Cognitive Abduction and the Study of Visual Culture

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Abstract. In this paper art history and visual studies, the disciplines that study visual culture, are presented as a field whose conjectural paradigm can be used to understand the epistemic problems associated with abduction. In order to do so, significant statements, concepts and arguments from the work of several specialists in this field have been highlighted. Their analysis shows the fruitfulness and potential for understanding the study of visual culture as a field that is interwoven with the assumptions of abductive cognition.

1 Introduction

Divergence and consensus are constants in the study of abduction. There are divergences in the exact meaning of the term, but a great consensus on the strong connection of abduction with many disciplines. Magnani [29] has justified and documented all kinds of evidence about the relationship between abductive reasoning and disciplines such as philosophy, legal reasoning, Artificial Intelligence, cognitive sciences, narrative reasoning, decision making, emotional cognition, etc. It is thus reasonable to assume that if abduction is so important as an interplay between this and many other fields it is because cognition in all living beings manifests a clear abductive mark. The idea of 'abductive cognition' has been shown to be important thanks to the contribution of Magnani to the vast and complex history of abduction studies.

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Walton [47] affirms that abduction is a process of hypothesis formation that is used at the discovery stage of scientific investigation, but we think that it is also a source for a better understanding of both the theoretical and practical dimensions in the study of the humanities. Here we will analyse the presence of abductive cognition in a field of the humanities that has not been explored sufficiently: the disciplines that study visual culture. These are art history and visual studies. It can be said that, in the long tradition of art history, research has been centred on some cultural objects, including some objects of visual culture, that have been selected according to aesthetic criteria. As Dikovitskaya [9] has shown, the 'cultural turn' has provoked important changes in the study of the visual such as the marriage between art history and cultural studies that has led to the appearance of visual studies. The interdisciplinary field of visual studies examines the role of all images in culture, trying to go beyond the limitations imposed by aesthetic criteria on the object of the discipline of art history as researchers like Vega [43] have stressed, and claiming that the study of the experience of the visual has to be contextual, ideological and political. Thus visual culture is (in whole or in part) the object of study both of art history and visual studies. Therefore in order to analyse the reasoning process used to think about this object, both disciplines are to be taken into account. As we will show, the abductive reasoning model, which can be more clearly identified in the work of some contemporary specialists in visual studies, is also present in the research of the founders of art history.

The purpose of this article is to explain why research in visual studies must be taken into account in studies in abduction. In order to sustain our thesis, we will establish several conceptual analogies to link both research fields. This will shed a new light on both, and show that abduction is one of the principal characters in the study of the visual. A broad set of concepts could potentially be used to do this, but we will focus on:

1. Conjectural paradigm and re-creative synthesis / inference to the best explanation, helicoid abductive reasoning.
2. Empathy, *pathosformel*, empathetic response / embodiment.
3. The combination of theoretical and manipulative abduction in the study of the visual.

From this analogical reasoning, three consequences are to follow: the first presents abduction as the logical pattern inherent in interpretation. The second is related to perception understood as a limited process. The activity of interpretation can be presented both as a process and as the result of a process where abduction is constantly present. It may appear either as theoretical abduction, as model-based abduction or even as manipulative abduction. The third has to do with the inferential structure of perceived objects. The use of abductive reasoning understood as epistemic change, models the incorporation of new beliefs. The interpretative process and product, the bodily involvement in visual culture experience and even visual culture itself, can be

understood as products that have an inferential structure or that even imply an inferential play.

2 Conjectural Paradigm and Re-creative Synthesis

The presence of abductive reasoning in scientific practices related to the arts has been identified in studies that were oriented towards the establishment of a relationship between the interpretation of the arts and semiotics. Ginzburg [16] included the method of the *connoisseur* Giovanni Morelli along with those of Freud and Sherlock Holmes (or better, Conan Doyle's method) in his essays about how in the late 19th century a theoretical model for the construction of knowledge emerged in the sphere of the social sciences, the conjectural paradigm. The methods of Morelli, Freud and Doyle had something in common: they were based on taking marginal, irrelevant details as revealing clues to forge their conclusions, and they shared the model of medical semiotics or symptomatology. But the roots of the 'semiotic' approach were deeper; Ginzburg traced them back to forms of explanation and divination that could be oriented towards past, present or future (jurisprudence, medicine and divination proper). Furthermore, his hypothesis was that the origin of the diagnosis from signs or symptoms lay in the practices of long-ago hunters and the 'reading' of animal tracks.

This kind of knowledge based on conjecture and speculation (born of experience, of the concrete and individual) responded to a paradigm that differed from the more prestigious scientific one, but it was used by all kinds of people. In the 18th century the situation changed when the bourgeoisie appropriated for itself much of the knowledge of artisans and peasants. The *Encyclopédie* is signalled by Ginzburg as the symbol and chief instrument in this offensive, with the novel and the literature of imagination as a substitute and reformulation of initiation rites, giving access to experience in general. Because of all this, the conjectural paradigm enjoyed an unexpected success. In addition, in the 18th and 19th centuries the constellation of conjectural disciplines changed, many new ones were born, with medicine assuming a preeminent position amogn them. All the 'human sciences' attempted to relate themselves to it explicitly or implicitly, and they did so by accepting the medical conjectural paradigm of semiotics. Medicine, and thus symptom deciphering, was well known by all the three authors mentioned by Ginzburg as well as by Peirce [33]. This knowledge probably helped them to formulate their methods according to the conjectural paradigm of medicine in a more accurate and convincing way. In so doing, their contributions to their disciplines gained a better 'methodological reputation' so to say.

Many of the controversies related to authorship identification of artworks (the main issue addressed by *connoisseurs* like Morelli) use the two types of hypothetical reasoning referred to by the historian of science Lipton [27]. He distinguishes between inference to the likeliest and to the loveliest explanation.

It is not clear wether the inference about the question of authorship precedes explanation or not. The use of inference to the best explanation (IBE) in the case of authorship identification and, more generally, in the study of visual culture, inverts the usual point of view about the relationship between inference and explanation. According to the natural point of view, or to common sense, inference would precede explanation. In spite of this, the reasoning model implicit in the 'Morelli method' consists of analysing to what extent the evidence can explain a set of hypotheses. In this model therefore, IBE, and thus the explanation, comes before the inference.

Perhaps because of the impact of Ginzburg's essays, the 'Morelli method' is usually the only one mentioned when abductive reasoning is presented in relation with art history. Moreover Morelli is generally the only reference cited to the studies on art when the influence of Peirce on contemporary thought is debated. For further details see Laine Ketner [24]. Besides the influence of structuralism and poststructuralism on the work of many art historians and specialists in the field of cultural and visual studies, from the second half of the 20th century on, authors like Holly [23] have noted that some of the issues that were addressed by early semioticians were already being explored at the same time by art historians like Riegl and Panofsky. According to Holly Panofsky was a keen student of semioticians' works and shared certain epistemological predispositions with semiotics. For Argan [4] Panofsky's method, iconology, confronted the problem of art as that of linguistic structures much more than the formalism of Wölfflin. Perhaps that is why Argan affirmed that Panofsky was the Saussure of art history. Although, as Hasenmueller [22] has noted, there are problems in simply calling Panofsky's work semiotic, as semiotics and iconology have a common interest in uncovering the deep structure of cultural products. Iconology, like early semiotics was devoted to exposing the existence of the conscious and unconscious rules of formation that encircle a language and make possible its sudden emergence -both visual and linguistic- on the surface of human history. For further details see Holly [23].

But what interests us here is that Panofsky's writings can be taken as an index of how he reached his conclusions. Panofsky's objective remained the value judgment he called 're-creative synthesis'. For him the definition of an artwork as a 'man-made object demanding to be experienced aesthetically' confronted the researcher with what he considered was the 'basic difference between the humanities and natural science'. The scientist dealt with natural phenomena and could at once proceed to analyse them. In contrast the humanist dealt with human actions and creations and had to engage in a mental process of a synthetic and subjective character. Humanists had 'mentally to re-enact the actions and to re-create the creations', and it was by this process that the real objects of the humanities came into being. According to Panofsky [32] the object of the humanities, and more precisely that of art history, was the result of this re-creative synthesis which was always in process. That is why he explained that the art historian did not constitute

his object through a re-creative synthesis first, followed by archaeological research. For him these two stages did not occur successively, but took place rather in an interwoven manner: the re-creative synthesis served as a basis for the archaeological research, but the latter served in its turn for the process of re-creation. Both stages were only conceived separately in theory (as a way to explain his method) but in practice they were recognised and used to qualify and correct each other in a reciprocal relationship.

This process is analogous to the abductive reasoning model described by the Ducth linguist Gorleé [20] as a method in interlinguistic translation. The necessary application of this method is manifest in the case of descriptive translation, whose objective is translation as a product. As an example, she mentions within this category translation understood as transference. There similarities are recognised that justify a translation which is considered valid in a transitory or derived way because words refer to specific cultural activities. In this sense, the explanatory hypothesis used in previous steps affects further research and interpretation procedures. That is why some authors, such as Tursman [42] consider that the use of abductive processes in this kind of studies is better described with the explanatory metaphor of the figure of the helicoid than with a linear figure. This is because there would be always something to go back to, something that could, in some way, be rediscovered. Gorleé [21] affirms that Peirce's logic-semiotic method can be fully applied to the identification, description and analysis of translation as a mental experiment in the generation of meaning, where a hypothesis generated by abduction is verified in a reiterative way.

The helicoid figure referred to by Gorleé can help us to evaluate the significance of abductive reasoning in the cases of Panofsky and Morelli. On the one hand, the affirmations of the latter are based on an abduction process that goes from effects to possible causes. On the other hand, abduction in Panofsky is linked to belief revision. In other words, it has to do with an understanding of abductive reasoning as ampliative and non-monotonic. It is evident that in both authors the use of abduction led them to infer hypotheses that could not be classically deduced from the given facts. In spite of that, Morelli used abductive reasoning to make irrefutable statements on the authorship of artworks just as if they were the result of deduction. So, even if both Morelli and Panofsky used the same type of reasoning they did not evaluate in the same way the impact of their statements on the discipline of art history. Morelli was deeply fascinated by the power of apodictic demonstrations of objects whose meaning, in fact, is partially veiled as are the objects themselves. In contrast, some of Panofsky's affirmations indicate that he was more aware of the always-in-process nature of interpretations of cultural objects.

The authors Kohlas, Berzati and Haenni [25] affirmed that abductive explanations are in general neither complete nor sound, and that for this reason they are not fully appropriate for model-based diagnosis. Nevertheless model-based diagnosis has been used in combination with abductive reasoning in

many research projects that deal with medical diagnosis. We share to some extent the scepticism of these authors, and propose the potential of the analysis of disciplines that study visual culture to analyse model-based abduction.

The paradoxical situation of objects whose meaning is always partially veiled can be better understood if we turn to computational studies. According to Thagard [41], this field provides a model for a better understanding of the hidden meanings of the data themselves and of the hidden meaning given to them by the producers of those data. Thagard distinguished four types of abduction: simple (which produces hypotheses about individual objects); existential (that postulates the existence of previously unknown objects); rule-forming (that produces rules that explain other rules), and analogical (that uses past cases of hypothesis formation to generate hypotheses similar to existing ones). But it would be difficult and inconsistent to classify the use of abduction in the construction of interpretation of cultural objects (by Morelli, Panofsky or any other interpreter) in just one of these four types.

Abduction is described as a useful mechanism for explaining knowledge acquisition in areas where empirical methods for testing hypotheses are not available, hypothesis, for example, about past or unique events. This inferential process is irreducible to other types of inference as Hintikka affirms. It has been used to describe the cognitive processes that intervene in scientific discoveries in experimental sciences. For further details see Rivadulla [38]. Although the link between this reasoning model and experimental sciences is unquestionable, we think that it has been overvalued. This is evident if we take into account the fact that scientific discovery and the logic of invention are not exclusive of experimental sciences. If abduction is a particular type of argument or epistemic process that attempts to model the incorporation of new beliefs as Aliseda [1] maintains, this process would be one of the principal characters in other kinds of research such as the study of visual culture.

These pages try to explore this tentative hypothesis by presenting analogies between the field of art history and visual studies, and abductive cognition. This is so because topics, inquiries and controversies in these disciplines could not exist independently from the three types of hypothesis identified by Peirce. In any case, they refer to facts or entities unobservable when the hypothesis was formulated but observable later; or to entities or facts that someone could observe in the past even though it is not possible to repeat the observation now, because they are facts of the past; or to entities unobservable in practice. But analysis of studies of visual culture in the light of abductive cognition is not only based on the Peircean definition of the types of hypothesis. Peirce [33] also stated that all thinking is in signs, and signs can be icons, indices, or symbols. All inference is a form of sign activity, where the word sign includes feeling, image, conception, and other representation. Along with these two arguments (one dealing with the different types of hypothesis, and the other with inference as a form of sign activity), a third can be found in Magnani [28] and Magnani and Li. Ping [30]. This author introduces the concept of theoretical and manipulative abduction. He maintains

that there are two kinds of theoretical abduction: sentential, related to logic and to verbal/symbolic inferences, and model-based related to the exploitation of models such as diagrams, pictures, etc. He reminds us that Peirce considered any cognitive activity whatever to be inferential. This included perceptual knowledge and subconscious cognitive activity, not only conscious abstract thought.

3   Empathy as Embodied Mechanism

Elements in the style of paintings were considered by Morelli, his heir Bernard Berenson and other *connoisseurs* as unconscious marks that identified their authors. The idea behind the assumptions of these *connoisseurs* was, as Friedländer [13] pointed out, that creative individuality had an unchangeable core and that the artist remained fundamentally the same. Something, therefore, that could not be lost revealed itself in his very expression. In spite of this, just as experience has shown (a well known example of this being the development of the Rembrandt Research Project), this assumption has to be taken carefully, as nothing prevents an artist from switching consciously between different styles in a way similar to the choice of high or low style of a rhetorician, according to the particular occasion of his speech.

In the writings of the scholars known as formalists, style was important not because it was considered characteristic of an individual artist but because it was understood as the specific expression of an age. The most significant representatives of the formalist stream, Riegl and Wölfflin, argued that art offered unmediated sensory access to past world-views. If, according to Ginzburg, Morelli took a prestigious model such as medicine to support his attributions, the formalist authors and their interest in physiology and psychology can be said to respond to a similar aspiration to gain theoretical authority.

The authors and ideas that influenced formalist art historians most were the German physicist and physiologist Hermann von Helmholtz, the psychologists Joahnn Fredrich Herbart, Theodor Lipps and Wilhelm Wundt, the aesthetic theory of the sculptor Adolf Hildebrand and Konrad Fischer. Their views formed the basis of the way Riegl and Wölffling understood art and its changes over time. They thought that the development of art through history responded to a process of development of vision that was analogous to the development of psychology of perception in individuals. By studying vision and the history of perception these authors focused on the relationship that people had to their environment. For them physical involvement in artworks provoked a sense of imitating the motion seen or implied in the work, and this enhanced the spectator's emotional responses to it. This idea was the result of the influence of empathy theory on the work of these art historians. The fundamental doctrine of empathy theory was that aesthetic experience depended on the experiencing subject's projection of bodily sensations and

emotional memory on fundamental formal elements of experience, such as lines and colours, and thus justified the interest in and need of formalist analysis. Vischer [45] was the first to employ the term 'Einfühlung' in a doctoral thesis, meaning the physical responses generated by the observation of paintings. Afterwards, Theodor Lipps, promoted this term and empathy theory in works such as *Die ästhetische Betrachtung und die bildende Kunst* [26]. Lipps was the supervisor of Wölfflin's dissertation *Prolegomena zu einer Psychologie der Architektur* [51] where the latter gave an ahistorical account of how architectural forms are perceived. Following Lipps' ideas, Wölffling stated that forms had no expression by themselves. In reality this only happened when the viewer read the proportions and relations of forms according to his own physiological and psychological constitution, endowing them with something of his own body's posture and mood.

In spite of the early influence it had on his work, Wölfflin would progressively move away from empathy theory in order to explain stylistic changes through time. In *Rennaissance und Barock* [50] he affirmed that changes in style and in other spheres of life as well occurred because of changes in bodily feeling. Later on, in *Classic Art*, he maintained that styles are conditioned by the combination of two independent factors: changes in purely artistic forms of vision, and changes in feelings and states of mind. Finally in his most famous book *Kunstgeschichtliche Grundbegriffe* (Principles of Art History) [49] he proposed a general set of descriptive terms to capture the artistic visual forms of an age without proposing any further explanation. In the introduction he criticised empathy theory arguing that when forms are read as expressions of states of mind, we make the false assumption that the same expressive methods are always available.

Following a process opposite to Wölfflin's, another important formalist author Riegl rejected the application of empathy theory to art history in *Stilfagen* (Problems of Style) [36]. His later work, however, would show implicitly that he had came closer to it. For example, in *Spätromische Kunstindustrie* (Late Roman Art Industry) [35], where he adopted the distinction between tactile and optical perceptions, he accepted the assumptions of empathy theory when he made the analogy between the apprehension of individual objects in the early haptic stage, and the sense we have of our own bodies. His last major work *Das Holländische Gruppenporträt* (The Group Portraiture of Holland) [37] focused on the paintings' implicit viewer and this brought Riegl closer to empathy theory. For Riegl Dutch paintings achieved coherence only when the viewer involved himself with the psychic sphere represented in them. According to this author, art in Holland was objective because it was concerned with the psychological relationship between figures that were independent from each other and from the viewer, a relationship that took place at a particular moment in a particular place in the absence of the artist's subjective point of view.

Empathy was also among the interests of another major figure in the study of the arts, Aby Warburg. He thought it was possible to demonstrate, for

specific conditions of time and place, how the visual arts expressed the perceptions and experiences of man. He analysed the representation of the movement of the body, hair and garments in artworks of 15th century Florence and traced back those movements in ancient art and also in contemporary images. For Warburg the borrowing of artistic forms from Antiquity had to do not just with forms, but was justified in terms of an affinity of expressive need. The intensified mimicry of Antiquity, its postures and gestures, were interpreted by Warburg as traces of violent passions experienced in the past, which were used by following generations as a repertoire to represent specific states of action and psychological arousal.

Warburg called these Pathosformel ('pathos formula' or 'emotive formula') a name that emphasized the stereotypical and repetitive aspect of the imagined subject the artist had to use to give expression to 'life in movement'. This term appeared for the first time in his essay on *Dürer and Pagan Antiquity* where Warburg [48] traced back the iconographic theme of Dürer's etchings *Orpheus* to the 'pathetic gestural language' of the art of antiquity. He discovered and traced this Pathosformel by scrutinizing all relevant evidence: archives, family diaries, psychology, folklore, mythology, religion, philosophy, ethnography, opera, astrology, etc. He even travelled to New Mexico to witness the 'living paganism' of the Pueblo Indians. All these interests gave form to the collection of his library, with the Greek inscription *MNEMOΣYNH* (Mnemosyne) above the door. As we will see later, the objects he named after Mnemosyne, the mother of all muses, would play a fundamental role in the development of his thought.

In *The Power of Images* Freedberg [12] described some of the recurrent symptoms of emotional responses to paintings and sculptures throughout history. He intended to draw attention towards the lack of interest that the history of art had taken in doing any research on the subject. In that book Freedberg referred to two kinds of response: direct and indirect, or unmediated and mediated. The first type of response seemed to be automatic and to be predicated on immediate or felt bodily responses, and the second type was mediated by concept, reflection and recollection. The first one can be said to be common to all humans, and the other is influenced by social, cultural and historical conditions. Could mediated response be understood as part of Umberto Eco's description of a hyper coded abduction?

To acknowledge the hermeneutic potential of the relationship between the neuronal bases of response and their historical and cultural inflection, Freedberg [10] has engaged in interdisciplinary work with neuroscientists. The objective of this collaboration is to find physical evidence of how art engages with the body and what the emotional responses that may ensue are. Of course, he signals that the question of the relations between inner and outward movement has a long tradition in the history of art and aesthetics (mentioning the previously cited authors among others), and also the interest in the arts of several neuroscientific works, but his intention is to discover the neuroscientific resolution (or at least refinement) of some of the older

intuitions, hypotheses and theories. His current work, therefore, deals with the neural bases of empathy and the relationship between emotional and motor responses to works of visual arts.

He has collaborated with neuroscientists such as Gallese who coined the term 'embodied simulation' to refer to a common functional mechanism that is the basis of both body awareness and basic forms of social understanding [15]. One of the results of this collaboration is a paper on the neural basis of motion, emotion, empathy and aesthetic experience. For further details see Freedberg and Vittorio Gallese [11]. In addition his work with neuroscientists Battaglia and Lisanby [5] examines the corticomotor networks involved in responses to the sight of particular gestures in artworks.

This collaboration between art historians and neuroscientists has challenged the primacy of cognition in responses to art. They propose a theory of empathetic response to artworks that is not purely introspective, intuitive or metaphysical but has a precise and definable material basis in the brain. They maintain that a crucial element of aesthetic response consists of the activation of embodied mechanisms encompassing the simulation of actions, emotions and corporeal sensation. These mechanisms are mirroring mechanisms and embodied simulation for empathetic responses to images in general, and to works of visual arts in particular. This gives importance not only to context and meaning in art but also looks for a response to works of art that is the same for all humans.

If the studies mentioned above are concerned with artworks only, the analysis of the broad field of visual culture as something that is interwoven with the body is one of the recent incorporations in the interests of many researchers. We can see the emergence of this matter in relation to what Moxey [31] signalled as the introduction of the problem of the 'presence' of the objects of visual culture (of their power as agents) when carrying out research on them. As an example of this, the statements of Belting [6] in *Bild-Anthropologie* can be cited. This author affirms that visual artefacts are embedded in mediums and that neither images nor mediums can be studied separately. This idea of medium is a metaphor for the human body: visual artefacts are inscribed in mediums just as inner images are inscribed in the human body. The medium is thus a figure necessary to the agency of visual objects that are conceived as something more than plain representations.

It can be said, however, that a full theoretical development of concepts such as embodied simulation would be possible if a more complex relationship between visual studies and abduction studies were established. This relationship should be established from a philosophical point of view, and also from that of cognitive sciences, psychology of perception and visual argumentation. To some extent this means that concepts like 'embodied simulation', 'empathetic response' or 'Pathosformel' can be presented as interplay between disciplines and, by extension, that both art history and visual studies are a cognitive niche of interdisciplinary research. The interpretation of visual culture can be analysed as a cognitive process that can be applied to an individual, a collective, a

group or a historical period. The activity of interpretation can be presented both as a process and as the result of a process. In both cases cognitive abduction is constantly present and may appear either as theoretical abduction (related to logic and to symbolic inferences), or as model-based related to the exploitation of models (pictures, photographs, diagrams, collages, etc.) or even as manipulative abduction. Perception is a limited process. This implies the use of this type of reasoning, also understood as epistemic change, for modelling the incorporation of new beliefs. The interpretative process and product, the bodily involvement in visual culture experience and even visual culture itself, can be understood as products that have an inferential structure or that even imply an inferential play. Hence studies in abduction cannot be indifferent to visual studies. The total evidence principle referred to by Eco (that it is impossible to register all the potentially relevant information) transforms perception into an abductive activity in itself. There is evidence for the consistency of this approach. The development of 'image-based hypothesis formation' has led authors like Magnani to consider abduction in terms of visual abduction. But the integration of visual abduction in the study of visual culture invites to explore a path where there is still much to discover.

4 Manipulative Abduction and *Mnemosyne*

To many of the authors who have stressed the agency of visual culture, the figure of Warburg emerges as some sort of 'historiographic hero'. For further details see Moxey [31]. In the field of archaeology, Shelley [39] stressed the important role played by the representation of visual images in the construction of new hypotheses. Abductive reasoning is constantly used in archaeology to discover archaeological remains and archaeological complexes. In the case of this discipline the discovery of some objects can be taken as an index of the existence of others that are absent. Abductive reasoning in archaeology is used to discover new forms or material remains that would be shaped in different ways depending on the associated assumptions. Abduction is thus related to the form of the objects, to their structure, and to the analogical inferences used in each case.

In Warburg's research abduction is not used as a form of induction as described by Reilly [34], neither it is understood as the inverted *modus ponens* described by Anderson [3]. It is seen as the heuristic form studied by Anderson [2]. Warburg's idea of *Pathosformel*, and his project of image argumentation are based on the assumption that the heuristic he proposed helped to obtain explanations with a certain inferential structure. In this sense, problems in interpreting the meaning of images are similar to those in the interpretation of texts, and of interactive discourse: it is impossible to escape the use of inferential structures. For further details see González Navarro [18]. In both cases the distinction between the hidden meanings of the data themselves and the hidden meanings of the producers of those data is a large theoretical

challenge as it was explained by Gabbay and Woods [14]. Warburg faced this challenge. We propose here an interpretation of his project of the atlas *Mnemosyne* according to which he offered a particular answer and a specific expression of the theoretical challenge as we described it before.

The atlas of images *Mnemosyne* was the last 'tool to see time', the last device Warburg worked on between 1924 until his death in 1929. It was based on the intuition that a regulated redistribution, a *problematized remontage* of the materials assembled during 30 years of research, could be great, heuristic fertility. This atlas of images was thought in connection not only to the theoretical manuscripts that accompanied the atlas elaboration, but also to the books of Warburg's library. For Warburg his library was not an ivory tower but an experimental device that made out of the Warburgian *Denkraum* a laboratory where machines to see time could be invented through action on words, images and gestures. The organization of the books in the library was designed by Warburg himself so that the reader would find not only the books she or he was looking for, but also their unexpected 'good neighbours'. The black panels of the atlas *Mnemosyne* were a place where images were disposed and composed and they constituted crucial elements in Warburg's talks. He was worried about how to present an argument whose elements were not words or propositions but images that were distant in space and time. As we said before, the atlas was an experimental device, a type of device where the lecturer and his audience were surrounded by a multiplicity of images that acted as visual indicators and not just as illustrations in the exposition of the argument.

Didi-Huberman [8] affirms that Warburg found in the atlas *Mnemosyne* the device that his investigation had always been waiting for: a method capable of manipulating as *interpreting objects* the images that themselves constituted the *objects to be interpreted* in the first instance. The Warburgian analytical space is based on a search for truth that transgresses the frontiers of knowing and seeing, of discourse and image, of the intelligible and the sensitive. But also because of that, it transgresses the canonical and deterministic models of explanation. According to Didi-Huberman, *Mnemosyne* is a theoretical work based on challenging the erudite explanation. It appears as a visual installation where that which cannot be explained in a deterministic way will have to be shown, where an Übersicht (a synoptic view) could go beyond univocal propositions, and establish a proper vision of the world. To put it in different words, the atlas *Mnemosyne* was an 'übersichtliche Darstellung'. At the same time that Warburg established his practice, Wittgenstein established his reason, a synoptic presentation of multiplicity valuable because of its heuristic capacity to raise comparisons.

Atlas *Mnemosyne* is characterised by Didi-Huberman as inexhaustible because of its capacity to mount, dismount and remount constantly a corpus of heterogeneous images in order to create unknown configurations and apprehend thanks to them unnoticed affinities or existing conflicts. *Montage* has to be understood as a procedure that goes beyond the artistic practice and

is able to open new spaces of thinking. As a consequence of all this, *montage* reveals itself as a very useful and significant space in epistemic terms. It is useful because it offers the spectator the possibility to conform, acquire or select beliefs, and significant because that space is clearly inclined towards an agent's epistemic stage conceived as an individual activity that models it as a consistent set of beliefs that can change by expansion and contraction.

According to this conception of belief revision the message, or in this case the interpretation, has priority over the agent's initial belief. However the progressive observation of more elements demands the use of an abductive reasoning process that finally turns into an operation that allows the emergence of observations oriented to the epistemic change of our beliefs or interpretations about the objects created by *montage*. In these spaces there exists constantly and for each agent what Aliseda [1] has called abductive novelties (that cause abductive expansion), and abductive anomalies (that can imply the revision of previous beliefs or interpretations). That is the basis of the rational foundations of the heuristic *montages* we are examining and interpreting as if they were situated and embedded cognitions. Because of it, this exhibition space can be understood as an invitation to explore cognition understood as abductive cognition. As Walliser [46] affirms abduction leads to the inference of hypotheses that cannot be classically deduced from the given facts. Objects and spaces constructed by *montage* cannot be interpreted as necessary deductions, they open a space for creativity and therefore, for abduction. Inherent to *montage* is the assumption that abduction is a model of epistemic change. Any individual, group or collective that places itself inside this space will have to interpret through abduction.

The assumptions that encourage this conception of epistemic change conceive of action as a device that provides otherwise unavailable information so that the agent is able to solve problems by performing an abductive process of generation or selection of hypotheses. Because of this, *montage* can be defined as a mechanism that reinforces epistemic change through manipulative abductions. In this type of abduction exemplified by *montage*, inferences are mediated through actions that create external objects which produce new affordances and through the detection of past affordances.

Warburg's atlas *Mnemosyne* is a very clear example of the combination of theoretical and manipulative abduction in the studies of visual culture but we think that, in fact, this kind of reasoning is used continuously in these studies. Could it be affirmed that *montage* is one of the basic activities performed (physically and/or mentally) by specialists in visual culture?

It is unlikely that the disciplines concerned with the study of visual culture can avoid the controversy between the supporters of internal cognition, who think that psychological processes do not extend outside the head and can be explained in isolation from their environment, and those of embedded cognition, according to whom cognition depends on external props and the structure of the environment. For further details see Sprevak [40]. Our objective here was not speculate or to adduce reasons for and against one position or the other. We

have presented analogies in order to show that studies in visual culture have to be seen as a field where cognitive abduction can be explored in the light of a broad epistemic perspective.

Nevertheless there is an assumption in the field of studies dealing with visual culture that has to be stated specifically. The problem of interpretation seems to be deeply rooted in these disciplines. This may be true, but that should also be the place assigned to abduction if we understand it as inseparable from the cognitive process by which we produce and revise interpretations. As a result, abduction could be presented as the logical pattern inherent in interpretation, thus answering one of the unresolved questions of the so called philosophy of interpretation.

The integration of the tradition of the studies in visual culture (represented by art history and visual studies) into studies of abduction would mean the introduction of an interpretative phenomenon that clearly reunites the representational and inferential components present in reasoning. Brandom [7] pointed out the differences between the position of Descartes and Leibniz in Enlightenment. On the one hand, Descartes divided the world into *res cogitans* and *res extensa*, thus converting the possession of representational contents into an explanatory but inexplicable instance. In contrast, Leibniz and Spinoza were concerned with what indicated the fact that a thing represented another taking into account the inferential significance of the representation. This should be elucidated through inferential relations. One of the main challenges since then has been to find how to define representational properties according to inferential ones. Abduction is part of this controversy, and it transforms radically the notion of 'interpretation' as González Navarro has stated [19] [17]. The consideration of the correctness of an inference is not a logical or a formal one; it is a hermeneutic matter, pragmatic and contextual. As Vega Reñón argues [44], the legitimacy of an inference manifests itself in relation to the set of beliefs actualised by the agent in order to cope with a situation. In this sense, the success of an inference depends on the intentional and epistemic attitudes of the agent. As a result, the justification of the inference becomes as complex as the rationalising of human action can be.

The inferential pattern of abduction would harmonize with interpretation understood as a form of cognition that is used, for example, in the production of new interpretations or even in the production of hypotheses leading to the development of new theories. Hence, the production of theories is an intrinsically interpretative process (conceive, T; transform T into T_1; extend T_1; reject T_1 in favour of T_2; producing, then, T_n...). The acquisition of a language and the historicity of our comprehension preform our cognitions through time individually and collectively. The ampliative effects observed in IBE are the result of the application of a reasoning model that is integrated into the action of interpretation. The inferential parameters that determine the logical relationship between *explanandum*, the *explanans* and abductive explanation are inseparable parts of an abductive competence which is shared in a theoretical and a manipulative sense.

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