequencies (e.g., details) (Borst & Kosslyn, 2010). This experiment also suggests that the processes involved in VMI and visual perceptions occur in the same regions of the visual cortex as both are modulated in the same way by aversive stimuli.

Although specific evidence of the influence of emotions on VMI is scarce to say the least, there is robust evidence that the emotional value of a stimulus modulates the activity of the areas of the visual cortex (Adolphs, 2004; Sabatinelli, Lang, Keil & Bradley, 2007; Pourtois & Vuilleumier, 2006; Vuilleumier & Driver, 2007). This emotional modulation is stronger in high-level visual areas such as inferior temporal (IT) visual cortex and LOC, which are associated with processing of the overall visual form and thought to be caused by efferent projections from the amygdala—probably from the basal nuclei and lateral and basal accessory nuclei (Freese & Amaral, 2009; Vuilleumier, 2009). It is also known that the amygdala sends projections to the dorsolateral PFC and the orbitofrontal cortex, which, as seen in Sections 3.4 and 3.5.2.4, are essential components of the systems involved in task-sets, visual working memory, and in the generation of VMI (Dolan, 2007; Schaefer et al., 2006). Interestingly, the amygdala, through the central nucleus, also connects with the cholinergic nuclei of the basal forebrain, which in turn projects to a large number of regions in the frontal, parietal and modality-specific cortices, where it amplifies ('enhances') the neural processes. Koch argues that if there is only one neurotransmitter that can be associated with consciousness, it is acetylcholine (and the cholinergic system), given its generalised projections to the entire cortex (Koch, 2004). Moreover, the activity of the amygdala is also modulated by hormones (Rodrigues, LeDoux & Sapolsky, 2009) and monoamines (LeDoux & Sciller, 2009), in line with the role of monoamines (e.g., dopamine and serotonin) and modulation of cognition, mood, emotions and motivations (Amin et al., 2005; Cools et al., 2007; Dayan & Huys, 2009).

The modulatory activity of the amygdala and monoamine systems on the visual areas—multimodal and unimodial (e.g., PFC and parietal processes associated with attention processes)—also modulates the processes related to memory. For example, Kensinger and colleagues show that humans are better at remembering stimuli with negative emotional valence (as opposed to neutral stimuli) and are able to recall more details of those negative stimuli. Interestingly, they show that the emotional effects on memory correlate with an increase in the activity of the right fusiform gyrus (rFG) during the coding process of the stimulus, and that, in turn, this increase correlates with an increase in amygdala activity (Kensinger, Garoff-Eaton & Schacter, 2007). Recall that the right fusiform gyrus is part of the inferior temporal cortex (ITC), which is believed to be involved in the processing and storage of specific visual objects, while the left fusiform gyrus is associated with the processing and storage of general forms of visual categories (Garoff, Slotnick & Schacter, 2005).

The visual cortex— its structures in low-level regions such as the visual cortex V1—receives a large number of connections from the midbrain and the cholinergic nuclei of the basal forebrain; thus, its activity is also modulated by the general state of the organism (e.g., level of vigilance) (Daw, 2004; Morrison, Hof & Huntley, 1998).

Finally, recent research suggests that cerebral representations of heartbeats influence the ability of subjects to report the presence or absence of a visual stimulus (Winston & Rees, 2014).

There is an indirect way by which emotions can modulate the activity of the visual cortex—through the modulation of attention. That the level of attention modulates activity in the visual cortex is an undoubted fact (Reynolds & Chelazzi, 2004). Actually, there is not much doubt that the emotional states guide the attentional resources in order to favour the processing of information relevant to the organism. In this way, emotions modulate the visual cortex activity through the modulation of attention resources (Kensinger, 2009; Pourtois & Vuilleumier, 2006; Vuilleumier & Driver, 2007).

In conclusion, Kiefer and colleagues show that the emotional state of an object also influences the semantic (conceptual) system; in particular, the emotional state facilitates the retrieval of semantic information that is congruent with the current emotional state of the organism ('mood-congruency') (Kiefer, Schuch, Schenck & Fiedler, 2007).

The presented evidence, coupled with the firmly established influence of emotions in decision-making processes (Damasio, 2003; Wallis, 2007a), clearly suggests that emotions exert a powerful influence on the perceptual, cognitive, and motor processes of (human) organisms.

While this evidence is, at best, indirect, I think it nevertheless suggests that the proposed theoretical approach of the interactions between mental imagery and emotions as an explanation of the effect of mental imagery on our emotional states (and vice versa) during the reading of literary works is at least plausible.

3.5.4 Neuroscience of literary appreciation: final observations

In this section, I propose the following theoretical postulate:

"The mental imagery contributes to the processes of literary artistic appreciation through the amplification of the emotional responses associated with the semantic (conceptual) content of a literary text."

Certainly, there are other ways in which mental imagery can contribute to the artistic appreciation of literary works. For example, images make explicit a lot of information not stored in a semantic (or conceptual) format. In other words, not all information associated with a stimulus is represented semantically (or conceptually). For example, if you are asked whether your first- or second-grade teacher used glasses, it is likely that to answer this question, you will have to form a VMI of the teacher and 'observe' whether or not she actually wears glasses. This is because this piece of information, while stored somewhere in the brain, is more likely to be represented perceptually (probably in some area of the right temporal visual cortex) than conceptually (Kossly et al., 2006). Moreover, mental imagery includes a great deal of difficult (or almost impossible) details expressible in words (e.g., the melody of a song, the facial features of a person, a scene of a birthday from our childhood).

While I focus exclusively on the role of mental imagery in the process of appreciation of literary works in this section, I do not assert in any way that any literary effect can be explained in terms of the relation between mental imagery and emotions. A great volume of formal resources influences the processes of artistic appreciation that have little or nothing to do with the relationship between mental images and emotions. Moreover, if the hypothesis of the artistic 'task-set' is correct, it is possible to have φ-works of art (literary) in which the generation of mental imagery plays a minor (or no) role in the artistic appreciation processes (e.g., much of the conceptual poetry like P = r = o = g = r = a = m = m = a = t = o = g = y from John Cayley or Jessica Smith's Manifest; see Figures 2.37, 2.38, and 2.30). In fact, the hypothesis underlying the artistic task-set suggests that it is difficult to reduce all the processes involved in artistic appreciation to one or more formal resources.

It is also important to remember that the effect of a formal resource depends on the artistic 'task-set 'activated by the reader. For example, Borges (1999) celebrates the interrogative tone imposed on the punishment in the following verses of Tagle Lara: "Where are those men and those Chinese, red ropes and chambergos that Requena knew?" (p.122, author's translation). But why, in the first place, should we read these verses with a distressed tone, as an expression of pain? Borges imposes on these verses his knowledge (or artistic 'task-set') of tango, which postulates that tango lyrics usually express negative emotions and therefore should be read by adopting a tone of complaint or lament. If we read these verses silently, the 'reading tone' is nothing other than the property of an auditory mental imagery. This illustrates the influence of the artistic 'task-set 'on our expectations and ways of processing φ-works of art (literary). While the theoretical approach is highly speculative, I would like to derive a series of implications from it, which the reader can scrutinise:

a) There should be a correlation between the emotional response caused by a φ-literary works of art and the ease with which the content of the same can be displayed mentally (as long as the φ-works of art require the generation of mental imagery to be appreciated);

b) Subjects are known to differ in their ability to generate mental imagery of different modalities—e.g., some people generate visual but non-auditory mental images with great ease, and so on. One possibility is that people generate mental imagery of a modality more easily. Specific ones prefer those φ-works of art that require, for their appreciation, the generation of mental images of that modality.

c) Some literary effects that are not traditionally associated with the capacity of generating mental imagery can be precisely explained by the mechanisms involved in the generation of mental images. For example, part of the attraction or taste for the rhetorical figure of speech called hyperbaton (the alteration of the normal order of words in a sentence) may be due to the fact that it poses a 'problem of configuration of the mental imagery', due to which the reader cannot anticipate the final appearance of the image until the normal order of the sentence is reconstructed. It is thus possible that part of the pleasure derived from hyperbaton comes from resolution to the problem of final configuration of the mental image.

d) Van Buren, Bromberger, Chatterjee, Miller, and Potts (2013) argue that there is a correlation between certain neuropsychological pathologies and alterations in visual artistic production and appreciation (e.g., painting). It is possible that the same thing happens in literary production and appreciation. For example, an inability to generate visual imagery may even underlie a preference for more conceptually-oriented literary works.

e) Readers commonly describe their reactions to literary works of art in terms of corporal experiences, such as ‘My heart speeded up', 'I could not breathe', and so on. Even renowned writers refer to their literary experiences in similar terms. Borges (1999), for example, often spoke of "physical pleasure" (p.23, author’s translation) or "physical commotion" (p.148, author’s translation) that finally led him reading this or that author/poem; the same holds for Nabokov, who in his story 'A forgotten poet', describes the poems of the main character (the forgotten poet) to provoke "the sensory effect of true poetry right between one's shoulder blades" (Nabokov, 2002). The proposed theoretical approach suggests that expressions of this type may be more than mere metaphors. The theoretical approach proposes that these physical feelings can be caused by projections from the modality-specific cortex (involved in the generation and experimentation of mental imagery) to i) somatosensory, interoceptive, and proprioceptive cortices involved in the generation and experimentation of affective mental imagery (in particularly corporals) and ii) the motor cortex and the mirror neuron system (MNS) involved in motor mental imagery (Freedberg & Gallese, 2007).

f) Johnson and Persinger show that during processes of verbal creativity that involve intense emotional states, subjects often experience the presence of the 'feeling of the presence of another self', and that this phenomenon may be the result of an increased activity in the right hemisphere, in particularly the right medial temporal cortex and the right temporal cortex (Johnson & Persinger, 1994; see also Kane, 2004 and Brooks Platt, 2007). Notably, Blanke and colleagues were able to induce experimental out-of-body experiences (OBEs)—that is, when the body itself 'floats', physically disconnected from our consciousness—through the electrical stimulation of the right angular gyrus and somatosensory cortex in patients suffering from epilepsy associated with the temporal lobe (Blanke, Ortigue, Landis & Seeck, 2002; see Berlucchi & Aglioti, 2010; Blanke & Arzy, 2005). The interesting thing is that the angular gyrus (also called temporoparietal junction) and the somatosensory cortex are associated with the generation of visual and affective mental imagery respectively (Kosslyn et al., 2006). It is possible, therefore, that experiences described by Johnson and Persinger (1994) are related to the capacity of mental imagery to activate regions of the cortex associated with corporal feelings.

The theoretical approach proposed here is not the only attempt that exists in the literature for promoting a neuroscientific approach to literary studies. Others have already suggested both theoretical and empirical models unrelated to neuroaesthetics; however, I find them unsatisfactory for several reasons. For example, Irving Massey in his book 'The Neural Imagination'—despite what the title may suggest as it actually presents neuroscientific results that may be relevant to the neuroscientific study of literary appreciation—concludes that since aesthetic experiences are subjective, they are scientifically irreducible: "It is probably futile to seek a physiological explanation for a problem in aesthetics" (Massey, 2009, p.128).

Another example is Norman Holland; his book 'Literature and the brain' (Holland, 2009) is certainly both catching and suggestive, and addresses many of the central problems of the neuroscience-aesthetic relationship discussed throughout this work. He also presents interesting hypotheses to explain certain literary phenomena, such as his suggestion that voluntary suspension of disbelief may be a function of the PFC that inhibits the reading of works of fiction-related processes with the planning of actions or behaviours that can be suggested by the semantic content of the text (Holland, 2009). However, I do not believe that his neuropsychoanalytic proposal is a promising conceptual framework for a neuroscience of artistic (literary) appreciation. This is because Holland never explicitly clarifies what he means by relating the mind and the brain (see Chapter 4). For example, in a passage, Holland seems to adopt a kind of dualism, when he states: "Inside our skull, two things are going on: brain processes and mental functions" (Holland, 2009, p. 17)—as if brain process and mental functions were two different realities. In fact, Holland later assumes a version of the so-called 'dual-aspect monism', which states that although mind and brain cannot be separated, they can be distinguished, since both are properties (or aspects) of the same neutral substance. However, in another passage, he seems to refer to the mind—especially to consciousness—as an object or an entity irreducible to brain processes and not as a property of another substance (Holland, 2009). This lack of clarity leads the author to positions very close to dualism, a theory that the author strives to avoid, such as when he states: "By relating psychoanalytic inferences about unconscious processes to neurological inferences about the brain, neuropsychoanalysts are beginning to show that various psychoanalytic entities (like libido, repression, wordrepresentation, or superego) function as brain systems"

(Holland, 2009, p.21). It should be noted that 'psychoanalytic entities' like id, ego, superego, repression, libido, and so on, have not received any type of neuroscientific validation—rather the opposite. It is regretful that Holland does not cite any neuroscientific literature to support his affirmations.

Finally, two methodological remarks must be made about Holland's proposal. First of all, the method proposed by Holland consists of the combination of free association, which for Holland is the only method to study unconscious processes, with "the neurons and neurotransmission that neurology examines" (Holland. 2009, p. 19)—I doubt the usefulness of such a method. Second, Holland proposes what he calls a 'noncontroversial relativism'—that is, the thesis that postulates that everything we can know is our perception; the world as it was, is, and will be, is and will forever be unknowable (Holland, 2009, p. 33). 'Relativism without controversies', far from being neutral, is contrary to the aims and foundations of science in general and neuroscience in particular.

3.6 Summary of part 2

a) The experimental programme of neuroaesthetics is based on the assumption that the mechanisms associated with artistic appreciation are essentially bottom-up mechanisms because they depend exclusively on how modality-specific cortices (e.g., visual cortex, auditory cortex, etc.) respond to the objective properties of works of art (Section 3.2; Figures 3.1, 3.2 and 3.3).

b) There are both conceptual (Section 3.2.1.1) and empirical research findings (see Section 3.2.1.2) showing that the experimental project of neuroaesthetics is untenable—for example: i) the concept of 'artwork' shows that both recognising an object as an artwork and appreciating an object artistically imply the knowledge on the part of the subject of a series of social conventions to be learned; ii) there are factors (or variables), both external (e.g., presentation of an artwork) and internal (i.e. level of artistic knowledge), which modulate artistic appreciation (Section 3.2).

c) The process of artistic appreciation cannot be reduced to the analysis of the manifested properties of stimuli; on the contrary, it is a complex process guided by expectations and prior knowledge and modulated by the context in which it occurs (Section 3.3, Figures 3.7, 3.8, 3.10, and 3.11).

d) I propose that the empirical results of experimental aesthetics can be explained, in part, if we assume that artistic appreciation is a process involving the activation of 'artistic task-sets' (Section 3.4); in particular I propose the following theoretical postulate: "Artistic appreciation is a process mediated (directed) by the top-down projections from the 'artistic task-sets' towards the areas of perceptual, emotional, and semantic processing."

e) Then, I propose to define an artistic experience as the result of the process of contrasting the knowledge and expectations activated by an artistic task-set (top-down process) with the perceptual, semantic, and emotional processes evoked by the presentation of a particular stimulus (φ-artwork) (bottom-up process) (Section 3.4.1; Figure 3.15).

f) I also propose the following theoretical postulate regarding the role of mental imagery in the artistic appreciation of literary works: "Perceptual mental imagery enhances or amplifies the emotional responses associated with the semantic (conceptual) content of a literary text, and this increase is, in part, due to the anatomical (and functional) connections between the modality-specific cortical areas ('substrate' of perceptual mental imagery) and the emotional areas of the brain" (Section 3.5.2; Figure 3.40).

3.7 Conclusions

As already mentioned in the introduction, this work is organised around two main objectives: (a) to provide a new conceptual framework on which the foundations for a new scientific aesthetic can be created; and (b) to demonstrate the possibilities and limitations of the current neuroscience-based research in aesthetics. In the first two parts of this work, I present a newly developed conceptual framework of aesthetics and propose a new neurocognitive theoretical approach of the systems and mechanisms involved in the artistic appraisal. I conclude with two final reflections or thoughts such as the problem of psycho-physical identity, which are addressed in Chapter 4.

It may be argued that the 'origins' of this work derives from a special academic concern—that is, a special interest in the artistic disciplines (such as fine arts, literature, music, and theatre). My concern can be summarised as follows: Despite the obvious successes of neurosciences in the field of aesthetics in general and literary aesthetics in particular, can artistic and literary work continue to be treated as independent of progress in the cognitive and affective neurosciences? In other words, is it scientifically justifiable to explore art and literature without examining the organ responsible for their enjoyment and their creation, namely the brain?

I am convinced—and I hope that this work provides the rational basis for supporting my conviction—that ignoring the neuroscientific bases of aesthetics can be likened to studying history without a knowledge of societies or studying metabolism without knowing about cells. A precondition for a scientific aesthetics is to also ponder its neuroscientific fundamentals, to investigate the cognitive and neural structures that underlie artistic appreciation and enable people to create, experience, and enjoy art. Certainly, as I have argued, the neurosciences are not yet sufficiently developed to properly uncover the processes of artistic creation and appreciation (and experience), and without the knowledge yielded by such an 'aesthetic neuroscience', a true understanding of the latter would be impossible.

However, it is also clear that this is not a hegemonic vision—at least it is not seen in the faculties and schools of art in our university landscape. Is it possible to speak of resistance regarding the neurosciences to integrate these into our humanistic faculties? Within the scientific community, the 'spiritual' phenomena have been studied in a restrained manner for centuries, but the neurosciences have gained recognition in a short time. There is no doubt that they can be regarded as equal in status and influence to the traditional sciences such as physics, biology, chemistry, and so on. However, it seems that this recognition has not yet spread to the humanities, where neuroscience is only now beginning to have a marked influence.

Undoubtedly, the causes of this situation are manifold and complex and range from the sociological, to the strictly scientific, and also the purely philosophical aspects. The importance of accepting neuroscientific results also implies the philosophical preconditions on which the programming of neuroscience is based, namely ontological materialism (e.g., mental functions are cerebral processes, see Chapter 4) and epistemological realism (e.g., the world exists independently of the subjects and is knowable, albeit gradually and imperfectly) (Bunge, 2004, 2007, 2010; Craver, 2007). Unfortunately, neither ontological materialism nor epistemological realism enjoys a high reputation in humanist faculties. I would therefore like to quote only two examples to illustrate this point:

1. The continental poststructuralist philosophy is non-rational in the traditional sense because it rejects the idea that orthodox science is the only tool that can be used to understand reality (i.e. the decree of science and logic as tools for understanding reality) and idealistic (or textualistic in the sense that it transforms reality into symbols and texts or reduces it to reading). The following quotation comes from an interview with Barthes from the magazine l'Express in 1970 (Barthes, 1981/1985, p.93–94):

> *Journalist: Don´t you think that you somewhat exaggerate the role of symbolic activity?*
>
> *Roland Barthes: No, I don´t think so, because I can only agree with Lacan: it is not man who constitutes the symbolic which constitutes man. When man enters this world, he enters a symbolic order which is already in place. And he cannot be 'man' if he does not enter the symbolic order.*
>
> *Journalist: You mean that from birth he is part of an upbringing, an education, a social class—institutions that are already established.*
>
> *Roland Barthes: Not completely. An institution is always established on the cultural level; it involves codes, protocols, a language. The symbolic is much more archaic, much more elementary […] But the importance of the symbolic order is corroborated everywhere, and not only be the theoretical reflections of a psychoanalyst.*
>
> *Psychosomatic medicine, for example, has been able to establish that specifically psychosomatic ailments such as asthma, or stomach ulcers, always originate in a disruption of symbolisation. Psychosomatic patients do not symbolise enough. The ideal cure would be to inject them with the symbolic factor, thus making them neurotic.*
>
> *Journalist: Cure the neurosis. The medicine you propose seems strange, to say the least.*
>
> *Roland Barthes: No, not at all. By the way, it´s the psychosomaticians who propose this method, not I. A neurotic is someone in whom a blockage has*

resulted from various censorships which annihilate all this symbol. His silence is a silence of censorship. The psychosomatic patient is in the opposite position. He does not symbolise his body, which remains matte, without echo. His silence is a silence of emptiness. His cure progress to the extent that the symbolic function is successfully re-established in him, for it is precisely that function which is hypertrophied in cases of neurosis.

2. The adoption of the Bakhtinian dichotomy between ‘humanities’ and ‘human sciences’ is a division that does not only promote but also ignores the neuroscientific program, which is nothing more than equating the mind and the brain. In Bakhtin’s own words: "One's [own and foreign-author’s note] spirit cannot be given as a thing [which is the immediate object of science-author’s note], but only as an expression of the text for itself and for others" (Bakhtin, 1998, p.297, author's translation). In the end, this means "[...] the humanities are sciences which examine man in his specificity and not as a voiceless thing or natural phenomenon" (Bakthin, 1998, p. 298, author's translation).

Part III:

THE ONTOLOGICAL FOUNDATION OF THE NEUROSCIENTIFIC STUDY OF ARTISTIC APPRECIATION

CHAPTER 4: THE MIND IS THE BRAIN- THE NEUROAESTHETIC APPROACH AND THE PHILOSOPHY OF MIND

4.1 Introduction

Aesthetics, understood as the scientific-philosophical discipline concerned with the elucidation, foundation, and explanation of concepts such as 'art', 'artistic value', 'beauty', 'inspiration', 'fiction', and so on, has its beginnings in Plato, who discussed in several of his dialogues many of the themes that would later be aesthetic material (Halliwell, 2009). Certainly, the aesthetics of Plato is untenable in the present debate, especially because it is based on a dualistic ontology incompatible with the ontological assumptions of modern science. However, there is one aspect of Plato's proposal that I think is important to emphasise—for Plato, aesthetics must be based on clear ontological principles; in particular, all aesthetic proposals are based on assumptions about the mind-brain relationship (theory of the mind) that must be made explicit; neuroscientific research of artistic appreciation and creation is no exception.

In this brief chapter, I explain what is, in my opinion, the theory of central focus of the neuroscientific research programme of appreciation and artistic creation, which is called neuroaesthetics in general. I will discuss briefly the central ontological preconditions of the neurocognitive studies of art, namely, the 'mind - brain' identity hypothesis, and compare it with other approaches regarding the mind-brain relationship.

4.2 A mind for neuroaesthetics

In simple terms, we can state that the central objective of neuroaesthetics is to explain the processes involved in artistic creation and appreciation with respect to systems of brain processes. This relates to the idea that it is possible to explain artistic creation and appreciation based on how our brain works. The central idea of all neuroscience and not only of neuroaesthetics is based on a very specific philosophical presupposition, namely that which we call mind is actually a set of brain processes. This presupposition is far from being accepted by the entire philosophical and scientific community. Consider, for example, the following proposals on the nature of the mind and whether or not they are compatible with the neuroscience programme:

a) The mind is an immaterial entity that, in the best of cases, interacts with the brain (dualism).

b) The mind, or rather mental function, is the specific function of a special class of structures or architectures (physical) for processing information—e.g., the specific function of recurrent networks (or systems) ('recurrent networks'; Churchland, 1996; Smith Churchland, 1989; Llinas, 2001)

c) Mental functions are functional states of multiple realisation ('Functionalism or multiple realisation'—'multiple-realizability': Aizawa, 2007; Aizawa & Gillett, 2009; Churchland, 1988; Putman, 1960)

d) Mental functions are holistic properties of a person considered as a whole, and not of any particular organ (Bennett & Hacker, 2003)

e) Mental functions are a product of brain activity—"All of our mental phenomena are caused by lower level neuronal processes in the brain" (Searle, 2002, p. 57; Searle, 2004)

f) Mental functions are molecular processes (Bickle, 2003, 2006)

g) Mental functions are processes of individual neurons (e.g., 'grandmother's neuron' or 'grandmother cell' hypothesis).

h) Mental functions are properties (functions) emerging from cerebral systems (Bechtel, 2008; Bunge, 1979, 2010; Craver, 2007; Damasio, 2012; Gazzaniga, 2010; Kandel et al., 2013; Koch, 2004; LeDoux, 2003; Sporns, 2011).

Although I do not analyse in detail any of these proposals (except the affirmation h), some discussion is necessary, particularly in relation to the methodology suggested for the study of artistic creation and appreciation. For example, as far as I know, proposal d is exclusive to Bennett (philosopher) and Hacker (biologist), who claim, for example, that "ascription of psychological attributes to the brain is incoherent […] For it makes no sense to ascribe such psychological attributes to anything less than the animal as a whole. It is the animal that perceives, not parts of its brain, and it is human beings who think and reason, not their brains" (Bennett & Hacker, 2003, p. 3).

Bennett and Hacker therefore argue that some neuroscientists are guilty of a 'mereological fallacy' when they refer to the brain (just a part of the body) as if it is the whole thinking person. Their argument is basically a Wittgensteinian critique of sloppy language usage and it has evoked some debate in collaboration with philosophers such as Dennett or Searle (Bennett, Dennett, Hacker & Searle, 2007). This linguistic critique is not considered any further in this thesis, but it is worth mentioning that, beyond that critical volume, no one has taken it seriously.

I pause briefly at statements b and c because these affirmations are popular within the philosophy of mind (see Schouton & de Jong, 2007).
There are three versions of the thesis of multiple realisation: radical (or dualist—Thesis c), moderate (e.g., physicalism—Thesis b), and a mild or 'degenerate' one.

The radical version of the multiple-realisation viewpoint was originally proposed by the famous philosopher and mathematician Hilary Putman in his classic article in 1967. In this article he stated:

> *Pain is not a brain state, in the sense of a physical-chemical state of the brain (or even the whole nervous system), but another kind of state entirely. I propose the hypothesis that pain, or the state of being in pain, is a functional state of a whole organism (Putnam, 1967, p. 54).*

In short, the radical version of the thesis of multiple realisation stipulates that functions or mental states are a particular kind of functional process characterised by causal relationships established between a) environmental stimuli (e.g., how they process a stimulus), b) other mental states (e.g., perception-memory relationship), and c) corporal responses. In this sense, what differentiates a mental function from a non-mental functional process (e.g., a thermostat) is the difference in degree (e.g., complexity) and not quality (Churchland,1988). In turn, the radical version of multiple realisation states that these functional processes are independent of the material support in which they are updated (or performed). In the case of mental functions, for example, these would be independent of the properties of the brains that perform these functions, and as such they are updatable (or realisable) in other substances.

Critical literature around the radical version of the multiple realisation is abundant. Here, I am only interested in highlighting two characteristics that make it incompatible with the neuroscience programme in general, and with neuroaesthetics in particular.

First, the radical version of the multiple realisation is vague. Despite having been proposed more than 40 years ago the relationship between the functional states and the materials where they are made remains a mystery. Second, in relation to the vagueness of the functional state/realisation, the radical version is surreptitiously dualistic. For example, Aizawa—one of the main contemporary exponents of the radical version—proposes the following definition of realisation:

> *(Realization) Property/relation instance(s) of F_1 -F_n realize an instance of a property G, in an individual s under conditions $, if and only if, under $, s has powers that are individuative of an instance of G in virtue of the powers together contributed by the instances of F_1 -F_n to s or s' s constituent(s), but not vice versa (Aizawa & Gillet, 2009, p.186).*

I must confess that I find the definition given by Aizawa and Gillet a bit cryptic, but I believe that what they say is basically that the property instance is a realisation of the property x sys, has causal powers attributed to x, and further that the causality is one way only, whatever that may mean in the particular situation. What is clear is that this definition of realisation depends on the distinction between two kinds of properties—the 'properties' themselves and the 'instances of properties'. While properties are abstract entities that only "exist in the natural world through their instances" (Aizawa & Gillet, 2009, p.184), an instance of property is "an entity that makes a difference to the causal powers of individuals" (Aizawa & Gillet, 2009, p.186). Leaving aside the fact that the properties are not entities but qualities of entities, this distinction between properties and instances of properties, is not only as vague as the relation between functional state/realisation, but is nothing other than a revitalisation of the old Platonic dualistic distinction between form and substance and the thesis that forms precede substances—that is, the properties exist beforehand, and independent of the entities that possess them (Aizawa, 2007, 2009).

Third, an epistemological implication of the radical version of the multiple realisation is that the final explanation of a 'functional state' or property (unlike a property instance) is independent of the material in which the property (or functional status) is performed (updated). Thus, the theoretical approach of a state functional/property does not need to refer to the entity that confers that state's functional/property. One could explain the action potential if referring to neurons, brainless perception and so on. In the case of artistic appreciation, this implies that one could explain how an artwork is artistically appreciated without referring to the properties of the organism that is artistically appreciating the artwork.

Evidently, this is not what science seeks. Scientists know that one cannot separate properties from things that possess those properties for the simple reason that properties are traits or qualities of material entities. Let me quote this somewhat extensive passage from Craver, in which he contrasts the epistemological goal of radical multiple realisation with the epistemological objectives of science:

> *No neuroscientist would claim, for example, that it makes no difference to the explanation of the action potential whether ions move across the membrane by active transport, passive diffusion, or a mechanism made of Swiss cheese (to pick a philosophically charged example). One might be entertained by building a model of the action potential out of Swiss cheese, and it would be impressive indeed if this model could reproduce the form of the action potential, but no reputable journal would publish the model, let alone allow the author to claim that it counted as an explanation of the action potential. Neurons are not made of Swiss cheese (Craver, 2006, p.370).*

The moderate version of multiple realisation, although it maintains that the mental functions are realisable in multiple substances, identifies mental functions with physical structures of information processing. In other words, for the moderate version, mental functions are a special kind of information-processing that can only be performed by a special class of physical structures. Then, although in principle mental functions can be performed in multiple entities and materials, they can only be performed in those entities that have the necessary structure to process the information in a certain way. As Christof Koch (2012) postulates in his last book:

> *It is not the nature of the stuff that the brain is made out of that matters for mind, it is rather the organization of that stuff—the way the parts of the system are hooked up, their casual interactions. A fancier way of stating this is 'Consciousness is substrate-independent (p. 120–121).*

Unlike the radical version, the moderate version of multiple realisation is not contrary to the objectives of science. However, I allow myself to make the following comments:

a) The moderate version does not know (or denies) the existence of emerging properties that are irreducible to physical properties. In other words, it tries to reduce everything that exists to entities and physical properties in the narrow sense of 'entities and properties studied by physics'. In this sense, it denies the existence of chemical, biological, social, and technological properties, which are not reducible to physical properties despite being material (for defences of the existence of emergent properties and their importance in the sciences in general and neurosciences in particular, see Bedau & Humphreys, 2008; Bunge, 2004, 2010; Clayton & Davies, 2006; Craver, 2007; Glennnan, 2010; Morowitz, 2002; Sawyer, 2004; Wimsatt, 2006).

b) By reducing all property to physical properties, it tends to favour research on artificial intelligence, robotics, and computer simulations over neuroscientific experimentation.

c) Although conceptually coherent and plausible, the least empirical evidence of the existence of mental properties (or functions) in any entity other than the brain does not exist, as the main promoters of the moderated version recognise (although these same authors believe that artificial intelligence will soon reverse this situation; Churchland, 1996; Koch, 2012; Llinas, 2001).

d) The moderate version can be counterproductive for the development of disciplines like psychology, psychiatry, or neurology—that is, specialised disciplines in understanding and treating different psychological or neurological problems. As one of the most recognised exponents of the moderate version of the multiple realisation recognises:

> *When the architectures for generating cognition are finally realized, we may have thinking/feeling machines. However, our ability to design and build them may not ultimately be that useful in understanding brain function, in the same way that understanding airplanes may not tell us all about how the physiology of bats or birds enables them to fly (Llinas, 2001, p. 266).*

e) Finally, although it is not a necessary implication of the moderate version, its promoters usually adopt positions close to dualism. Take the case of Paul Churchland. Churchland's proposal is called "vectorialism" (Laakso & Cottrell, 2006), because it defines the brain as a multidimensional geometric space and mental functions/representations such as "an activation vector across the representing population of neurons" in that multidimensional space (Churchland, 1996, p.48). Thus, for example,

> *[…] the external environment is represented in the brain with high-dimensional coding vectors; and if the brain's 'intended' bodily behavior is represented in its motor nerves with high-dimensional coding vectors; then, what intelligence requires is some appropriate or well-tuned transformation of sensory vectors into motor vectors! (Churchland, 1996, p.93).*

Llinas makes similar claims, such as when he asks what the self is and responds: "it is a very important and useful construct, a complicated eigen (self) vector. It exists only as a calculated entity" (Llinas, 2001, p.128).

As we can see, both Llinas and Churchland define mental functions in terms of mathematical objects (e.g., constructs, vectors) and abstract entities. However, vectors and other mathematical constructs are theoretical objects and not the properties of brains. In short, the vectorialism of Churchland and Llinas is dangerously close to the dualism that both despise (and consequently to postures similar to those of radical multiple realisation).

Finally, we need to mention the third version of the multiple realisation—the mild or 'degenerate' version. In this version, mental functions are defined in terms of cerebral systems and processes—which makes it very different from the radical and moderate versions. However, unlike the classic identity theory that each mental function corresponds to a single cerebral system ('one-to-one mapping'), scholars who propose this slight version of multiple realisation claim that the same mental function can be performed by different cerebral systems and processes ('one-to-many mapping'). In other words, the relationship function /cerebral system is one-to-many, or as is said in genetics, it is a degenerate relationship (Edelman, 2004). The idea of 'degenerate code' emerged in genetics, in relation to which the same amino acid is encoded by different codons—for example, the amino acid Leucine (Leu) is encoded by the codons TTA, TTG, CTT, CTC, CTA, and CTG.

This mild version of multiple realisation is not only compatible with the neurosciences, but there is empirical evidence that supports it and it is furthermore one of the pillars of the so-called "neuroconstructivism". One of its characteristic claims is that during brain development, the same mental function is performed by different brain systems, which change in response to the interactions established between the different brain subsystems and the interactions of the organism with the environment (de Haan & Johnson, 2005; Johnson & de Haan, 2011; Karmiloff-Smith, 2006; Westermann et al., 2007). For example, there is neurocognitive evidence showing that as we develop, the brain uses different systems to visually process faces (Johnson et al., 2009; Kadosh, Kadosh, Dick & Johnson, 2011; Kadosh & Johnson, 2007; Figure 4.1).

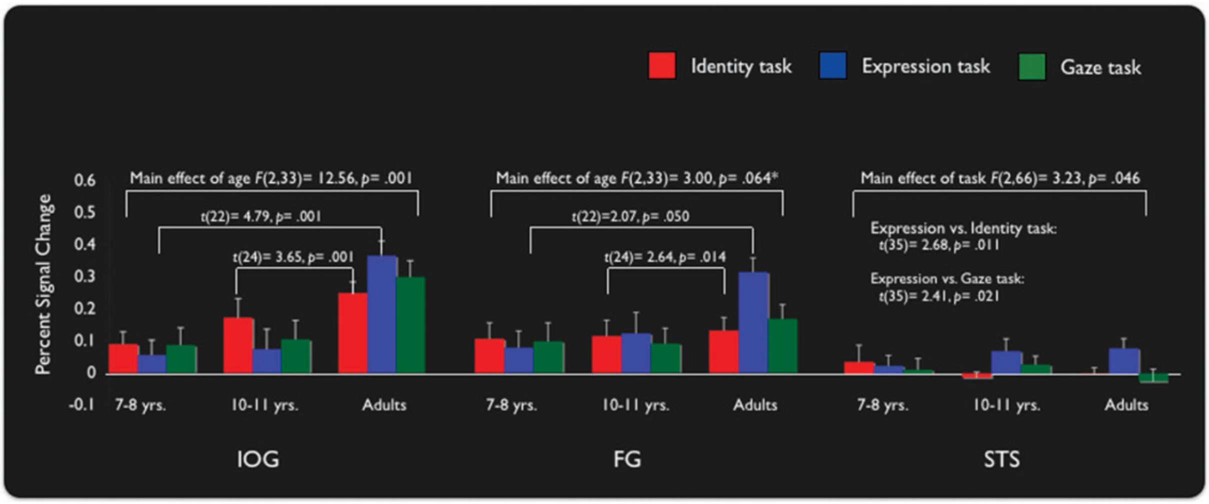

Figure 4.1 Different systems to visually process faces: This graph shows changes in the activity of three recognised brain areas as components of the system involved in the perception of faces, depending on the task and age; IOG (inferior occipital gyrus; inferior occipital convolution); FG (fusiform gyrus; fusiform convolution); STS (superior temporal sulcus) (from: Kadosh et al., 2011).

In this section, I argue that the ontological principle that underlies neuroscientific research in general and neuroaesthetics in particular is a variant of the so-called psychoneural identity thesis.

Before going a little deeper into the psychoneural identity thesis, I think it is important to offer the following definition:

'Mind' = $_{def}$ *"the set of all mental functions."*

As we can see in the case of the definition of art (see Table 2.1), the concept of mind refers not to any concrete material entity but to a set composed of all mental functions. As in the case of art, we can say that the mind is not real—what is real are the mental functions.

Let us go back to the thesis of psychoneural identity, which postulates that every state or mental process is a cerebral state or process; in other words, "the brain is the organ of mental processes" (Squire & Kandel, 2000, p 56). If the brain is the organ of mental functions, these cannot be explained independently of the brain, just as breathing cannot be understood without the organs of the respiratory system or digestion without the organs of the digestive system. These analogies should not, however, lead us to commit the error of thinking of the mind as a product of brain activity (as postulated by Searle, 2002, 2004). Thinking of mental functions as products of cerebral activity implies that, like all products, they can be studied independent of the productive process. This is not true in the case of mental functions. If we want to look for an analogy, I would say that the mental functions are rather like the beating of the heart, which is nothing other than the beating heart. The mental functions can be entitled as "mental" brain.

Identifying mental functions with cerebral processes—or with the brain as the organ of mental functions—although it is a radical conceptual change in relation to how mental functions are characterised, is not enough. The brain is an extremely complex organ organised into different hierarchical levels, composed of millions of elements—each performing millions of processes (Sporns, 2011). Not every process that occurs in the brain deserves to be described as mental. Individual neurons, for example, perform hundreds of processes common to all cells (neurons and non-neurons), from protein synthesis to the regulation of homeostasis. While there are those who have proposed defining mental functions in terms of molecular processes (Bickle, 2003, 2006), most evidence suggests that mental functions are functions of complex neural systems.

Moreover, not every complex brain process is defined as mental: the regulation of the heart rate and reflexive responses, for example, are both functions of brain systems composed of thousands of neurons, and yet they are not traditionally considered as mental functions.

Actually, only a small part of the processes that occur in the brain is considered to be mental. In other words, if M is the set of mental functions and C is the set of brain processes, then $M <C$—that is, M is a subset of C. This is equivalent to $\{x \mid x \in M \rightarrow x \in C\}$, which means that if x belongs to M (x is a mental function), then x belongs to C (x is a brain process), but the inverse is false.

Consequently, the psychoneural identity thesis, despite being fundamental in neuroscience, is not enough.

In this section, I would like to propose a very speculative theoretical approach about mental functions. In particular I would like to propose a hierarchical view of the mental functions and distinguish between mental functions of low level, medium level and high level, characterised by emergent (or systemic) properties[17] particular to each level and related to each other by compositional relationships (Figure 4.2).

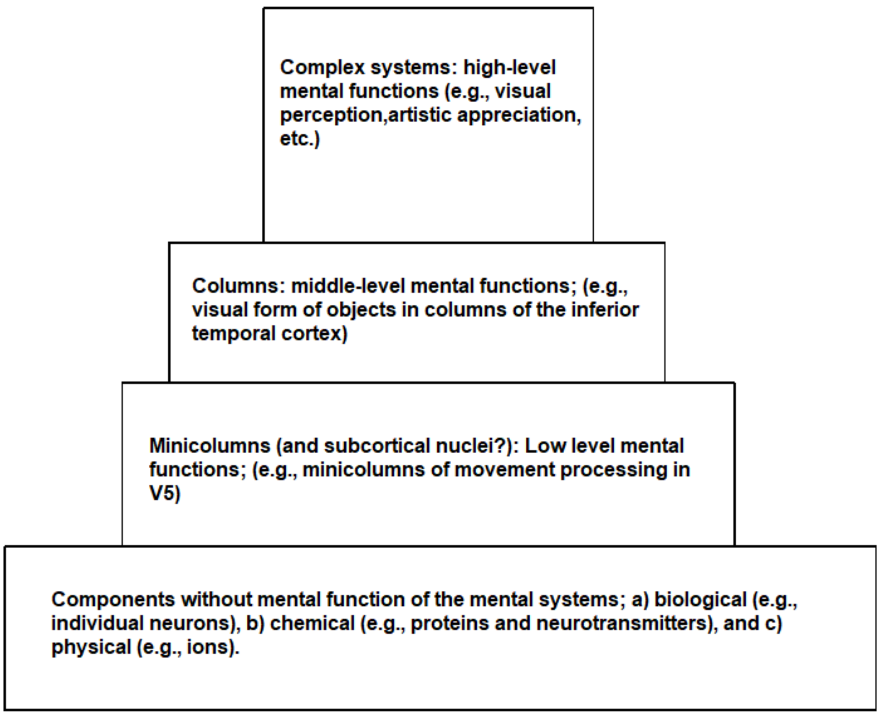

Figure 4.2 Compositional relationships: (Source: own presentation).

[17] Basically, emergent properties mean those properties that a system possesses but that the parts composing this system lack. For example, inflation is a property of a country's economic system, and not a property of some companies that make up that system. That is why the emergent properties are qualitatively novel in relation to the properties of the components of a system, and they cannot be reduced to any property of the parts.

The relationship between the levels illustrated in the figure above, should not be understood as a causal relationship. It is not the case that low-level mental functions cause mid-level functions or that high-level functions are a product of mid-level functions (as Searle, 2002, proposes). On the contrary, the figure represents compositional relationships and emergent properties—that, is it shows that high-level mental functions are emergent functions of brain systems composed of systems with mid-level functions. mid-level functions, in turn, are emerging properties of brain systems composed of systems with low-level functions, and so on.

4.3 A hierarchical and emergent model of mental functions

A central hypothesis in relation to mental functions, whether low, medium, or high level, is that mental functions are systemic or emerging properties of neuronal systems (or 'networks')[18] (Bunge, 1979, 2010; Casanova, 2010; Casanova & Tillquist, 2008; Meyer & Damasio, 2009; Gazzaniga, 2010; Hebb, 2002; Kandel et al., 2013, Koch, 2004; Kosslyn, 2005; LeDoux, 2003; Mountcastle, 1997; Sporns, 2011; Tononi, 2012).

This hypothesis is supported by numerous sources of evidence, from computational models that seek to simulate brain operations to neuropsychological and neuroimaging studies showing that large portions of the brain (or the loss of large portions of the brain) are needed to perform (or prevent) any mental function.

It has certainly been proposed that mental functions could be functions of individual neurons or even molecules (Bickle: 2006). However, individual neurons have certain properties that make them poor candidates for organs of mental functions. For example, individual neurons are unable to depolarise themselves to a postsynaptic neuron (Koch & Segev, 2000). More relevant is perhaps the fact that the activity of a single neuron is “[unstable and] is not activated uniquely by one specific complicated or simple stimulus […] [which means that] activation of single neurons alone cannot specify any unique information in a situation” (Sakuray, 2007, p. 251).

This has been demonstrated experimentally, among others, by Sato and colleagues;

[18] Actually, it would be better to say cerebral systems, since we do not know exactly what is the role of non-neuronal components (e.g., glia cells) in mental functions.

through the implantation of electrodes directly into the brains of monkeys, they recorded the activity of individual neurons and populations of neurons in the lower temporal cortex. As we see above, these neurons are involved in the processing of global visual forms and the visual recognition of complex objects (see Figure 3.35). What they observe is that individual neurons in ITC have a very large range of stimuli to which they are activated—that is, they have very little selectivity. On the contrary, when analysing the activity of populations of neurons, they report much more stable selectivity. In other words, while it is possible to recover the identity of the stimulus seen by the monkey from the activity of neuron populations, this is impossible with the information provided by an individual neuron (Sato, Uchida & Tanifuji, 2009). Something similar was done by Kreiman and colleagues, who show that the local field potentials (LFP—believed to measure the activity of small populations of neurons in relation to the inputs that the population receives) of populations of neurons in IT have a stronger selectivity to complex visual forms than individual neurons. Furthermore, the activity of an individual neuron is a poor indicator of LFP selectivity (Kreiman et al., 2006; see also Meyers et al., 2008).
Interestingly, Koch and Segev could not predict the properties of the LFP through the activity of individual neurons, which led them to conclude that circuits of neurons can offer emergent properties that are not easy to visualise by looking at individual neurons without studying their interactions (Koch & Segev,1989).
Finally, Hung and colleagues obtained results similar to those of Kreiman and calculated that the activity of a population of at least ~100 neurons in ITC is necessary to decode the identity of the visual stimulus (Hung et al., 2005). This result is interesting since it is estimated that between 80 and 100 neurons make up a cortical minicolumn (Buxhoeveden & Casanova, 2002; see more about minicolumns below).

In summary, although more research is undoubtedly necessary, there is a general convergence on the idea that the brain encodes perceptual stimuli, memories, and motor actions at the level of populations (systems) of neurons (Kreiman, 2004; Logothetis, 2008; Quiroga, Kreiman, Koch & Fried 2007; Quiroga & Kreiman, 2010), and that the information processed at the population level cannot be reduced to the level of individual neurons (much less at the molecular level) (Liu, Agam, Madsen &

Kreiman., 2009; Meyers et al., 2008; Quiroga & Panzeri, 2009; Rasch, Logothetis & Kreiman, 2009). As Sporns emphatically states:

> *The notion that brain function can be fully reduced to the operation of cells or molecules is as ill-conceived as the complementary view that cognition can be understood without making reference to its biological substrates. Only through multiscale network interactions can molecules and cells give rise to behavior and cognition. Knowledge about network interactions on and across multiple levels of organization is crucial for a more complete understanding of the brain as an integrated system (Sporns, 2011, p. 2–3).*

Assuming that mental functions are in effect properties of emerging cerebral systems, I would like to propose the following

Theoretical postulate: At the level of the cortex, the elementary (smallest) system capable of performing mental functions is the cortical minicolumn.

The idea that the cortical minicolumn is a functional unit was proposed for the first time by the Spanish neuroanatomist Rafael Lorente de Nó—disciple of the great Ramón Santiago y Cajal—who, based exclusively on criteria and anatomical evidence, proposed that the minicolumns are the "elementary cortical unit of operation" (DeFelipe, 2005, p. 61; Figure 4.3).

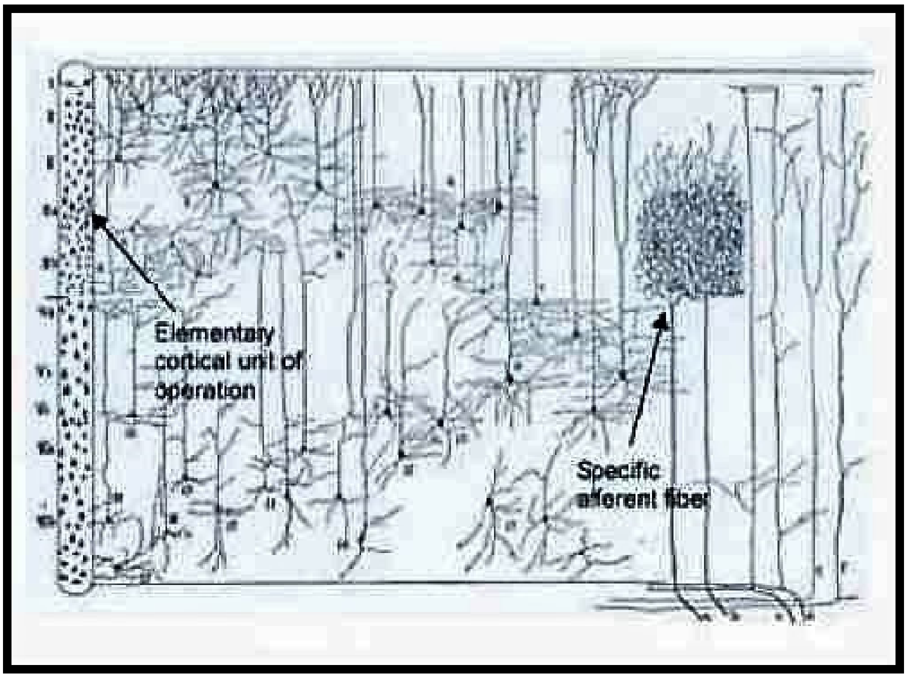

Figure 4.3 Drawing made by Lorente de Nó and adapted by DeFelipe, representing a cortical minicolumn as the elementary processing unit of the cortex (each black point represents a cellular soma) (from: DeFelipe, 2005).

The first functional evidence (not only anatomical) in favour of the minicolumn as the elementary processing unit of the cortex, came from the electrophysiological recordings performed by Vernon Mountcastle on the somatosensory cortex of cats (Mountcastle, 1957) and the electrophysiological recordings made by Hubel and Wiesel in the primary visual cortex of cats too (Hubel & Wiesel, 1959; see also Shepherd 2010). Since then, more evidence has been accumulated - both in monkeys and in rats (especially in the so-called 'barrel cortex') in favour of the minicolumn theoretical postulate as the elementary unit of the cortex (Buxhoeveden & Casanova, 2002; Casanova, 2005, 2010; Mountcastle, 1997; Rockland, 2010; Tommerdahl, et al., 2005).

Anatomically, a minicolumn is a vertical organisation of neurons that goes from the second cortical layer to the sixth cortical layer (Figure 4.4 and 4.5).

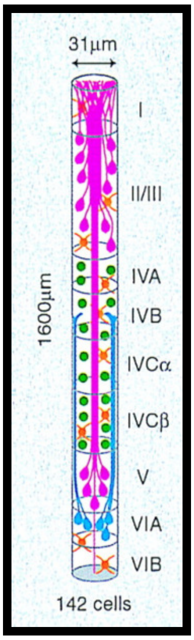

Figure 4.4. Schematic representation of a minicolumn. The numbers and letters on the right represent the cortical layers (from: Jones, 2000).

Note that in this figure the type of neurons that make up a minicolumn are differentiated by colour: Pink = pyramidal neurons; Greens = candelabra cells ('chandelier cell'); Blue = double bouquet cells; Yellow = large basket cells.

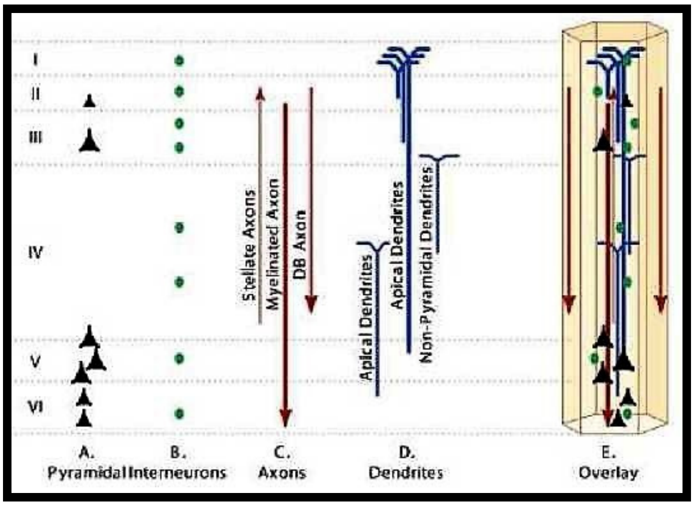

Figure 4.5 Schematic representation of a minicolumn (from: Casanova, Buxhoeveden & Gomez, 2003).

Unlike the previous image, in this image, the excitatory centre (stellate and myelinated axons) and the inhibitory neuropil (axons of double bouquet cells) are clearly visible. Neuropil inhibitory connections are an essential mechanism for functionally differentiating each minicolumn.

A typical minicolumn consists of a centre composed of pyramidal neurons and a periphery (or neuropil) composed of GABAergic interneurons and local synaptic connections; each minicolumn consists of about 80–140 neurons and has an average width of 60 µm (Buxhoeveden & Casanova, 2002; Casanova, Trippe, Tillquist & Switala, 2009; DeFelipe, 2005; see Figure 4.4). It is important to mention that both the composition and the structure of the minicolumns differ not only between species, but between individuals of the same species and between different regions of the cortex (Casanova et al., 2009, DeFelipe, Alonso-Nanclares & Arellano, 2002; Jones & Rakic, 2010).

A very interesting fact about minicolumns is that each minicolumn contains all the neuronal phenotypes—that means all minicolumn contains both spiny neurons ('spiny neurons', excitatory pyramidal and stellate neurons) and non-spiny and non-pyramidal neurons ('aspiny nonpyramidal neurons', inhibitory GABAergic interneurons); metaphorically, it could be said that each minicolumn is a miniature brain (Casanova et al., 2003). This particularity means that each minicolumn can carry out very complex processes that involve very precise excitatory and inhibitory interactions and balances. Minicolumns are far from being simple processing units;

on the contrary, it is evident that each input received by a minicolumn receives an "extensive localised processing" (Buxhoeveden & Casanova, 2002, p. 943) before being projected towards another region of the cortex (to see a model of the involved mechanisms, see Douglas & Martin, 2004; for the role of inhibitory interneurons, see Raghanti, Spocter, Butti, Hof & Sherwodd, 2010).

Functionally, a minicolumn can be defined by its receptive field, selectivity, and afferent and efferent connections (Buxhoeveden & Casanova, 2002; Casanova et al., 2009; DeFelipe, 2005; Hubel & Wiesel, 1977; Mountcastle, 1997). It is interesting that to date, minicolumns have been identified in all studied mammals, including rats, cats, non-human primates, and dolphins (Raghanti et al., 2010). According to the proposed theoretical postulate, all these species demonstrate mental activity.

Minicolumns have very interesting functional properties. One of the most significant properties is that minicolumns are plastic—that is, they can undergo structural and functional changes due to activity-dependent processes[19]. In other words, minicolumns can learn and store information. That minicolumns experience plasticity is relevant, basically, for two reasons. The first reason is that the ability to learn has been proposed as a necessary property of all mental function (Bunge, 2010, Kandel et al., 2013). For example, plasticity is one of the characteristics that distinguish cortical areas from subcortical fixed-action circuits (Tucker et al., 2000)[20]. The second reason is that plasticity is an activity-dependent process and neuroscience cannot ignore environmental effects on the development and functions of the brain. Given that the (social and cultural) environment in which human beings develop and act is predominantly artificial, classical cognitive and affective neurosciences must be integrated with what has been called cultural or social neuroscience (see Balcetis & Lassiter, 2010; Franks, 2010). According to the seminal works by Hubel and Wiesel on sensory deprivation (Hubel & Wiesel, 1977), the plasticity of the primary visual cortex (V1) is a firmly established phenomenon, to the point that it is possible to

[19] Note that plasticity—associated with learning and memory processes—is a property of cerebral systems and not of individual neurons or molecular processes.

[20] Significantly, structures similar to minicolumns and columns have been identified in subcortical nuclei (Rockland, 2010); also, it is known that certain subcortical nuclei have plastic properties, such as certain nuclei of the amygdala (LeDoux, 2000). Consequently, the idea that mental identities = cortical and non-mental = sub-cortical may be false.

affirm that “rearing in a pattern of vertical stripes reduces the percentage of cells responding to horizontal bars [in V1-author’s note]; rearing in a pattern of horizontal stripes reduces the percentage of cells responding to vertical bars; and so on” (Daw, 2004, p. 128).

Another interesting property of minicolumns is that the interaction between excitatory and inhibitory connections result in the emergence of global properties that are not found in individual neurons. For example, minicolumns can amplify the input signal, reduce noise, acquire a selectivity to a more robust stimulus, and maintain the level of activity during the absence or decrease of the stimulus signal (Logothetis, 2008).

There are other scholars who propose that minicolumns are not the essential unit (smaller) processing of the cortex but a microsystem composed of a 'bundle' of apical dendrites and their neuronal bodies—not always found in the same minicolumn (defined anatomically)—and their targets are both cortical and subcortical (Innocenti & Vercelli, 2010). It is entirely possible that both functional structures—and many others that we cannot even imagine—exist in the cortex: more research is necessary to understand the overwhelming functional organisation of the cortex.

It is time to move to the second level of mental functions—the functions of mental illnesses (see Figure 4.2.).

In my theoretical approach, I propose that the mental functions of the middle level are the emergent function of neuronal columns. Cortical columns—also called hypercolumns (Hubel & Wiesel, 1977) or macrocolumns (Buxhoeveden & Casanova, 2002; Mountcastle, 1997; Rockland, 2010)—are systems or microsystems, composed of minicolumns (Figure 4.6).

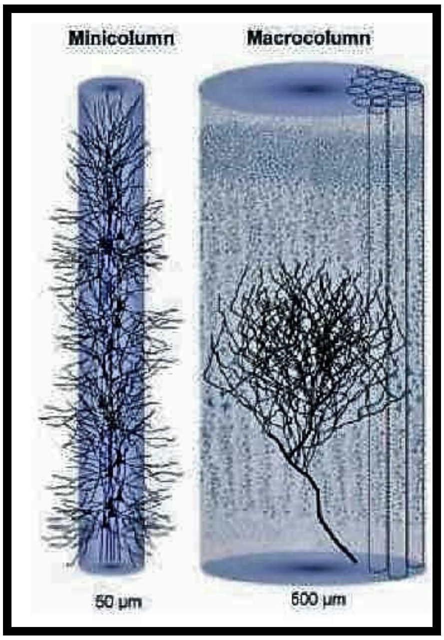

Figure 4.6 Schematic representation of the relationship between minicolumns and a macrocolumn (from: DeFelipe, 2005).

Each cortical column is composed of approximately 50 to 80 minicolumns and has an average width of 300µm to 500µm. We must remember that there is a lot of variability between columns of different species, between individuals of the same species, and between regions of the same brain (Rockland, 2010).

In contrast to minicolumns, the structure of a minicolumn is dynamic and varies according to task demands (Tommerdahl, Chiu, Favorov & Whitsel, 2005). Likewise, the components of the same column do not necessarily have to be contiguous; the same minicolumn can be part of different columns.

Both columns and minicolumns are identified as functional units in a wide variety of processes. Here, I mention only a few: a) columns and minicolumns of ocular dominance, orientation, and colour in V1 (Dow, 2002; Hubel & Wiesel, 1977); b) selective minicolumns for movement in V5 (DeAngelis & Newsome, 1999); c) minicolumns and macrocolumns in the sensory cortex (Mountcastle, 1997; Tommerdahl et al., 2005); and d) columns of visual forms complex in IT (Kreiman et al., 2006; Sato et al., 2009; Tanaka, 2003, 2004; Tanifuji, 2004; Tanifuji, Tsunoda & Yamane, 2005). There is even evidence of anomalies in both the structure and the composition of minicolumns associated with neurological pathologies such as autism, schizophrenia, Alzheimer's, and dyslexia (Casanova, 2010; Casanova & Tillquist, 2008; Blatt, 2010; Chance, Casanova, Switala & Crow, 2008; Di Rosa et al., 2009).

Undoubtedly, the most studied system of minicolumns and macrocolumns is the barrel cortex in rats. The barrel cortex is a component of the primary somatosensory cortex (S1) that is specialised in rats in the processing of information from the whiskers. The interesting thing about this cortex is that each of the whiskers of a rat is represented by a single minicolumn; at the same time, the organisation of the minicolumns responds to the distribution of whiskers in the snout of the rat. In other words, the distribution of the minicolumns in the barrel bark forms a map of the whisker distribution. In turn, the minicolumns are organised into macrocolumns that can integrate the information of several minicolumns (or whiskers) (Feldman & Brecha, 2005; Wilent & Conteras, 2005). A very interesting and relevant property of barrel bark is that both minicolumns and columns are plastic and can thus undergo structural and functional changes in response to environmental stimuli (Huber et al., 2008; Lendvai, Stern, Chen & Svoboda, 2000).

We finally reach the high-level mental functions (see Figure 4.2). High-level mental functions are the functions traditionally associated with mental functions: visual perception, attention, semantic memory, decision-making, aesthetic and artistic appreciation, feelings, mathematical calculation, and so on. In other words, when you think of mental functions, you think of high-level mental functions.

The high-level mental functions are the emergent functions of systems (or suprasystems) composed of columns (or macrocolumns) (Bunge, 1979, 2010; Farah, 2004; Gazzaniga, 2010; Hebb, 2002; Kandel et al., 2013; Koch, 2004; Kosslyn, 2005; LeDoux, 2003; Mesulam, 1998, 2002; Meyer & Damasio, 2009; Mountcastle, 1997; Sporns, 2011; Tononi, 2012). In other words, perception (visual, auditory, gustatory, etc.), the different types of memories (semantic, autobiographical, etc.), cognitive functions (decision making, planning, mental visualisation, mathematical calculation, etc.) and feelings are all functions of complex systems composed of subsystems (columns) specialised in the different processes necessary for the function. In turn, the components of a system are not exclusive to that system; the same brain 'area' can participate in different systems and collaborate to perform different functions (McIntosh, 2007).

What Mesulam says in relation to spatial attention can be applied, almost without any change, to any high-level mental function:

Although each component displays a relative specialization for specific behaviours, the domain of spatial attention, as a whole, is the emergent property of the entire network rather than the product of a hierarchical assembly line (Mesulam et al., 2005, p. 32).

An example of the statement by Mesulam is the model of aesthetic appreciation (beauty) proposed by Marcos Nadal, Camilo Cela-Conde, and collaborators. It is based on a review and synthesis of the neurocognitive literature in relation to preferences and visual aesthetic experiences. The model postulates that appreciation and aesthetic preference are the emerging function of the complex brain system composed of regions of the fronto-parietal network, the ventral visual pathway, the anterior medial temporal cortex, the temporal pole, the medial orbitofrontal cortex, the PFC ventromedial, the prefrontal pole, and various subcortical nuclei (Cela-Conde et al., 2011; Nadal et al., 2008, 2009; Nadal & Pearce, 2011; Figure 4.7).

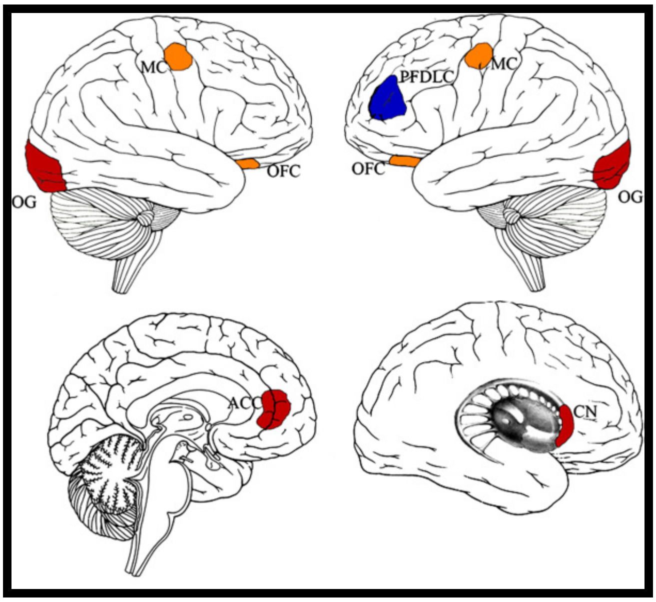

Figure 4.7 Schematic representation of some areas of the system involved in preference and aesthetic appreciation (beauty). OG = occipital gyrus; MC = motor cortex; ACC = anterior cingulate cortex; OFC = orbitofrontal cortex; PFDLC = prefrontal dorsolateral cortex; CN = caudate nucleus (from: Nadal et al., 2008).

As the authors of the model point out, none of these regions is exclusively dedicated to aesthetic processing—the same components of the aesthetic system participate in other functions; on the other hand, it is at the level of the system where the aesthetic function develops. In other words:

Aesthetic preference is the result of the interaction of several component cognitive processes. […] Neuroimaging studies have confirmed that there is no single brain center for aesthetic preference, and that different component processes are associated with activity in different brain regions (Nadal et al., 2009, p. 123).

The same can be said of the model of aesthetic experience (e.g., beauty) associated with the music proposed by Brattico, Bogert, and Jacobsen (Figure 4.8). Clearly, both models are opposed to the idea proposed by Zeki of the existence of a 'beauty spot' in the orbitofrontal cortex (Ishizu & Zeki, 2011; Kawabata & Zeki, 2004).

In short, the composition of the systems involved in the high-level mental functions suggests the following:

Theoretical postulate: High-level mental functions show emergent complex[21] *systems located and distributed at the same time.*

As can be seen, this theoretical postulate is incompatible with the phrenological idea of existence of specialised centres in a mental function, as a 'centre of the vision', a' centre of memory ', an 'emotional centre', 'centre of consciousness', 'beauty centre', and so on. This idea that been completely ruled out by modern neuroscience.

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[21] In this work, I mean by complex system a system composed of many distributed parts that interact, and not the more specific sense given to the complex term in physics. While there is evidence that brain systems with high-level mental functions are complex in the most specific sense (Chialvo, 2010; Sporns, 2011; Tononi, 2012), this is not the sense in which I use it in this text.

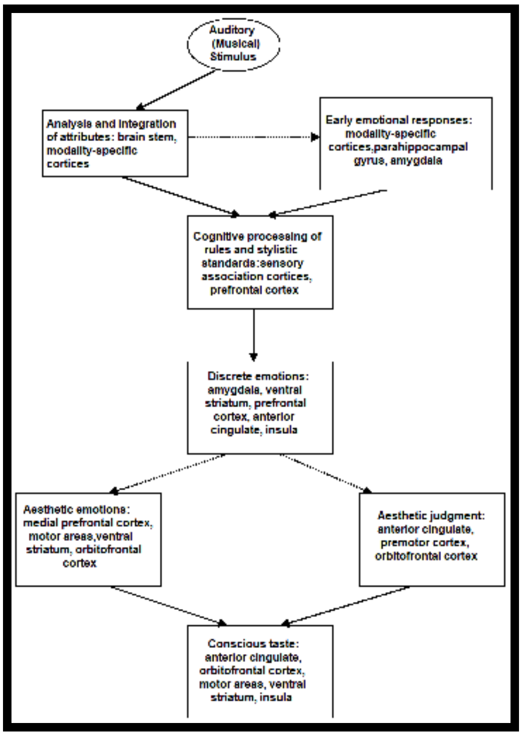

Figure 4.8 Schematic representation of the cerebral system involved in the musical aesthetic experience (author's adaption of Brattico et al., 2013).

In the figure above, dotted lines represent processes that may or may not occur during a musical aesthetic experience. It is important to note that the authors highlight the modulatory effects of the 'external context' on the aesthetic musical experience (e.g., environment, peers, etc.), just as the 'internal context' (e.g., expertise, attention, humour, etc.)

While several general models of systems with high-level mental functions have been proposed, the most representative are undoubtedly the two proposed by Mesulam (Figures 4.9 and 4.10) and Damasio (Figure 4.11). Whether one or any of these models is closer to reality is still too early to decide. On the other hand, there is a consensus that high-level mental functions are a function of complex (e.g., with many components) and dynamic systems (Sporns, 2011; Tononi, 2012).

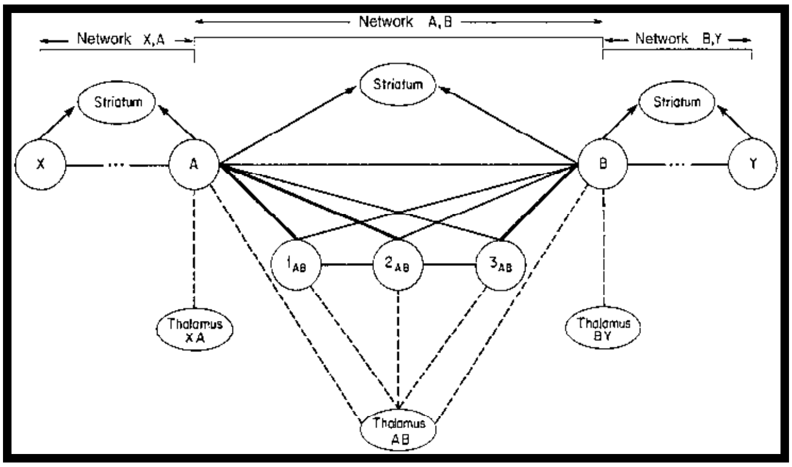

Figure 4.9 Schematic representation of a cerebral system with high-level mental functions(from: Mesulam, 1998).

The dotted lines in the figure above represent projections from the thalamus; the lines without arrows represent reciprocal connections between two areas; lines with arrows represent unidirectional connections. Circles 1, 2, and 3 represent modality-specific areas (or 'unimodal'). Circles A and B, X, and Y represent transmodal or heteromodal areas.

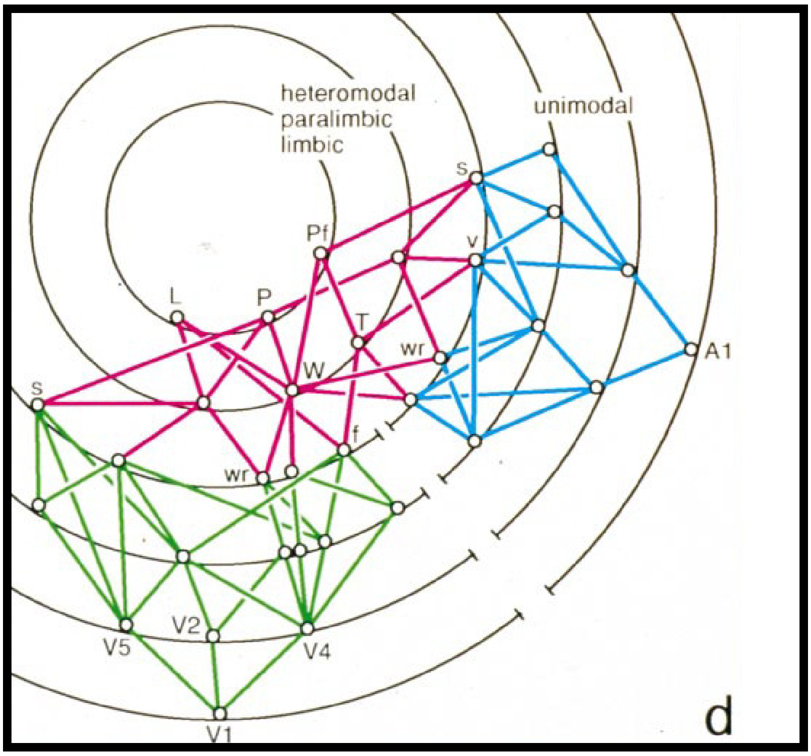

Figure 4.10 More detailed representation of Figure 4.9 (from: Mesulam, 1998).

Each ring in this figure represents a synaptic level; the small circles represent discrete brain areas. Blue = auditory system; Green = visual; Red = transmodal (or heteromodal) system. Note that both the visual and auditory systems share many transmodal areas

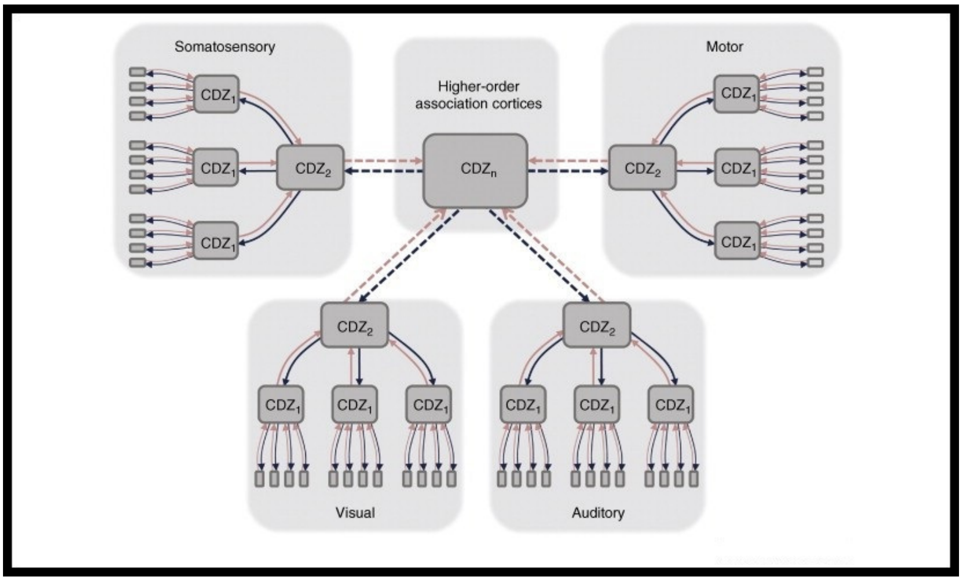

Figure 4.11 Schematic representation of a cerebral system with high-level mental functions (from: Meyer & Damasio, 2009).

In the figure above, each convergence-divergence zone (CDZ) rectangle represents an association area of the information coming from lower regions. The smallest unnamed rectangles represent primary unimodal (or modality-specific) areas. As in the case of Mesulam, note that the system of heteromodal areas (or 'higher order association cortices') receives projections from all unimodal systems while sending projections to all unimodal systems

4.4 Concluding remarks

I think it is possible to summarise the central point of this chapter with the following postulate:

Theoretical postulate: mental functions have a hierarchical structure determined by the emergent (systemic) properties of the minicolumns, columns, and complex systems.

It should be noted that there is currently no clear definition, much less a scientific theory, about what the mind is, or more precisely what mental functions are and what properties they have that separate them from non-mental functions of the brain. There are certainly properties which—it is agreed—all mental function should possess; in particular, there are two properties that every system with mental functions seems to possess: a) unlike the activity of individual neurons, systems with mental functions represent information in a stable and robust manner (what Koch calls "explicit representation" (Koch, 2004, p. 26), and b) they are plastic systems (i.e. they can learn). As we saw, minicolumns, columns, and complex systems all have both properties.

One could ask how is it possible that there is a science that investigates mental functions as cerebral processes if there is no precise definition of mental functions? The same question was asked of LeDoux in relation to the neuroscientific study of emotion: “How is it possible to study neuroscientific emotions if we do not know what emotions are?” So far, I do not know of any better answer than that given by LeDoux himself: "The short answer is that we fake it" (LeDoux, 2012, p. 653).

4.5 Summary of chapter 4

Within chapter 4 I have been pointed out that, all aesthetic proposals are based on assumptions about the mind-brain relationship (theory of the mind) that must be made explicit; neuroscientific research of artistic appreciation and creation is no exception.

As already be mentioned in the 1st chapter of the thesis I have discussed briefly the central ontological preconditions of the neurocognitive studies of art, namely, the ‘mind - brain’ identity hypothesis, and compare it with other approaches of the mind-brain relationship.

Furthermore, I have argued that the ontological principle that underlies neuroscientific research in general and neuroaesthetics in particular is a variant of the so-called psychoneural identity thesis. It has, however, become clear that the psychoneural identity thesis, despite being fundamental in neuroscience, is not enough in light of the considerations above.

In the following course of the section, I have tried to propose a very speculative theoretical approach about mental functions. In particular I have tried to propose a hierarchical view of the mental functions and distinguish between mental functions of low level, medium level and high level, characterised by emergent (or systemic) properties particular to each level and related to each other by compositional relationships (see Figure 4.2).

A central hypothesis in relation to mental functions, whether low, medium, or high level, is that mental functions are systemic or emerging properties of neuronal systems (or 'networks').

CHAPTER 5: CONCLUSION

The primary aim of this thesis was to develop a conceptual framework that can serve as the basis for a scientific aesthetics of art, and particularly for the visual arts such as painting. The arguments and evidence supporting the development of such a framework were presented in two logical stages: (a) the first entailed an exploration of foundational issues relating to the development of a scientific aesthetics in art; and (b) the second critically examined the possibilities and limitations of the current neuroscience-based research in aesthetics, as exemplified in particular by the neuroaesthetics research programme.

In this final chapter I provide a summary of the structure of the argument and indicate the contributions as well as implications of the study. I also briefly mention limitations and indicate some research directions that other researchers can pursue in future.

5.1 Summary and contributions of the study

5.1.1 A critical examination of the foundations of the neuroaesthetic approach to art appreciation

The first two parts of the thesis explored the foundations of the current neuroaesthetic framework and tried to uncover some of its assumptions about the systems and mechanisms involved in artistic appraisal. In this part of the thesis the focus was on a critical review of current neuroaesthetic research, and particularly on the extent to which it responds appropriately to the ‘question’ of what art is.

I tried to show that the experimental programme of neuroaesthetics is based on two theoretical assumptions. First, that an object is an artwork if and only if is capable of eliciting a cognitive/emotional condition or process that only artworks can provoke. In other words, if x is an artwork, then the features (Pn) associated with X provoke (or is capable of provoking) the cognitive/emotional condition in a subject s. Second, that the factor that causes the object *x* to induce the cognitive/emotional state *e* in the subject *s* is a set of objective properties of the object *x* (see Section 3.1).

In this approach art appreciation is therefore a function of a dedicated brain system that responds to the objective quality of the art product. The implication is that only the ‘right kind’ of art will trigger an appropriate aesthetic response.

5.1.2 Reviewing problematic aspects of the neuroaesthetic research programme

In the second part of the thesis, I tried to demonstrate that the neuroaesthetic programme, at least in its current form, is problematic in the light of empirical evidence. I then offered my own theoretical view about the possible cerebral mechanisms and the systems involved in artistic/aesthetic appreciation.

I argued that one of the implications of the neuroaesthetics approach is that the mechanisms associated with artistic appreciation are essentially bottom-up processes that depend exclusively on the mode in which the specific cerebral cortex areas (e.g., visual cortex, auditory cortex) respond to the objective properties of artworks (Ramachandran, 2004; Ramachandran & Hirstein, 1999; Redies, 2007; Skov & Vartanian, 2009; Zeki, 1999).

Artistic appreciation is thus construed as a function of the objective properties of artworks and the systems and mechanisms of specific cortex modalities involved in the processing of these objective properties. This follows from the basic assumption: If A (artistic appreciation) is a function of P (objective properties), then each time P is given, the result is A. Hence, if x has the appropriate objective properties P1, P2 ... Pn, then the subject perceiving x will experience an artistic appreciation.

This approach implies, among other things, that artistic appreciation is independent of the knowledge and expectations of subjects. In other words, artistic appreciation does not depend on 'top-down' (or 'knowledge-based') processes. Thus, to explain artistic appreciation in the neuroaesthetic perspective on art, only the systems and mechanisms of specific cerebral cortex areas involved in the processing of the objective properties of artworks must be characterised.

I then tried to show that this conception of art appraisal or aesthetics is too narrow and that knowledge and contextual factors have an effect on the process of art appraisal. This part of the thesis is summarised in the next section.

5.1.3 Factors modulating artistic appreciation

I argued that numerous studies clearly show that the level of artistic expertise or experience modulates or influences artistic behaviour, ranging from preference scale scores to eye movement during the observation of a painting. Second that, even though in this case the experiments are less numerous, there is clear evidence that the context of presentation of an artwork (e.g., museum, gallery, laboratory, etc.) also modulates or influences artistic appreciation.

I contended that by uncovering the variables involved in the neural and cognitive process of artistic appreciation, the formulation of new hypotheses about how these variables are related is encouraged and the current issues and limitations associated with neuroaesthetic research into art appreciation become clear. For example, from the proposed formalisation, it is evident that neuroscience research regarding the processes involved in artistic appreciation suffers from at least three methodological limitations at the present time:

i) *Time*: In the case of certain works art and artistic genres subjects need time to view, listen or inspect a work before arriving at a subjective appreciation. It is impossible, both technically and analytically, to record the brain activity of a subject as he or she listens to an opera or symphony, reads a novel or story, watches a play, and so forth. This effect of time and the attendant learning processes are therefore not taken into account in neuroscience research of art appreciation.

ii) *Materials*: The materials used to create an artwork are an essential part of the 'object-as-artwork' and therefore influence our cognitive and emotional responses (Locher, Smith & Smith., 2001). In the visual arts (e.g., paintings), neuroscientists are often restricted to reproductions of digitally processed works, and in cases where brain activity is recorded with PET, fMRI, or MEG, these images must be presented through the reflection of mirrors.

iii) *Context*: Not only is the context in which an artwork is presented an essential condition for the object being perceived as an artwork, but the context of presentation also modulates our cognitive and emotional responses to artworks (Kirk et al., 2009b; von Lindern, 2008). However, for obvious reasons, the vast majority of neuroscientific experiments are carried out in laboratories.

One of the most important implications of my definition of φ-artwork (see Section 2.5, 2.6, 2,7; Table 2.3) is that in order to correctly categorise an object x as an artwork, it is essential to know the conventions (F, T, M, H, O) established by the artistic world (A, E)) for the production of the works. In other words, the process that allows us to categorise an object as an artwork is mediated by a system of learned knowledge, and not—as postulated by neuroaesthetics—a process guided by the objective properties of objects.

I have argued that this is not just a trivial difference, but that experimental research in aesthetics has shown that artistic knowledge effectively modulates the artistic (aesthetic) responses of the subjects. It establishes a system of conventions for the categorisation of objects as artworks, and it is based on such knowledge (implicit or explicit) that subjects subsequently evaluate and respond to concrete works (Bullot & Reber, 2013; Leder et al., 2004).

5.1.4 The role of the task set in art appreciation

I tried to show that the perceptual and semantic processing of an artwork is preceded by a set of knowledge and expectations that modulate how the object (the artwork) is processed, both perceptually and semantically. I then put forward the following postulate:

Theoretical postulate*: "Artistic appreciation is a mediated process (directed) by the efferent projections ('top-down') from the 'artistic task-sets' to the areas of perceptual, emotional and semantic processing."*

The task-set "consists of information about which stimulus attributes to attend, the important conceptual criteria, goal states, and condition-action rules. It reflects not only which items are subject to process, but also how the subject plans to process the items and the rules of the to-be-performed task" (Bunge & Wallis, 2008, xv).

The idea of 'artistic-task-sets' suggests an alternative definition of art than that implicit in the current neuroaesthetics approach. An artistic task-set is composed of the system of conventions necessary to categorise and respond to an object x as an artwork. Thus, we could define artistic expertise as a continuum—at one extreme, we would have the ideal expert with a specific artistic task-set for each artistic-system (Figure 3.16), while at the other extreme, we would have the inexperienced novice who has not received a formal education in art or who does not have much experience in art (e.g., he does not regularly attend art museums). The novice possesses a single artistic task-set and applies it indiscriminately to different objects (Figure 3.17). Thus, we can define the degree of artistic expertise ('expertise') of a subject as the number of specific artistic task-sets that the subject possesses.

Although there is no direct neurocognitive evidence in favour of or against the existence of artistic task-sets, there is indirect evidence that gives plausibility to the theoretical postulate of artistic task sets. First, as we have already seen (Section 3.2.1.2), there is evidence that artistic expertise, the context of presentation, and how an artwork is categorised (original vs. copy), modulate the artistic experience, and that this modulation is correlated with differences in the activity of regions of the frontal, prefrontal, and parietal cortices identified as components of the system involved in the task-sets (Bhattacharya, 2009; Huang et al., 2011; Kirk et al., 2009b; Wiesman & Ishai, 2010). In particular, Cupchik and colleagues have shown that the same stimulus can evoke different attentional and emotional responses, depending on the demands of the task that a subject has to perform (aesthetic attitude vs pragmatic attitude) (Cupchik et al., 2009).

5.2 Towards a new theoretical framework

In view of the discussion above, I have suggested a framework for developing a scientific aesthetics of art within the cognitive neurosciences. The summary below is a brief reconstruction of my main argument, and highlights the main points underlying my conception of the approach required to develop a proper cognitive neuroscience-based theory of aesthetics in art.

a) The experimental programme of neuroaesthetics is based on the assumption that the mechanisms associated with artistic appreciation are essentially bottom-up mechanisms because they depend exclusively on how modality-specific cortices (e.g., visual cortex, auditory cortex, etc.) respond to the objective properties of works of art (see Section 3.2; Figures 3.1, 3.2 and 3.3).

b) There are both conceptual (Section 3.2.1.1) and empirical research findings (see Section 3.2.1.2) showing that the experimental project of neuroaesthetics is problematic—for example: i) the concept of 'artwork' shows that both recognising an object as an artwork and appreciating an object artistically imply the knowledge on the part of the subject of a series of social conventions to be learned; ii) there are factors (or variables), both external (e.g., presentation of an artwork) and internal (i.e. level of artistic knowledge), which modulate artistic appreciation (Section 3.2).

c) The process of artistic appreciation cannot be reduced to the analysis of the manifested properties of stimuli; on the contrary, it is a complex process guided by expectations and prior knowledge and modulated by the context in which it occurs (Section 3.3, Figures 3.7, 3.8, 3.10, and 3.11).

d) I propose that the empirical results of experimental aesthetics can be explained, in part, if we assume that artistic appreciation is a process involving the activation of 'artistic task-sets' (Section 3.4); in particular I argue that artistic appreciation is a process governed by the top-down projections from the 'artistic task-sets' towards the areas of perceptual, emotional, and semantic processing.

e) Then, I propose to define an artistic experience as the result of the process of contrasting the knowledge and expectations activated by an artistic task-set (top-down process) with the perceptual, semantic, and emotional processes evoked by the presentation of a particular stimulus (φ-artwork) (bottom-up process) (Section 3.4.1; Figure 3.15).

f) I also make some tentative suggestions about the role of mental imagery in the artistic appreciation of literary works, proposing that mental imagery probably amplifies the emotional responses associated with the semantic aspects of a literary text. This increase of emotional response is due to anatomical and functional connections between the modality-specific cortical areas (the substrate of mental imagery) and the emotional areas of the brain.

In chapter 4, I briefly touched on philosophical problems concerning the mind-brain relationship (theory of the mind) that are relevant to current neuroscientific research of artistic appreciation and creation. I discussed briefly the central ontological preconditions of the neurocognitive studies of art, namely, the ‘mind - brain’ identity hypothesis, and compare it with other approaches of the mind-brain relationship. I suggested that the ontological principle that underlies neuroscientific research in general and neuroaesthetics in particular is a variant of the so-called psychoneural identity thesis.

I then put forward a very speculative theoretical approach about mental functions. In particular I proposed a hierarchical view of the mental functions and distinguished between mental functions of low level, medium level and high level, characterised by emergent (or systemic) properties particular to each level and related to each other by compositional relationships as illustrated in Figure 4.2 in the previous chapter.

5.3 Some limitations of the research

The research in this thesis is based on a theoretical exploration of aesthetics and did not involve any specific empirical research. In a sense the research is mostly programmatic and some of the claims made, particularly about the hierarchical networks in visual aesthetics obviously require further empirical research and substantiation.

The reductionist assumptions underlying the neuroaesthetics approach was only briefly dealt with in this study. The mind-brain relationship and the current debates about this in cognitive science require a full-length study to consider properly and thus only a brief survey of some issues were presented here

The study focused mostly on aesthetics in the visual arts, and the extension to literary art was only briefly mentioned, and other arts such as music and dance were not considered.

The task-set was only presented in a rather intuitive manner. A proper mathematical formalisation of the ideas was beyond the scope of this study. However, it is certainly possible to develop a mathematical or computational model of the concept of a task set and such a model is likely to have some resemblance to the dynamic systems approaches that are now developed within the embodied conception of cognitive science (see e.g. Chimero, 2009).

5.4 Future research prospects

There are a lot of remaining questions in this still relatively unexplored area for neuroscientists who are not just interested in the mechanisms of artistic appreciation but also those associated with the creation of artworks. Some of these are highlighted below:

i. What neural systems are an issue for the storing and retrieving of art-related knowledge (e.g., different artistic systems' conventions), and how might these differ between art experts (e.g., artists) and novices?

ii. Are artistic styles such as surrealism, socialistic realism, kinetic art, and so on consistently represented by different neural structures or processes? In other words, is it possible to deduce the artistic style of an observer from, for example, an fMRI pattern?

iii. Is the learning process associated with the development of expertise in art and reflected in changes in the neural networks and systems in the brain, and if so what are these changes?

iv. Are the same task-sets implicated in the different types of art, or are there specific factors governing, for example, art appreciation in the visual arts that are different from those associated with the literary arts so that each genre of art requires its own particular task sets?

v. Are the arts capable of inspiring neuroscience research in exploring aspects such as creativity? Artists often exhibit an unconventional worldview and if this artistic perspective on the world is analysed carefully it may yield a new approach to studying the creativity in mind and brain, thereby furthering knowledge of art development and appreciation in cognitive neuroscience.

vi. The ideas about hierarchical processing explored in chapter 4, have some similarity to the computational models of cognition based on a hierarchical ordering of pattern recognisers developed by Hawkins (2004) and Kurzveil (2012). These ideas clearly need further exploration, elaboration and testing by mathematical modelling and computer simulations.

5.5 Conclusion

The main objectives of this study were to explore the neuroaesthetics approach to specifically the visual arts, to elucidate some problematic implications resulting from its assumptions about art appraisal, and to show how this approach may be developed into a more coherent theoretical framework for research in art and aesthetics within the cognitive neurosciences if its scope is broadened to encompass not just the art object but the social and contextual factors influencing art evaluation and interpretation.

Much of the research in this field is still at a relatively early stage, but the general impact of neuroaesthetics and its exploration of how art and beauty are processed in the brain, can already be seen in a renewed dialogue between the sciences concerned with mind and brain in the domain of art. Because of the essentially interdisciplinary nature of this research, the cognitive neuroscience exploration of art and aesthetics forms a bridge between human sciences such as psychology and philosophy, and the neurosciences, and this encourages contact and debate between the mind-brain sciences in this research area. In fact, the scope and impact of this research domain is expanding rapidly; thus, the University of London has recently instituted an MSc degree in *Psychology of the Arts, Neuroaesthetics and Creativity* (https://neuroaesthetics.net/2017/08/31/msc-in-psychology-of-the-arts-neuroaesthetics-and-creativity/).

One of the benefits of neuroaesthetics is that it helps to overcome classical divisions between disciplines sciences and stereotyped notions of what research topics scientists may pursue. Aesthetics is certainly an unusual topic for neuroscience and at first impression one that lies beyond its grasp because it is not aligned with the typical neuroscience research techniques and methodology. However, Radman (2004) correctly dismisses these preconceptions of what sciences may investigate as "myths" and "philosophical misconceptions". This study was critical of some aspects of current research and theory in neuroaesthetics, but the intention was certainly not to dismiss this research as irrelevant or inconsequential. We live in the era of neuroscience, there is an ineluctable aspect to scientific progress, and the neurosciences will almost certainly increasingly make inroads into areas traditionally reserved for purely behavioural analyses. Thus, instead of trying to discard neuroaestetics research, I have tried to point out some limitations in the work of mainstream researchers such as Zeki and Ramachandran, arguing that this research is too narrow and limited in its scope at this stage. I contended that two main issues can be raised.

Firstly, I have argued against the idea that the seat of aesthetic appreciation lies only in a certain brain area (e.g. medial orbital cortex) and have suggested that larger systems may be implicated such as the hierarchical processing associated with the emergent (systemic) properties of the minicolumns, columns, and complex systems. The idea is that high-level mental functions required for art appraisal are a function of complex (i.e., comprising many components) and dynamic systems (Sporns, 2011, Tononi, 2012). and that, In this regard, aesthetic preference and artistic judgments can be seen as a result of an involvement of widespread cortical neural networks (see Nadal et al. 2009; Nadal, 2013)

Secondly, I have suggested that the prospects of neuroaesthetics of making any significant contributions to the more theoretical and philosophical research in the philosophy of mind is limited at this stage due to a rather naïve theory of psychoneural identity that prevails in this research. Neuroaesthetics is in its present conception mostly an investigative and exploratory discipline with an empirical research methodology.

Still, one of the main values of the body of neuroscience research into art is that it may eventually yield an understanding of how various brain systems and subsystems interact in the perception and appraisal of art that behavioural research alone cannot address. There is an important reciprocal influence in cognitive and neural research, and some topics are of mutual interest. For example, exploring how subjects perceive and interpret abstract paintings may yield some insight into how people deal with indeterminate visual stimuli and try to make sense of the visual world.

Ultimately the important question is what does neuroaesthetics have to offer to psychologists and researchers in art and aesthetics? When and how does neuroscience provide deeper descriptive texture to our knowledge of aesthetics? These questions still await complete answers; art and science are different but not completely separate fields of inquiry and only time will tell whether aesthetics is the right kind of bridge that can link them together.

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