



University of Bradford eThesis

This thesis is hosted in [Bradford Scholars](#) – The University of Bradford Open Access repository. Visit the repository for full metadata or to contact the repository team



© University of Bradford. This work is licenced for reuse under a [Creative Commons Licence](#).

**A TRANSDISCIPLINARY STUDY OF EMBODIMENT IN
HCI, AI AND NEW MEDIA**

H.D.A. AL-SHIHI

PhD

UNIVERSITY OF BRADFORD

2012

**A TRANSDISCIPLINARY STUDY OF EMBODIMENT IN
HCI, AI AND NEW MEDIA**

Hamda Darwish Ali AL-SHIHI

submitted for the Degree
of Doctor of Philosophy

Bradford Media School
School of Computing, Informatics and Media
University of Bradford

2012

Hamda Darwish Ali Al-Shihi

A Transdisciplinary Study of Embodiment in HCI, AL and New Media

Keywords

Embodiment, transdisciplinary, meta-analysis, affectivity, Mark Hansen, Gilles Deleuze, Gilbert Simondon, becoming, Basarab Nicolescu, Alan Turing

Abstract

The aim of this thesis is to report on a transdisciplinary approach, regarding the complexity of thinking about human embodiment in relation to machine embodiment. A practical dimension of this thesis is to elicit some principles for the design and evaluation of virtual embodiment. The transdisciplinary approach suggests, firstly, that a single discipline or reality is, on its own, not sufficient to explain the complexity and dynamism of the embodied interaction between the human and machine. Secondly, the thesis argues for thinking of transdisciplinary research as a process of individuation, becoming or transduction, that is, as a process of mediation between heterogeneous approaches rather than perceiving research as a stabilized cognitive schema designed to accumulate new outcomes to the already-there reality. Arguing for going beyond the individualized approaches to embodiment, this thesis analyzes three cases where the problems that appear in one case are resolved through the analysis of the following one. Consisting of three phases, this research moves from objective scientific 'reality' to more phenomenological,

subjective and complex realities. The first study employs a critical review of embodied conversational agents in human–computer interaction (HCI) in a learning context using a comparative meta-analysis. Meta-analysis was applied because most of the studies for evaluating embodiment are experimental. A learning context was selected because the number of studies is suitable for meta-analysis and the findings could be generalized to other contexts. The analysis reveals that there is no ‘persona effect’, that is, the expected positive effect of virtual embodiment on the participant’s affective, perceptive and cognitive measures. On the contrary, it shows the reduction of virtual embodiment to image and a lack of consideration for the participant’s embodiment and interaction, in addition to theoretical and methodological shortcomings. The second phase solves these problems by focusing on Mark Hansen’s phenomenological account of embodiment in new media. The investigation shows that Hansen improves on the HCI account by focusing on the participant’s dynamic interaction with new media. Nevertheless, his views of embodied perception and affection are underpinned by a subjective patriarchal account leading to object/subject and body/work polarizations. The final phase resolves this polarization by analyzing the controversial work of Alan Turing on intelligent machinery. The research provides a different reading of the Turing Machine based on Simondon’s concept of individuation, repositioning its materiality from the abstract non-existent to the actual-virtual realm and investigating the reasons for its abstraction. It relates the emergence of multiple human–machine encounters in Turing’s work to the complex counter-becoming of what it describes as ‘the Turing Machine compound’.

Dedication

To my mother and father, and my brother and his family.

Acknowledgements

I am thankful for the Ministry of Higher Education in the Sultanate of Oman for providing me the opportunity to develop my knowledge. I thank the University of Bradford for the friendly atmosphere and support. My special thanks go to my dear friends Halima Al-Bedwawi, Aisha Al-Wishahi and Amina Al-Sawai for making our learning an interesting journey. I am deeply grateful to Dr Patrick Allen for his trust, support and insights. I am indebted to Dr Ben Roberts for his deep constructive feedback, interesting discussions and valuable comments. I thank Mr David Robison for his support.

Table of contents

Abstract	i
Dedication	iii
Acknowledgements	iii
Table of contents	iv
Table of figures and illustrations	ix
0. Introduction: Transdisciplinarity: Research as individuation	x
0.1. Embodiment	x
0.2. Research background	xviii
0.3. Transdisciplinarity	xxxii
0.4. Research structure	xlii
0.5. The outline of the PhD phases	xliv
0.5.1. The first phase (chapter one)	xliv
0.5.2. The second phase (chapters two, three and four)	xlvi
0.5.3. The third phase (chapters five and six)	xlviii
0.6. Significance and contribution of the research	xlix
0.6. Limitations of the research	li
1. Chapter One: Embodiment in Human–Computer Interaction (HCI) Research: A Comparative Meta-Analysis of Research on Embodied Pedagogical Agents (PAs)	1
1.1. Introduction: Embodied conversational pedagogical agents (PAs): Definition and background	1
1.2. Debatable issues in PA research findings	3
1.3. PA development	5
1.4. Applications in educational settings	6
1.4.1. Computing and design	8
1.4.2. Multimedia learning	9

1.4.3. Communication	10
1.5. Research method.....	11
1.5.1. Studies retrieval	12
1.5.2. Studies coding	13
1.5.3. Inclusion criteria	13
1.5.4. Analysis procedure	14
1.6. Results.....	17
1.6.1. Descriptive results.....	17
1.6.1.1. Publication characteristics.....	17
1.6.1.2. Participants' characteristics.....	18
1.6.1.3. Research design and experiment settings	19
1.6.1.4. Independent variables.....	20
1.6.1.5. Agents' characteristics	20
1.6.1.6. Learning context	22
1.6.1.7. Measures	24
1.6.1.8. Tasks and data collection.....	24
1.6.2. Meta-analysis results.....	25
1.6.2.1. What is the effect of embodied agents on learning?	25
1.6.2.2. What are reasons for the obtained contradictory results?	27
1.6.2.2.1. Evidence of heterogeneity.....	27
1.6.2.2.2. Residual analysis	28
1.6.2.3. Embodied agent and disembodied agent contrasts	29
1.6.2.3.1. Modality analysis.....	31
1.6.2.3.2. Subjective measures	36
1.6.3. Publication.....	40
1.7. Discussion.....	43
1.7.1. Discussion of the results	43
1.7.1.1. The effect of embodied conversational pedagogical agents on learning	43
1.7.1.2. Multimedia learning principles.....	44

1.7.2. Discussions of methodological shortcomings	46
1.7.2.1. Factors influencing PA evaluation	46
1.7.2.2. Embodiment: What was embodied?	47
1.7.2.3. Embodied learning and embodied learners.....	49
1.7.2.4. Researching embodiment	50
1.7.3. Disciplinary bias	53
1.8. Conclusion	54
2. Chapter Two: The ‘Centre of Indetermination’ Between New Media and Cinema	55
2.1. Introduction	55
2.2. Embodiment in new media	60
2.2.1. Artwork analysis	69
2.3. Deleuze on cinema	82
2.4. Summary	104
3. Chapter Three: Embodied perception: From representation to enaction	106
3.1. Introduction	106
3.2. Bergsonian image	108
3.3. Deleuze’s reading of Bergson	114
3.4. Hansen’s interpretation	118
3.4.1. The enactive approach	118
3.4.2. Hansen: Practical activity	121
3.4.3. Virtual Environments	124
3.5. Revisiting the enaction approach	131
3.6. Summary	146
4. Chapter Four: From Perception to Affection: Embodied Affectivity	148

4.1. Introduction	148
4.2. Embodied affection	149
4.3. Qualitative progression	155
4.4. Spectatorship	169
4.4.1. Imitation and suggestibility	169
4.4.2. The close-up	178
4.5. Triggering affectivity and temporality	182
4.5.1. Hansen’s account of time-image.....	182
4.6. Summary	196
4.7. Conclusion: beyond polarization	197
4.7.1. Embodiment constituents.....	200
5. Chapter Five: From Polarization to Immanence: Embodiment in AI	204
5.1. Introduction	204
5.2. Turing Machine	213
5.2.1. Reality of Turing Machine	213
5.2.1.1. Machine’s statue and materiality	216
5.2.1.2. Scientific Culture and Turing	221
5.3. What was in Turing’s mind?	231
5.3.1. Is it a game or a test?	231
5.3.2. Is there a Turing test?	237
5.4. Summary	240
6. Chapter Six: Individuation in AI	243
6.1. Introduction	243
6.2. The loss and gain of affective modality	244
6.3. Living being and machine individuation	254
6.3.1. Living being individuation	254
6.3.2. Technical object individuation	258

6.4. The Turing Machine “taking-effect”	275
6.5. The mixed and virtual characters in Turing Machine	281
6.5.1. The child-machine.....	282
6.5.2. Adult-machine: The imitation game.....	285
6.6.2. Compound of heterogeneous systems	290
6.7. Summary.....	294
6.8. Conclusion: beyond immanence.....	294
7.1. Conclusion and future implications	298
7.2. Points for future phase.....	303
8. Appendices	307
9. References	313
10. Notes	

Table of figures and illustrations

Figure 1. a. Trandisciplinarity and b. The transdisciplinary Reality defined by its Object and Subject and their levels, and the Hidden Third.	xli
Figure 2 Study analysis structure.....	25
Figure 3 Forest plot of meta-analysis of PA (25 studies)	27
Figure 4 Residual analysis.....	29
Figure 5 Forest plot of embodied versus disembodied agents (16 studies)	31
Figure 6 Forest plot of text interfaces versus PA interfaces (9 studies)	32
Figure 7 Forest plot of text to agent with voice contrasts (7 studies)	33
Figure 8 Forest plot of voice interfaces verses PA interfaces (9 studies).....	34
Figure 9 Forest plot of voice to agent and voice contrasts (9 studies)	35
Figure 10 Forest plot of PA's effect on subjective measures (13 studies).....	36
Figure 11. Forest plot of PA's effect on sociability (11 studies).....	38
Figure 12. Forest plot of PA's effect on learning experience (10 studies)	39
Figure 13. Forest plot of PA's effect on usefulness (8 studies)	40
Figure 14. Funnel plot of standard error by Hedges's g	42
Figure 15. The immersive virtual reality social conversational protocol training system.	51
Figure 16. The virtual environment for health dialogue consent form.	52
Figure 17. Figures of speech and movement between categories of the real.	215

0. Introduction: Transdisciplinarity: Research as individuation

0.1. Embodiment

This introduction has two aims. First, it introduces the themes of the thesis and second, it attempts to establish the transdisciplinary approach as a research methodology. The thesis focuses on the complexity in thinking of human embodiment in relation to machine representation or virtual embodiment. Through its exploration, it also attempts to elicit practical points to consider while designing and evaluating virtual embodiment. Current theories and technologies have revolutionized the conceptualization of the relationship between human and virtual embodiment, considering virtual embodiment as a 'new paradigm.' This is not limited to different socio-techno-science disciplines such as human-computer interaction (HCI), artificial intelligence (AI), computational modelling, informatics and communication, but is also the case in the fields of media and new media theories or what is seen as the domain of the arts and humanities. Here, contemporary debates have already shifted from Cartesian mind/body dualism to consider monist philosophers such as Baruch Spinoza, Henry Bergson and Gilles Deleuze, who affirm the body and the role of affectivity in human life. This thesis follows a transdisciplinary approach to work across these disciplines, theories and philosophies in order to find different ways of thinking about the relationship between human and computer embodiments for evaluation and design in HCI. This section, first, explores

embodiment in technological disciplines, then, introduces the transdisciplinary approach and the motivations for adopting it as a research methodology.

The bulk of research in AI, HCI and communication studies seek one goal: humanizing the computer, hypothesizing that the resemblances between the technical and the human (e.g. brain, image, language and movement) will defeat the difference between them.¹ These fields question the role of artificial or virtual embodiment in machine intelligence, the creation of social bonds with humans, and in facilitating communication between social groups, social networks and synchronic and asynchronous computer-mediated communication technologies (CMC). This area of research is grounded on the work of Alan Turing on machine intelligence (this account is explored in chapters five and six). Turing argued against perceiving machines through their limitations, suggesting a case of machine intelligence in which a machine can be considered as ‘thinking’ if it can fool a human being to believe that it is human (1950, p.19). Following the same aim, AI focused on studying the human brain and building the mechanical brain. Later on, Rodney Brooks’ article ‘Intelligence without Representation’ (1991) has influenced the path of research by redirecting the focus from building thinking machines to their construction as “completely autonomous mobile agents that co-exist in the world with humans” where they can be “seen by those humans as intelligent beings in their own right” (1991, p.142). Brooks specifies the requirements for the creature as the ability to deal with the dynamic environment without collapsing, having purpose

of being in the world and being able to “adapt to surroundings and capitalize on fortuitous circumstances” (1991, p.142).

It is important to note here that the focus on embodied cognition does not explicitly mean focusing on the role of the body in cognition. Wilson has found that the mind in the approaches of embodied cognition is “seen as operating to serve the needs of a body interacting with a real-world situation” rather than “the body (or its control systems) serving the mind” (2002, p.635).² The only body-based approach Wilson identifies concerns “off-line cognition” where sensory and motor functions run simulations of aspects of the physical world that are distant in time and space or are altogether imaginary, as a means for drawing inferences or representing information (2002, p.633/635).

Ziemke conceptualizes the problem of the body by posing the question “what kind of body is required for embodied cognition?” and arguing that “there is little agreement on what kind of body an artificial intelligence would have to be equipped with” (2003, p.1305). He presents an “organismic embodiment”, which is based on Maturana and Varela regarding the autopoietic organization of living systems. According to autopoietic theory, “a living system as a molecular system occurs as a closed dynamic molecular architecture that in its continuous transformation through thermal agitation continuously gives rise to itself” (Maturana 2002, p.8). The living system has a relational condition to the medium or environment in which it exists (Maturana 2002, p.10) where it appears to know how to live while conserving its internal autopoietic relations and its adaptation to this environment (Maturana 2002, p.17). Yet, it is blind to

the consequences rising from its interaction with other molecules (Maturana 2002, p.8) where these external relations do not change the determined structural organization of the system (Maturana 2002, p.12). The living system interacts with those changes in the environment or medium that maintains its autopoietic organization (the composite unity or totality). Based on this interaction, a 'structural coupling' is formed, where certain structures (components and the relations between them) of its organization are selected, leading to the triggering of a determined structural change in the organization. Although it forms a recursive spontaneous and congruent relation with the medium to re-establish itself – thus conserving the autopoietic organization – destruction or disintegration could occur in the absence of these conditions. In effect, within the autopoietic system the organization conserves the virtual organization for the organism and, at the same time, relegates evolution and reproduction to historical networks of self-interest interactions that cause structural change but maintain and protect the physical boundaries of the organization.

Ziemke explains that machines, for Maturana and Varela, have "*allopoietic*" organization rather than autopoietic. In other words, they proceed through concatenation of their process. They are not "autonomous" but "heteronomous" as their components are produced independently from their organization and the changes in this latter "organization are necessarily subordinated to the production of something different from itself" (2003, p.1308). Ziemke argues that although there are self-organizing robots, these cannot be autonomous, in the

sense that Maturana and Varela provide, as machines are constructed while, for Maturana and Varela, autonomy cannot be “put” from the outside into a system that does not already ‘contain’ it (2003, p.1309).

Although Ziemke’s question, “what kind of body is required for embodied cognition?” considers body-based embodiment, the body seems subordinate to cognition based on his aim of identifying the “restricted” type of body required for artificial cognition. It could be argued that Cartesian mind/body dualism still has influence on prioritizing the mind over the body (chapter one shows how this influence has affected embodied interaction). Scientific explorations show the error of this mind/body split. A major influence here comes from Antonio Damasio who stresses, “the organism constituted by the brain-body partnership interacts with the environment as an ensemble, the interaction being of neither the body nor the brain alone” (1994, p.88). For Damasio, this interaction is anatomically supported by biochemical and neural circuits (1994, p.87). He states that not all behaving organisms or intelligent actions mean having mind or cognitive processing. On the other hand, “no organism seems to have mind but no action” (1994, p.90). Besides this, through investigations of patients with brain damage, Damasio also points out that the cognitive process (e.g. reasoning and decision-making), bodily regulation, and emotions and feelings, are all interwoven anatomically (1994, p.70/123). He emphasizes the role of emotions in decision-making, social behaviour and survival whereas any defect or lack in emotions “may constitute an equally important source of irrational behaviour” (1994, p.53).

In his account, Zeimke refers to one approach which, rather than considering the type of body required for artificial cognition, is concerned with understanding the role of embodiment in social interactions. This is “social embodiment”. This type of embodiment rejects amodal architectures of cognition and emphasizes that cognition is grounded on physical context and relies on the “brain’s modality-specific systems and on actual bodily states” (Niedenthal et al. 2005, p.186). Amodal architectures, as Niedenthal et al explain, are based on the computer metaphor where mental operations are processed through a central unit, where the sensory system delivers representations of the external world to the central unit (as input devices), and the motor system executes the comments from the central unit (output devices) (2005, p.185). In addition to the *offline* embodiment explained previously, Niedenthal et al explain *online* embodiment that is related to situated cognition where “sensory, somatic, and motor responses [are] necessary for the encoding and interpretation of the new individual, not simply as a by-product of a purely amodal analysis” (Niedenthal et al. 2005, p.187). Niedenthal et al. review many studies from literature and neuroimaging research that show how the “representations of participants’ own bodies contribute to the performance of the visual task”, which is called online effect, and that “blocking the embodiment impaired access to the conceptual elements of the representation”, is offline effect (2005, p.187-188). The reviews addressed attitudes (where motor movement or body posture of positive or negative attitudes reproduce the attitude), social perception (explaining the role of mimicry and imitation of other behaviours in social modelling), and emotions (where bodily responses facilitate cognitive processing of emotion stimuli).

This type of embodiment could be said to apply when thinking about the interaction and relations between the human and virtual embodiment in HCI and communication applications. These fields of research are interested in the role of the body and its embodied effects 'in relation to' rather than in its object being. To some extent, it explains why the human shape as well as emotions and behaviours become a way of embodying software since it provides effective and efficient interaction, as it provides immediate and continuous information about many factors related to our presence, affection and capabilities (Benford et al. 1995). It is the model of imitation that informs our assumptions; that is, we know what our bodies can do and, thus, we expect that we know what the embodied characters can do. The "reduced visibility" of the physical body and "reduced social visibility" in comparison to face-to-face communication (F2F) have been reported as missed in text-based interfaces (Derks et al. 2008, p.768). Benford uses the word "Poltergeists" to refer to this lack of embodiment in computer interfaces (1995, p.242). Virtual embodiment is presumed to reduce the 'poltergeist effect' due to the continuity of communication that discloses the 'otherness' identity through verbal communication. Within text-based interfaces, spontaneous emotions and non-verbal gestures remain invisible and their verbal disclosure can be controlled as the person can write, edit and reflect on their verbal presentation, which makes them less intense and less durable.

This moves us from 'cognitive intelligence' to 'emotional intelligence' in considering design and interaction with embodied computers, especially in cases such as software agents where the embodiment of machines carries a

body's representation. Rosalind Picard, the founder of affective computing research, has argued that the role of emotions is "marginalized at best" or "completely ignored" in science as they are believed to be "inherently non-scientific" (Picard 1995; 1999). For Picard, computers need "emotional intelligence" for self-protection and to express the problems they have such as overheating, cooling or leaking (Picard 1997, p.49; 2003, p.60). "Emotional intelligence" is defined as consisting of "the abilities to recognize, express, and have emotions, coupled with the ability to regulate these emotions, harness them for constructive purposes, and skilfully handle the emotions of others" (1997, p.49). Adapting human-like emotions for computers can make them recognize affects, and perceive human responses easier, so that they can adjust their behaviour.

Computers have bodies. They have different organs than humans such as keyboards, mice and microphones which could "be structured to produce human like functioning" (1997, p.52). Computers that recognize human emotions in a situation can use input devices analogous to human ones, such as hearing and gathering facial expressions and gestures, or different from them, such as reading infrared temperature or measuring electrodermal responses (1997, p.50). Computers can be designed to express or communicate emotions (even if they do not have any) through their channel of communication such as voice and image. Their output could have the semantic information (the *what* or content) and the affective information (the *how*), which refers to how they carry out pleasant interaction and efficient communication

(e.g. voice tone through modulation of vocal parameters) (1997, p.56). Even when the machine is used as a means of communication between two people, it can also make use of affective information to express the data lost by bandwidth (1997, p.57). The issue and challenge for embodied affective computers, as Picard sees it, “is not one of the body, or of the body’s capabilities to express, but the issue is a much harder one: how to get machines to express emotion in an appropriate way?” That is, to express the right emotion in the right situation and time (2003, p.61). Designers should give computers “the ability to act intelligently with emotions” rather than poor emotional skills which would make the interaction worse than non-affective computers” (1997, p.48).

The evaluation of affective computing could be based on describing the system behaviour in relation to the intended emotion (1997, p.69), or how fast the system responds with distinctive behaviour to certain stimuli (1997, p.70). Evaluation entails the computer’s ability to reason with emotions generated in a specific situation, its ability to discriminate different emotions, and whether it can retrieve and recognize information based on the condition of its mood (1997, p.70).

0.2. Research background

This research started with the evaluation of virtual embodiment of embodied conversational agents (ECA) in HCI. A selected area of focus, that is relevant to my educational background in technology, is pedagogical agents (PA). The

outcome reached, after carrying out qualitative and quantitative reviews, was that there was a failure in defining and evaluating embodiment. It was clear that the research examined and preserved the methodology (comparative experimentation) and hypothesis (ECAs or PAs are effective) without questioning the phenomenon itself, that is, without providing deep theoretical insight into 'embodiment' in empirical studies. The studies did not confirm the base effect that ECA is effective, yet the research has branched into comparisons questioning the effectiveness of different aspects of ECA (e.g. gender, emotions, and realism). In other words, in the realm of the non-effectiveness of ECA, which aspects are more effective? HCI conforms to Martin Heidegger's criticism of modern science in his essay 'The Age of The World Picture' (1977). This account is presented in chapter five but the point to be made here is that scientific research as "on-going activity" adheres to predetermined plans where "the methodology of the science becomes circumscribed by means of its results" (1977, p.124). While on the one hand, this ensures the explanation of new findings, it also preserves the known findings.

Hence, my thesis focuses on investigating and integrating the ways embodiment is thought of in relation to machine representation, or what is called virtual embodiment, by transgressing disciplinary boundaries and framing the debate on embodiment within both science and the arts. This transgression is referred to as 'transdisciplinarity'. Before elaborating on this approach, I will explain what makes it important as a way of researching the ECA phenomenon.

Transdisciplinarity appeared in my purview, first, in its form of ‘plurality’ as a “disciplinary bias” in the design of PA and paper elaborations of information in relation to the intended discipline and participants. This plurality of disciplines interested in the embodiment of software agents strengthened the research interest but, at the same time, it affected its design, conceptualization and application (e.g. blurring the difference between the design of an animated image and an artificial interface agent). On the other hand, the evaluation and the extent of the papers’ elaboration on certain aspects of design, information and findings differ based on the disciplinary background of the published paper. For example, papers from psychology or educational psychology elaborate on experimental design but overlook topics related to educational and pedagogic issues. Computer science papers elaborate on the design and implementation model but put less emphasis on presenting the experimental procedures and findings. This has affected the evaluation and the findings of studies.

I have adopted the transdisciplinarity approach as a methodology of research that is about a becoming, because, it seems to me as if it is not an approach *about* research. To a certain extent, it is the way through which the research evolves or becomes rather than following predetermined convictions or the conventional methodology of a certain discipline to which everything is brought to fit. Here, I provide two examples of this latter problem. First, statistical results are seen as constitutive of the research findings rather than as a part of the findings. This difference has already informed the misinterpretation of the null hypothesis significance testing (NHST) in experimental studies, which has

currently become a focus of statistical researchers. The NHST is commonly taken as telling us that, “given these data, what is the probability that H0 is true?” rather than “given that H0 is true, what is the probability of these (or more extreme) data?” (Cohen 1994, p.997). Although extensive literature reviews and effect-size estimations or the measurement of effect magnitude are proposed to overcome this misinterpretation, unfortunately, these could be interpreted based on the same convictions, that is, the certainty rather than the probability of the research data.

An interesting example of this appears in Reeves and Nass’s (1998) communication research which has guided the general research on virtual embodiments, agents and avatars within HCI whether methodologically or qualitatively, by addressing the way people treat media objects like television and computers; it proposes the ‘media equation’. Their research is based on social science laboratory experimental methods and addresses human–media interaction from a social perspective.³ Investigating different aspects of interaction related to communication and media forms (e.g. manners, personality, emotions, social roles, media forms and so on), the authors emphasize that *media = real life* since humans treat and respond to media forms naturally as social actors and this belief is automatic, and unconscious.⁴ The authors argue that the evolution of the human brain has made, “anything that seemed to be a real person or place ... real” (1998, p.12) and it takes effort to resist this primitive response (1998, p.13). In other words, people treat computers as feeling entities, so they apply social rules in their interaction with

them, and this application of social rules, the authors insist, is “not just a matter of being nice; it’s a matter of social survival” (1998, p.28). *But that is not all:* actually the authors observe that *participants have denied that they treat the computers as real humans*. In other words, for the researchers, it seems as if the participants cannot describe the essence of this treatment.

In another publication, the researchers Nass and Moon referred to this as ‘mindlessness’ where the application of social rules to computers and media appears without the participant’s awareness (2000, p.93). The participants’ denial was related to the Greek word *Ethopoeia*, which involves “a *direct* response to an entity as human while knowing that the entity does not warrant human treatment or attribution” (2000, p.94). The direct response is due to the “obliviousness to the unique characteristics of a computer as an interactant” that “certainly can” elicit these social responses (2000, p.94). However, the detachment between participants’ knowing and responding does not answer the question of why, when it is brought to their attention, the reflective participants “vehemently” deny their obvious behaviour.

The ‘media equation’ tends to convince us that there is only *one reality*, human reality, and when humans respond, their response bears this reality and its likeness. What the ‘media equation’ emphasizes is that, when the ‘interaction box’ is opened with media, different ‘autos’ emerge and with them only one line of flight escapes the box, that is denial.⁵ The Greek word ‘*Auto*’ means ‘self’. Here, it means occurring by itself as automatic or spontaneously as autonomous from consciousness. Interestingly, a counter-denial is observed.

The researchers, Reeves and Nass, admit the equation itself, *media = real life*, and thus media reality, but what they deny is the essence of this reality as being of a different reality from human reality, as for them what seems true is true. In other words, this leads to identity, that is what seems true is identical to the true: media reality is identical to human reality (this aim towards this dedifferentiation between the two seems to be inherited in AI and HCI, as we will see in part three of this thesis). On the other hand, the participants deny this identity; what seems true is what 'seems true' and what 'seems true' is not identical with what is 'true'. What the participants deny is not the media reality or sociability, what they really deny is that the media is 'human' and that they are 'experiencing' media as 'humanlike' rather than medialike. People do not deny the media individuality, its difference, its artefact and they, let us say, cannot deny the 'scientific fact' of being unconscious and automatic. They cannot submit or accept. They resist. They and the researchers are stampeding over a 'margin' where the researchers are determinists of identity, and participants are indeterminists or maintaining a level of uncertainty.⁶

This margin, I would say, is constituted by emotional intelligence that informs the difference between experiencing human and non-human and between emotions with intelligence and emotions without intelligence. Reasonably, the 'unconscious and automatic' response is not constitutive of human reality or of social experience. It could be argued that the participants are emotionally intelligent. I use the phrase 'emotional intelligence', here, to refer to the fact that they are capable of differentiating between their reality and media reality as they

feel, even if they cannot name the feeling or give 'evidence' equal to scientific empirical data, that the dedifferentiation is a threat to their future survival. It could be argued that while, on one level, the social treatment of media is a matter of survival, the differentiation between it and human, on another level, is also a matter of survival. In this sense, emotional intelligence expresses a dimension of futurity within it. Thus, the participants might seem 'irrational' while the matter of this irrationality is what is unknown or beyond the graspable materiality of rationality, which is based on the collected data. In this sense, the direct response warrant the computers a degree of humanness and the reverse might be true, that is, it warrants humans a degree of machinery. Nevertheless, this degree is not constitutive of either human or media reality.

Eventually, then, the participant's 'vehement' denial of their obvious behavior means that this behavior is not constitutive of their social experience. As the researchers insist on the 'equality' that pertains to a hazardous dimension of 'identity' based on their given data, they do not accept the participants' denial as true. Hence, without the belief that there is something beyond the totality of the cumulative data, this case implies reducing human beings to scientific objects that can be calculated and expressed as scientific data. However, this belief is essential in rejecting the certainty of this implied identity in the relationship between human and machine embodiment (in chapter three this point is made more noticeable as the difference between representation and presence).

The misinterpretation of the NHST supports the rejection of the certainty based on the collected data. In relation to the mentioned case, the researchers should perceive their findings as, 'given the participants' denial is true (as this denial constitutes the difference between human and media), how likely or probable is the collected data?' The importance of this is that 'uncertainty' is always there. Thus instead of insisting on what 'seems true is true' and media equals real life, another level is that what seems true is 'probably true' and media 'probably equals' real life as this probability is relative and based on the different dimensions of the relationship (for example, culture, generation, duration and emotions). Shneiderman and Plaisant (2009) have pointed out some weaknesses of controlled experimentation. These are the difficulty of finding adequate subjects, the overlooking of extremely good or poor performance and the distortion of the situation so the conclusions may have no application. Controlled experimentation also deals with short-term usage, so understanding of long-term consumer behavior or experienced user strategies is difficult. It also emphasizes statistical aggregation where individual insights maybe less emphasized (2009, p.38). The experimental research of Reeves and Nass shows that the participants' insights may not fully support the statistical data or the hypotheses of the research. These insights draw attention to the 'probability' of the statistical data. Reasonably, this means that disciplinarity could result in reducing human beings and restricting interpretations within certain boundaries.

The second example of the effect of disciplinarity on research is related to the newness of the phenomenon in relation to its spatial and durational dimensions.

These dimensions are overlooked as embodiment is staged as a new paradigm. In HCI, this leads to dissociation between design and evaluation studies, on the one hand, and embodied historical or current virtual representations such as Galatea, idols and statues, movie characters and cartoons, on the other hand. Regardless of the difference in their materiality, all of these could account for a degree of effect or affect in the relationship between human and virtual embodiment whether of machine or another materiality. On the other hand, dissociation appears between the studies, participants and their culture. As Manovich argues, “the area of new media where the average computer user encountered AI in the 1990s was not, however, human-computer interface, but computer games” (Manovich 2001, p.54). In other words, the participants’ encounter with ECA is not a new phenomena for them and thus, if the effect is already established, then, it moves to the realm of a learned habit. Without admitting virtual embodiment and the evaluation of the relationship between it and human embodiment in these dimensions, an ‘effect distortion’ may appear. Reasonably, there is a risk that the studies and their interpretations cannot identify or extract the investigated effect and thus their conclusion might have no application to either the participant’s context or design. The majority of the participants in these studies are undergraduate and are from or living in developed countries (USA or UK), that is, they are in industrial and highly technical cultures, which means that exposure to interface agents or games is relatively high.

Although 'embodiment' has been adopted with the advancement of the artificial body, the word has been taken for granted as referring to the appearance or representational character and as a support for the conversational medium. As seen from the evaluation criteria of Picard presented above, the evaluation is not based on whether humans experience machines as affective but on the construction of machines emotions and their usability. The conclusions of chapter one shows that embodied interaction, users and their experience were not evaluated in the analyzed experiments. A transdisciplinarity approach is planned to move beyond one discipline to explore the problem of embodiment in-between disciplines.

A similar concern about the lack of theoretical foundations in HCI and an attempt to go beyond its limits is expressed by Paul Dourish in his book *Where the action is* (2004). Dourish states,

Theory grounds design by providing a framework within which hypotheses can be constructed and tested, options explored and compared, and results analyzed, evaluated, and verified. From this perspective, design is simply speculative without an understanding of how and why it works; theory makes design real, because it places design in a context that explains it. Whichever position we hold, though, a working relationship between theoretical understanding and design practice is crucial (2004, p.175-176).

This statement emphasizes that theory and practice are not separated domains but are interdependent. For the time being, Paul Dourish's work, along with a few other studies motivated by his research (Antle et al. 2011), have started to consider seriously phenomenological understanding of embodiment (e.g. in Edmund Husserl, Martin Heidegger and Merleau-Ponty). Dourish emphasizes

that “embodiment is not a new idea” (2004, p.100) because it was a common theme of twentieth-century philosophical thought and phenomenology in particular (2004, p.20-21). Thus, he restages the history of user interface development and design, especially in relation to tangible and social computing, as modes of interaction based on a perspective that considers human skills and abilities (2004, p.4). His approach differs from traditional HCI approaches to design by placing embodied interaction “at the centre of the picture” rather than the interface (2004, p.2). He argues for “an approach to the design and analysis of interaction that takes embodiment to be central to, even constitutive of, the whole phenomenon” and not simply “a form of interaction that is embodied” (2004, p.102). Embodied interaction “*is the creation, manipulation, and sharing of meaning through engaged interaction with artifacts*” (2004, p.126).⁷ Engaged interaction with computer systems is based on exploiting the fact that they occupy our physical and social world in the way that they interact with us (2004, p.2).

Dourish addresses computational and foundational topics rather than computing or technical topics where computation is perceived as the “representational power” of computing (2004, p.3). His phenomenological exploration is based on hypothesizing that embodiment is the core and mutual element on which both tangible and social computing are founded (2004, p.22/100). Tangible computing entails, first, the direct physical interaction with artifacts rather than graphical user interfaces or interface devices such as mice (2004, p.16), second, the distribution of computation across different devices that are spread

across the environment (e.g. tags), and third, the augmentation of everyday objects (e.g. pens and toys) to respond to the environment and peoples' activities (2004, p.15). Social computing "attempts to understand how the "dialogue" between users and computers can be seen as similar and dissimilar to the way in which we interact with each other" (2004, p.15). Both tangible and social computing, for Dourish, encompass "a number of different activities" (2004, p.15), draw on the same sets of skills and abilities (2004, p.15) and exploit a sense of "familiarity" of the everyday world (2004, p.99).

Embodiment, for Dourish, is "a feature of interaction, not of technology" (2004, p.188). It is defined as "*the property of our engagement, with the world that allows us to make it meaningful*" (2004, p.126). It is about "*the relationship between action and meaning*" (2004, p.126) and "engaged actions" (2004, p.189). This means that embodied interaction changes the role of the everyday world from being a resource for interface metaphors to something which is socially and physically experienced by individuals (2004, p.17/99). The metaphors exploit our familiarity with the real world in designing interactions but do not use the real world as a "*medium*" for interaction (2004, p.101). For example in video games and virtual environments, the users are "disconnected observers of a world they do not inhabit directly" (2004, p.102). Likewise, conversational computational systems using natural language-processing techniques, attempt to encode and incorporate conversational rules based on familiar patterns of everyday human actions, but they are a world away because rules about turn-taking and anaphoric references arise out of a world of human

social action (2004, p.102). Therefore, interface metaphors conform to the Cartesian and cognitive approach of the disembodied brain that continues to dominate the thinking of computer system designers (2004, p.18). In contrast, tangible and social computing effectiveness is based on the fact that “we, and our actions, are embodied elements of the everyday world” (2004, p.100). That is we inhabit conversations as embodied phenomena and “inhabit our bodies and they in turn inhabit the world, with seamless connections back and forth” (2004, p.102). Tangible computing capitalizes on our physical skills with real world objects, and social computing makes the most from the relationship between social action and ‘situatedness’

Embodied interaction is an embodied design perspective that focuses on the relationship between people and systems (2004, p.192). It could be directed to inform, support and provide tools for system developers and designers to understand, design, analyze and evaluate interactive systems (2004, p.3/22). Interaction design utilizes a different perspective in HCI from those used by engineering and psychology. It recognizes that the artifact is part of a larger system (e.g. culture) and that design both expresses a system of values and communicates messages in relation to its task (2004, p.202). Embodied interaction does not mean a *purely* physical manipulation of the information object (2004, p.207). “Software is a representational medium” (2004, p.208). Thus, the aim of embodied interaction design is to call for,

a more nuanced understanding of the role that those representations play, how they are subject to a variety of interpretations and actions, and how they figure as part of a larger body of practice. The opportunity is to break the link between an inevitably representationalist stance towards software and a much more questionable representationalist stance towards action and interaction (2004, p.208).

This means that actions and meanings, technologies and practices cannot be separated (2004, p.204). Meaning resides in the ways the system is used rather than the system itself (2004, p.183), redirecting interactive design towards the way people engage with the artifact in different settings (2004, p.184) rather than interfaces.

The move Dourish makes from the interface and abstract mental models applied in designing interfaces, to embodied interaction or that which is 'in-between' the systems such as the human and the interface, is crucial in capitalizing on the transdisciplinary approach this thesis follows. While Dourish uses a hypothesis to structure his reading, my research is guided more by resistance to the current state of evaluating and designing ECA in HCI research and my interest is in investigating embodiment in other disciplines in order to provide design and evaluation alternatives. This should be viewed within the limitation that my research is based on exploring ECA in certain areas of HCI. My readings inform my motivation to understand and rethink the relationship between virtual embodiment and human embodiment, and identify the in-between of the two systems as a locus of this relationship rather than focusing on technology or human.

0.3. Transdisciplinarity

Transdisciplinarity aims to transgress disciplinary boundaries and frame the debates of embodiment within a larger context. By disciplinary ‘transgression’ I mean to refer to an evolutionary way of thinking about the interaction of or the relation ‘in-between’ terms; this is the transdisciplinary approach of Basarab Nicolescu. This approach is not about research, the body, the machine or technology but about a process of researching or of becoming that goes across and beyond arguments framed by one field to another. In this way, it shows how the multiplicity of levels in thinking about the relation between human embodiment and machine embodiment results in either diagnosing failure in one field, presenting problems in another or opening new potential in a third.

A transdisciplinary approach, according to Nicolescu, “concerns that which is at once between the disciplines, across the different disciplines, and beyond all disciplines” (2008b, p.2).⁸ By going beyond disciplines, it caters for the existence of immanence between the diversity of scientific knowledge and artistic knowledge through its three axioms. These are the ontological (simultaneous multidimensional and multi-referential levels of Reality),⁹ the logical (the included middle which preserves coherence between disciplines), and the epistemological (complexity which refers to multiplicity in perspectives, participations and interactions, which could lead to levels of uncertainty and unpredictability). Understanding these three principles of transdisciplinarity is important to the way my research progresses from one field of thought to the other and the potential in-between of these fields.

First of all, Nicolescu defines 'Reality' as *resistance* to our experiences, representations, images or mathematical formulations, where each level of Reality has its own levels of organization (Nicolescu 2008b, p.4). The passage from one level of Reality to the other is signed by a fundamental *discontinuity* in the structures (Nicolescu 2008b, p.4) where "every level of Reality is associated with its own space-time" (Nicolescu 2008a, p.18). Each level of Reality has a contradiction (A and non-A). Coherence of information transmission between these levels is brought by the logic of the included middle. The included middle represents a third axiom (T) where the contradiction (A and non-A) is resolved in a different level of Reality than the one it exists on. As Max-Neef (2005) explains, "every theory at a given level of reality, is a transitory theory, since it inevitably leads to the discovery of new contradictions situated in new levels of reality" (2005, p.13). In other words, as the resolution is found in a different level of Reality, on this same level, a new contradiction appears that is resolved in yet another level of Reality. This process is iterative which ensures its openness.

It could be argued that transdisciplinary research is a transductive process. I use the term 'transduction' in reference to Gilbert Simondon's work on individuation. Simondon's work is elaborated in chapters five and six of this thesis but here I want to pick only one theme related to the methodology of this thesis, which is transduction. Transduction expresses a process of individuation in progress (Simondon 1992, p.313).¹⁰ Simondon defines individuation as a process that entails "*the conservation of being through becoming*" (1992,

p.301). He emphasizes the understanding of the individual from the process of individuation rather than the reverse (1992, p.301). Simondon criticizes the substantialist and hylomorphic approaches of individuation as they both presuppose the existence of a principle of individuation through which the constituted individual is explained. Substantialism considers the essence of the living being in its pre-given or primary unity, which is formed through chance association. Thought here is deductive. It seeks to grasp the essence of this unity through decomposing it into its original elements (1992, p.299). Decomposition requires a powerful force (in the physical case) or a method from elsewhere to solve the problem at hand (1992, p.314-315). On the other hand, hylomorphism thinks that the individual requires the conjunction of a form and some matter to exist as a 'whole' (1992, p.298). It analyzes these terms to develop a model of the whole being (1992, p.311). Here thought is inductive. It seeks to explain the terms of the investigated reality that are required for solving the problem at hand, and to establish conceptual relations that connect their independent existence (1992, p.312). This is achieved through developing conceptual models and structures that preserve these terms or the positive and common characters to all of them. At the same time, singularities peculiar to each term are eliminated which results in loss of information (1992, p.315).

For Simondon, both of these approaches suggest, "the sort of constituted individual at which we will arrive, and the properties it will have once the process of constitution is complete" (1992, p.298). Simondon emphasizes that the transductive process is an individuation or becoming in progress (1992,

p.313). It takes place when an activity (mental, social, physical or biological) begins at a centre and gradually and correlatively extends itself in different, heterogeneous and multiple dimensions around this centre (1992, p.313). This process brings forth a structure, which becomes the basis for the next one (1992, p.313). Thought here is transductive. It is not a logical procedure but a mental procedure that corresponds to a “course taken by the mind on its journey of discovery” (1992, p.314). This discovery reveals the dimensions according to which a problem can be defined (1992, p.313). Intuition and potentiality are inclusive parts of this procedure that allow the emergence of a structure that yields a resolution to the problem at hand (1992, p.314):

[Transduction] represents a discovery of dimensions that are made to communicate by the system for each of the terms such that the total reality of each of the areas' terms can find a place in the newly discovered structures without loss or reduction (1992, p.315).

In this sense, communication is effected between the heterogeneous terms where the latter preserve their singularity and at the same time forms relations with each other. A transductive relation is not a connection between these terms but it is a modality or a way of being that belongs to both terms and their context (1992, p.312). It is in itself a dimension of becoming that is contemporaneous with the terms it mediates.

In respect to this research, there is a need to focus on the individuation of research rather than individuality. For example this research starts to explore the problem of embodiment from an objective perspective identified by collecting and analyzing statistical data in the field of HCI, but it is not satisfied

that the search for the solution for this problem or for the contradiction recognized by the quantitative review can be restricted within the boundaries of this discipline. Similarly, there is a need not to review the state of art (the outcome of the logical procedure) but to continually art the state, that is, to discover the dimensions through which research in a certain discipline 'becomes' in relation to other disciplines. Although both the 'state of art' and the "arting" of the state, show contemporariness, the former, regardless of the 'acknowledging' part it plays, captures the art within the state presupposing it, within the "disciplinary big bang" (Nicolescu 1999, p.2); thus it prevents knowledge from opening to other structures, eventually leading to 'recycling research'. The latter, however, liberates the art from the state to creativeness that recursively advances the state. This does not mean that the 'acknowledgment' part is not important as a base for knowledge acquisition of the research field, but that its hazardous limits reside in enfolding the research area so that it forms a whole Reality enclosed within itself. In metaphorical terms, the state of art, habitually and artificially, evolves as an autopoietic cell of disciplinary research ignoring the flexibility, openness and connections, that is 'beyondness', simply because such openness questions its death and such beyondness problematizes the death-after. In other words, is there 'an after' for the disciplinary state of art? This question is crucial because it fairly summarises the distrust in the chaotic non-state, which also means there is nothing for us to art in our second part of the argument. This marks the disappearance of research and its displacement, with fragments that cannot be brought together to form a unified field or area of research. This 'after' could be

rethought through the transdisciplinary approach without falling into chaos. Simply, the chaos does not have a guarantee for the emergence of a system or order that could preserve the continuity of research. What characterizes this approach is the space-time moment of 'going beyond'. In transdisciplinary research, I observe this moment where the review of the state of art and the potentiality to art the state, the dominating disciplinary or single level of Reality and the new level of Reality, and the conflict between certainty and uncertainty, all appear simultaneously in what Nicolescu calls an 'open unity'. This open unity is what Nicolescu defines as the zone of non-resistance between the levels, in which they disappear not in emptiness but in unification. The illusion, that is the artificial division and the stability of boundaries between disciplines, is unveiled. Nicolescu views boundaries as unstable, moving in a space that is 'full':

We have a different approach of the boundaries between disciplines. For us, they are like the separation between galaxies, solar systems, stars, and planets. It is the movement itself that generates the fluctuation of boundaries. This does not mean that a galaxy intersects another galaxy. When we cross the boundaries, we meet the interplanetary and intergalactic vacuum. This vacuum is far from being empty; it is full of invisible matter and energy. It introduces a clear discontinuity between territories of galaxies, solar systems, stars, and planets. Without the interplanetary and intergalactic vacuum, there is no Universe (2010, p.23).

This space-time moment is full of potentiality and energy (1992; Nicolescu 2010). It reveals the sacred or the "Hidden Third", associated with different levels, "that which does not submit to any rationalization" (Nicolescu 2008b, p.9; 2010, p.27). This moment, on the one hand, frees the subject from following the habitual sequence of one discipline by providing it time to think. While its

irrationality appears from disciplinary viewing, its rationality is perceived in the totality of the research. It marks a living moment where the future can be traced “in the sand of the present moment” (Nicolescu 2005, p.14). This moment differentiates transdisciplinarity as a continual process of research individuation or going beyond, that is forever open through transdisciplinarity as “joint problem solving” or collaborative projects such as the td-net project of Swiss academies (Pohl and Hadorn 2007; Hadorn et al. 2008). In the latter, different disciplines focus on resolving the same problem, starting point, goals and requirements, in order to obtain better solutions. For the latter, complexity is experienced in relation to the plurality of disciplines and problems occur as a result of disciplinary bias or lack of communication within the application contexts, thus a mutual understanding of the problem is required, when the research focus is on the space between the disciplines. Nicolescu (2005, p.1) points out that transdisciplinarity is not a superior discipline or a “science of the sciences”. Transductively, it does not search for absolute effectiveness but for a resolution to current problematics. In this way it cannot be contained within the two definitions provided by Scriven (2008, p.65) where it is seen as a perspective with some application in several disciplines, or as a ‘discipline’ and an analytical tool. These definitions already presume that which they deny in the first place which is disciplinarity and thus the outcome is evaluated by linking it back to disciplinary territories. The integrative finding of a transdisciplinary approach should be seen in itself as a ‘unit of becoming’ with its own complexity and relations that advance autonomously with all their heterogeneities. Heterogeneity in the integrative phase is not only caused by the participatory

disciplines and theories, but also because new relations and perspectives come into being that provide this phase with its own particularities or 'haeccities', and hence complexity and problematics. In other words, the integrative phase is the outcome but not the 'endcome' of the research in individuation; otherwise there would be no going 'beyond disciplines'. 'Going beyond' takes place when the integrative phase is seen as a transductive phase that "aids in tracking processes that come into being at the intersection of diverse realities" (Mackenzie 2006, p.18) but, as a unit, it starts to individuate as a complex of heterogeneity in its own right, that is born to follow its own path. In this sense, rather than conceiving Nicolescu's transdisciplinary approach as a unity of all our knowledge (Nicolescu 2002, p.110; Hadorn et al. 2008, p.29), it can actually be conceived as a continual searching for the knowledge required for 'life-world' problems. The "common good" (Pohl and Hadorn 2007, p.27; Hadorn et al. 2008, p.19) aimed at by project-based approaches is effective in terms of the 'project' but not in terms of research, because any research basically precedes from the uncertainties of questioning the 'common' and the 'good'.

The transdisciplinary approach advocates a level of relativity or *incompleteness* of each level rather than totality (Nicolescu 2008a, p.18), which means that there is no privileged level, thus rejecting dualism and binaries, as it places emphasis on the 'in-between', that is, on the relation or interaction. Knowledge is not exterior or interior (Nicolescu 2010, p.27), but in-between. A level of coherence (Nicolescu 2005, p.12) allows the communication and the transmission of information between heterogeneous levels. Although a

transdisciplinary perspective acknowledges the experimental level, it rejects the reduction of knowledge and of the subject to an object of science. When objectivity becomes the sole reality, it marks the “the death of the Subject” or its transformation to

an object of the exploitation of man by man, an object of the experiments of ideologies which are proclaimed scientific, an object of scientific studies to be dissected, formalized, and manipulated. The Man-God has become a Man-Object, of which the only result can be self-destruction (Nicolescu 2005, p.3).

Consequently, it admits the contribution of body and feelings (Montuori 2008, p.xvi), as well as spiritual and cultural levels in knowledge formation. “Without spirituality, the knowledge is a dead knowledge” (Nicolescu 2010, p.27). The etymological meaning of spirituality, as Nicolescu explains, is representation that is “in an act of communion between us and the cosmos” (2010, p.31). He emphasizes that technoscience which “drives a hugely irrational force of efficiency for efficiency sake: everything which can be done will be done, for the worst or the best” (2010, p.32) is one of the reasons for the need for a new spirituality. Thus the transdisciplinary approach recognizes values as a main aspect of interaction (Nicolescu 2005, p.14). It also considers the effect of disciplinarity on the “New Man” who turned out to be “sad, empty man” nostalgic to return to the “Golden Age” (Nicolescu 2002, p.108). The new spirituality between cultures and religions embodies the transdisciplinarity principle, which is “unity in diversity and diversity from unity” (2010, p.32).

Importantly, the subject, the researcher or the individual is an active participant whom through “a discipline of self-inquiry ... integrates the knower in the

process of knowing” (Nicolescu 2008c). Once the uncertain knower is integrated in the process of knowing, thinking is no longer performed by the subject but becomes “an individuation of a thinking subject”, where to think transductively means “to mediate between different orders, to place heterogeneous realities in contact, and to become something different” (Mackenzie 2006, p.18).¹¹ Like the transdisciplinary object, which has levels of discontinuous realities and a zone of non-resistance between them, the subject for Nicolescu has levels of perception and a zone of non-resistance between them. Figure 1 (2010, p.34) shows the interaction between the object’s and the subject’s levels of Realities and zones of non-resistance, which engenders different levels of transperceptions and transrepresentations that can explain “moments of scientific and artistic creation” (Nicolescu 2008b, p.15).

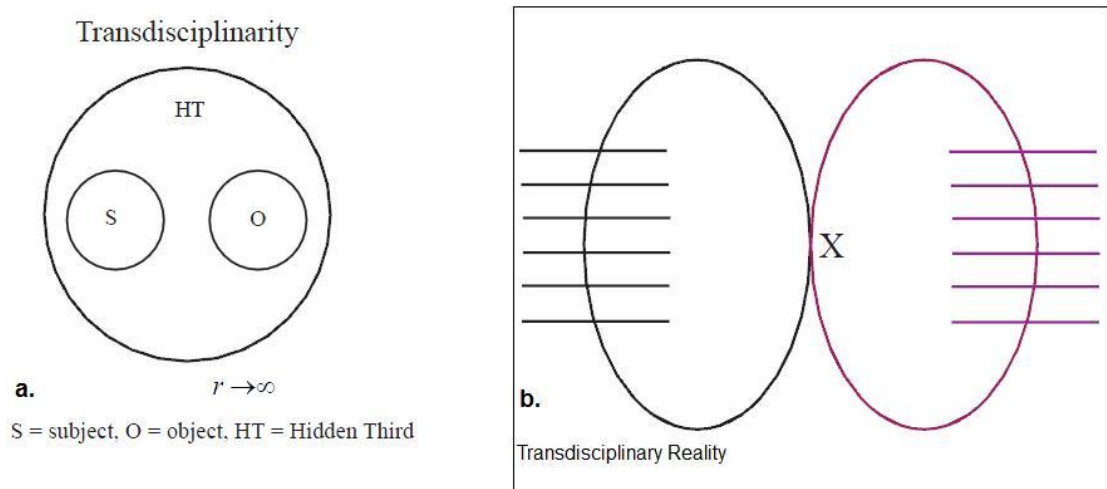


Figure 1. a. Transdisciplinarity and b. The transdisciplinary Reality defined by its Object and Subject and their levels, and the Hidden Third.

0.4. Research structure

To cater for this variation, my research consists of the three aspects of the transdisciplinary approach Nicolescu insists on (Nicolescu 2005; 2008b; 2010), the experimental, phenomenological and theoretical, as well as an integration level. A phase defines a mode, which draws on a case study within a certain field depending on the particularities of the field itself. This gives the phase a discreteness or discontinuity from the content of other phases. In other words, the phase has a structure within itself before condensing into a phase transition. The phase transition forms a layer that reserves the continuity and connectivity with the next field as the boundaries between them are crossed. The findings of each phase are explored in relation to the problems posed by the previous phase and the direction or orientation it poses for the next case. The experimental phase (meta-analysis in HCI) identifies a logical and objective level of knowledge. According to Coryn and Hattie,

the objectivist view of evaluation asserts that evaluative claims of merit, worth, and significance are possible in principle and practice, based on logic and reason, and if properly understood, objectivity (2006, p.108).

The second level is the phenomenological (analysis of Hansen's work in new media), which identifies theoretical or normative influences on a certain phenomenon and connects with the logical or objective level. The third one is the theoretical or value level, based on what or how to apply (analysis of Alan Turing's work on machinery intelligence). The final level is the integration of the

three levels in explaining certain examples of interaction between humans and technology.

There are two phase transitions in my research. The first one occurs at the end of the experimental level, which generally points to a reduction of both the virtual body and the participant's embodiment due to both the particularities and methodological shortcomings of the HCI research field. The second phase transition arises from the failure of Mark Hansen's work to represent a techno-human experience *per se*. His theorization of new media is influenced, I will argue, by a projection of a subjective patriarchal view based on the transformation of female body and its functions to technological situations. The notion 'technology is female' does not allow a critique of technology *per se*. In all cases, Hansen's work presents a mind/body and subject/object polarization between virtual embodiment and the participant's embodiment. This directs the research to the final phase of the exploration of the immanent relation between the machine and the human. The primary allocation of the case study for the third phase is based on the hypothesis that the immanent techno-human relationship could be identified by its effects that persist as continuity or through the emergence of new productions. Alan Turing's relation with machines has reserved such a position that is still coexisting within the present and marching into the future.

0.5. The outline of the PhD phases

The phases are outlined as follows:

0.5.1. The first phase (chapter one)

This phase obtains the objective data. On the one hand, this data is necessary as a foundation for the transdisciplinary approach. On the other hand, the resistance to reducing the research to 'objective data' adds to the contradictory findings, which is what motivates the transdisciplinary view and establishes the need to go beyond the 'disciplinary bias'. It explores embodiment, understood as the embodied conversational agent (ECA), in HCI where it is considered a new paradigm and its effectiveness, known as the *persona effect*, is evaluated through comparative experiments. Although the interest in researching this effect has expanded in different fields and become the focus of new centres and institutions, which indicates multiple levels of Reality and a level of complexity due to the plurality of disciplines, contradictory findings are becoming more common in the field, raising questions about whether virtual embodiment is worthy or worthless. This research uses a quantitative meta-analysis for two purposes: first, to measure the effects of embodiment, and second, to find the reasons for contradictory results. Meta-analysis research at this stage has great potential, firstly, in being able to extract "the common elements, design, and process from existing disciplines and synthesize them into the foundation of the new transdiscipline" (Ertas et al. 2003, p.291). Secondly, it provides a thorough review that shows the boundaries of the discipline in solving certain problems

within its current duration of the study and the future directions of its effects. That is because it entails a process of thorough study retrieval, categorization and coding. As ECA research is driven by application studies, this meta-analysis focuses on 'embodied conversational pedagogical agents' (PAs), which are implemented in learning and training contexts, because: 1) it is one of the most mature fields for new implementations to explore; and 2) the number of studies enables the application of the methodology and the consistency of results. Studies from other fields and disciplines, which report similar measures, were included based on having similar experimental designs. The findings of the meta-analysis are surprising. First, similarly to a study conducted by Yee et al. (2007), the effect size is small, showing that there is no 'persona effect' (the embodied effect of ECA), on the participants' learning and subjective measures. Second, my research emphasizes the confusion between the image effect and embodied effect. That is, what has been tested in the interaction between the human and the computer is the interface image rather than embodiment. The contradictory findings are due to a lack of definition of virtual embodiment and embodied effects, that is, embodied perception and affection. Neither participants' embodiment nor embodied interaction has received any attention as almost all the learning measures are concerned with knowledge transfer and retention, and the subjective measures are based on questionnaires and abstract scales or statements. As we realize from a transdisciplinary perspective, this finding, ignoring the embodied participant in favour of objectivity, is not surprising. This redirects us to question the definition of embodiment and embodied effects.

0.5.2. The second phase (chapters two, three and four)

The second phase investigates 'embodiment' in the work of Mark Hansen in new media. Like the studies in HCI, Mark Hansen has identified embodiment as the new paradigm in new media theory and new media artwork. Hansen's research differs in fundamental ways from HCI as it follows a more philosophical and, presumably, phenomenological approach to media artwork. Yet, through debating and surveying contemporary theories ranging from biological (Varela's 'embodied mind'), metaphysical (Bergson) and media based (Deleuze), it highlights the phenomenological experience of embodied interaction between the human and the work, media and image, rather than the post-reflections observed in the HCI account. The work is characterized by arguments and debates with philosophers, theorists and artists – which is not observed in the first field and thus could be regarded as a resource, opening new potentials in understanding and conceptualizing embodiment. It becomes a requirement to research 'embodiment' in this new field of work, rather than applying the issues found in the previous phase, which will only bring us to the reductions we are trying to avoid (e.g. reducing the embodied effect to an image effect). Hansen's work introduces us to another account of embodiment and its transformation into technology. This is Gilles Deleuze's transformation of Henry Bergson's theory of embodiment in *Matter and Memory*, in his work on cinema leading to embodying cinema. In his book *New Philosophy for New Media* (2006), Hansen argues that Deleuze has disembodied the centre of indetermination (that is the human being) by locating embodied perception and

affection outside the body. I argue, on the other hand, that Deleuze's transformation and conceptualization of embodied cinema is very useful to understanding the relationship between human and machine embodiment and taking it beyond the purview of scientific applications. Chapter three follows this argument in relation to embodied perception. It concludes that Hansen misinterprets Bergson in regard to Francisco Varela's enactive approach and that the two approaches are irreconcilable in relation to the concept of 'representation'. Eventually, Hansen's misreading of Bergsonian perception also leads to what I call the 'King Midas effect'. This is because Hansen defines perception as the 'subtraction' of what interests the participant from the world rather than the 'subtraction' of what does not interest the participant. Reasonably, this reversion means that the participant loses interest in the world because he subtracts all that interests him in the first place.

Chapter four focuses on the embodied affectivity of Hansen's argument against Deleuze. Here, the argument is centred on three points: embodied affectivity, spectatorship, and temporality. The three accounts indicate that Hansen has departed from Bergson and Varela and misread Deleuze, in order to advocate a conscious-affective account, rather than affects as impersonal.

Both HCI and Hansen's account lead to mind/body polarizations. While the former focuses on the technology, the latter focuses on the participant. HCI evaluates ECA as a mental effect; Hansen's explains the interaction in relation to the body and physical response. In HCI the effect of virtual embodiment is interpreted in terms of its equality to human embodiment. For Hansen, the effect

is interpreted in terms of the participant's physical response to media. Deleuze's embodied cinema comes in-between as it focuses on the effect as a relation of becoming between the two embodiments. Besides the embodied techniques of the cinema and the physical response of the viewer, there is a virtual field in-between them, full of forces and potentials in which each of them participate. The next phase attempts to overcome the polarization and to pursue the relational aspect rather than interactional one between human and machine embodiments.

0.5.3. The third phase (chapters five and six)

This phase investigates 'embodiment' in Alan Turing's work on intelligent machines. This is considered as a historical account of emerging relations between human and machine, which has remained controversial in AI, HCI and other literature studies. As noted, the previous cases present a counter problem (object/subject, art/science, experimental data/philosophical debate, complexity of plurality/complexity of ambiguity) that needs to be overcome in order to place the media and the body at a trans-level. The analysis of Alan Turing's work on machinery provides us with a case different from these accounts, where complexity is more oriented towards multiple relationships between human and machines.

Chapter five investigates the material reality of the Turing Machine and the reasons for its abstraction. It repositions it from the abstract, nonexistent realm to the actual virtual one. It explores the affective relationship between Turing and machines that has led to the emergence of the Turing Machine and the

widely asked question of what was in Turing's mind. Complexity in explaining Turing's work is observed in relation to the multiple emergences of encounters – the 'imitation game', the 'Turing test', the 'child machine' or 'learning machine.'

Chapter six explores the relationship between Turing and the machine in relation to Simondon's work on individuation, human-machine counter-becoming and affective modality. Simondon's focus on understanding technical culture, the living being and the technical object's individuation as a process allows a different reading and analysis of Turing's work and the Turing machine.

0.6. Significance and contribution of the research

The thesis contributes to the transdisciplinary approach by rethinking transdisciplinarity at the level of the subject or researcher, where research is perceived as a process of individuation. As such, it is appropriate to think about or explore the width and depth of the human-machine embodied interaction problematic. It argues that one level of reality is not enough to solve the problem. The research brings to light the mutual dominant paradigms influencing different disciplines. For example, both HCI and Mark Hansen's accounts, consider embodiment as a new paradigm. Although Hansen's account (the second part of this thesis) is different from HCI, the mind/body polarization persists directly or indirectly in both of them as chapters one and two show. Moreover, Hansen's account reinforces the issues related to the abuse or misuse of interface female characters explored in HCI. That is, it can be considered as a form of theoretical abuse of technology.

Importantly, the thesis claims that the notion of embodying technology itself, does not seem to be restricted to a certain technology. Artificial Intelligence has focused on embodying machines or computers, but Gilles Deleuze equally philosophised cinema through the transformation of Henry Bergson's theory of human embodiment. It can be claimed that Deleuze introduces us to embodied cinema or cinema intelligence. The difference is in what this embodying of intelligent computer or intelligent cinema involves. The cinema for Deleuze is not embodied because it has 'characters' who are real but because, similar to the human body, it can relate to other bodies, perceive, affect, be affected, and act. Deleuze, thus, elaborates on the techniques through which the cinema, as an embodied body, that is like the human body but different from it, creates its own images. Deleuze's account presents us with a different way of perceiving technological embodiment and probably technological intelligence, and the difference this brings to the relationship between human embodiment and machine embodiment. Recursively, this means that ways other than human body modeling can be pursued in software development and artificial intelligence and these ways can be perceived as intelligent, due to the different effects and relations they establish. I believe that my engagement with the embodied cinema is a significant account I need to think about and take beyond the boundaries of this thesis, to rethink the design and evaluation of virtual embodiment in HCI beyond the modeling of the human body, image or situatedness as a body of relations.

Finally, this thesis brings to light the symptoms of antagonism of the current relationship between the human and machine, realized in the different accounts. That is HCI's determination to show machines' effectiveness in influencing people, Hansen's insistence on a crude patriarchal order by devaluing media, Simondon's warnings about believing in machine humanization and loss of affectivity, and Turing's dedifferentiation between human and machine and warnings of machine takeover. In other words, there is a crisis in the interpretation not only of our relation to the machine but of our relation to ourselves that needs us to rethink our own reality, affects, and perceptions. Disciplinarity and machine humanization seems to be part of this. Thus, the thesis advocates rethinking the aim of design not for design sake but in order to sustain the relationship between humans, and between them and the world. Here, affectivity could be seen as an immanent capacity of the relationship between human and machine. In this way, difference and communication between different realities form the basic requirement for the emergence of the new creativity and continuity.

0.6. Limitations of the research

The major aim of this thesis is to follow a transdisciplinary problem-based approach in researching embodiment; nevertheless it does not intend to provide a comprehensive theory or practical framework for researching embodiment. This is because a transdisciplinary approach requires a balance between the breadth and depth of the disciplines participating in the enquiry, which induces a source of limitation, particularly, in considering the scope of the (secondary)

literature survey. The approach emphasizes the on-going process of research rather than focusing on the outcomes. A complementary perspective to overcome these limitations is to broaden the research of embodiment into other fields.

1. Chapter One: Embodiment in Human–Computer Interaction (HCI) Research: A Comparative Meta-Analysis of Research on Embodied Pedagogical Agents (PAs)

1.1. Introduction: Embodied conversational pedagogical agents (PAs): Definition and background

Embodiment is considered the new paradigm in human–computer interaction (HCI) research, which has developed from interdisciplinary fields related to artificial intelligence (AI), graphical user interfaces (GUI) and social communication studies. Embodied conversational agents (ECA) are defined as animated life-like autonomous characters that are embedded in computerized environments and are designed to interact socially with the users. It is widely believed that embodying these in the interface of different applications, that is providing them with representational behaviours and appearance, has positive affective and cognitive effects as they increase users' motivation and interest in the application context, therefore resulting in better interaction. However, the narrative systemic reviews of the empirical studies in some fields have pointed out research shortcomings and indefinite findings. As HCI forms an integrative field of different applications that participate in knowledge development based on the generalizability of the findings, here I focus on education for two reasons. First, it is one of the major contemporary fields where embodiment in relation to machine representation has been explored extensively in relation to other fields

as part of their training and educational programs. Second, the design of computerized learning materials is related to my educational and practical expertise and so I can reflect on the findings from both theoretical and practical backgrounds before taking further steps in my research field. Embodiment, as an emerging paradigm in educational technologies, is included within the term of pedagogical agent (PA) (Johnson and Rickel 2000; Domagk and Niegemann 2005). The use of agents in education originates from intelligent tutoring system (ITS) models. Yet, their ability to act as separate social entities from the traditional ITS models has been seen as important advancement in learning technologies. While an ITS tends to model human tutors (Ohlsson 1986; Merrill et al. 1992; Frasson et al. 1996) and use text-based interfaces to communicate with the user while focusing on facilitating natural language dialogues, e.g. *PACT Geometry Tutor* (Alevan et al. 1999); *Cognitive Tutor* (Alevan and Koedinger 2002); *Ms. Lindquist* (Heffernan and Koedinger 2002); *CIRCSIM-Tutor* (Michael et al. 2003); and *DiaWoZ* (Fiedler et al. 2004). The use of PAs extended this simulation by simulating a human relationship (Selker 1994), and providing the awareness of social interaction, collaborative knowledge building (Mørch and Nævdal 2004) and social learning (Chou et al. 2002). Therefore, with their spread in interactive multimedia environments, more emphasis has been placed on the importance of their visual appearance in the interface. Research based on disembodied agents has already pointed out that, with a lack of graphical representation, the learners did not feel the agents' presence and the agents were seen as unbelievable (Chou et al. 2002; Rasseneur et al. 2002; Faraco et al. 2004). Furthermore, the persona effect, referring to the

positive effect of the agents' embodiment on increasing learners' interest and motivation, and on making the software agents more helpful and credible, has been supported by Lester and his colleagues (1997b).

1.2. Debatable issues in PA research findings

The embodiment of pedagogical agents has become the focus of much of the current research and systematic reviews have pointed out that findings of empirical evaluations have proved to be contradictory (Dehn and Van Mulken 2000; Clark and Choi 2005; Gulz 2005; Moreno and Flowerday 2006). Lester et al. (1997b) found that animated life-like pedagogical agents are capable of affecting a learner's perception of the learning experience, positively defining this as the persona effect. Similar findings were reported by Van Mulken (1998), Lester et al. (1999b; 2000), Mitrovic and Suraweera (2000), Moundridou and Virvou (2002), Darves and Oviatt (2004), and De Carolis et al. (2006). However, Dirkin et al. (2005) found that learners perceive a higher degree of social presence and positive learning experience at both ends of the sociability continuum (text only and social animated agent). But in the study conducted by Hubal and Day (2006), although the participants were not impressed with the overall realism of the character and only moderately liked it, they did better than the control group.

On the other hand, Clark and Choi (2005) point out that, when adequate design comparisons are made, the difference in learning might not be due to the agent's presence but to the instructional methods. This was proved by an

experiment conducted by Choi and Clark (2006) where the interface agent was replaced with an arrow to direct learners' attention to specific information. They found that the use of an agent did not increase learners' motivation and interest more than the other group. Better learning achievement was only obtained by learners with low background knowledge. Moreno et al. (2001) conducted five experiments to find out whether the use of agents and the agents' properties enhances learning and learning experience. In both experiments (1 and 2) there were no significant statistical effects of the agent on retention, understandability of the content or learning difficulty. Significant statistical effects of the agent were only constant on far transfer and interest measures. In experiments 4 and 5 there were no effects of the embodiment (image) of the agent on all the dependent variables. Apart from the first experiment, there was no effect of agency on motivation. Craig et al. (2002) also points out that there was no effect of agents' properties (static, with gesture, no-agent) on retention, matching, transfer or enjoyment. Van Mulken et al. (1998) found that there was no effect of persona on learning (recall and comprehension), although learners found the presentation of the technical material entertaining. Gilbert et al. (2005) attributed the success of the system (Adam) to adaptive instruction more than incorporation of the PA. On the other hand, Beun et al. (2003) found that there was a statistically significant result for the realistic agent. Furthermore, acting autonomously, the agents were able to focus learners' attention on the task and help them to develop deep explanations (Holmes 2007). Hubal and Day (2006) and Babu et al. (2007) found that the participants practising with virtual agents did better in their post-assessments.

Respectively, these contradictory findings make the effectiveness of the embodiment of a PA on learning a debatable issue and do not finalize the arguments in the field. Thus, this debate mandates a sound research methodology that thoroughly examines these studies, cumulates their results and comes out with applicable conclusions. This research investigates the effect of PAs on learning by applying a meta-analysis methodology to integrate, compare and synthesize the conflicting findings. This chapter intends to reopen this debate in order answer the following two research questions:

- 1) What is the effect size of embodied agents on learning?
- 2) What are reasons for the obtained contradictory results?

1.3. PA development

The growing interest in the field and its expansion led to the formation of centres that focus their research on the effects of implementing agents on learning, which indicates a potentiality towards a transdisciplinary perspective. For example the IntelliMedia Center for Intelligent Systems at North Carolina State University uses education as the application field for its research on intelligent human–computer interaction and communication. Another initiative is the ‘Social Intelligence Project’ developed in the multidisciplinary Center for Advanced Research and Technology (CART) at the University of Southern California. A critical expansion in the field was the formation of research groups. The Pedagogical Agents and Learning Systems (PALS) research group in the Center for Research of Innovative Technologies for Learning (RITL) was

founded in 2004 by Dr Amy L. Baylor at Florida State University. Another voluntary international research group is the IEEE Virtual Instructor Pilot Research Group (VIPRG) founded by Dr Jayfus Tucker Doswell in 2005 and sponsored by the IEEE Computer Society Technical Committee on Learning Technology. While developing, the field started to draw on diverse disciplines and theoretical perspectives. Embodiment moved the agents from being a particularity of computing disciplines to social sciences. On one hand, studies were not only restricted to assess the effectiveness of the embodied agents on promoting deep learning but also entailed various educational and training contexts. Contextualization within these different frameworks increased the need for enhanced believability in the agent's embodiment and behaviour. On the other hand, this required transmitting the different research methods across the involved disciplines to effectively implement and evaluate the PA. In the following section, some of the core disciplines of the research will be discussed.

1.4. Applications in educational settings

The embodiment of the agent became a salient feature of the interface as it made the interaction between the learner and the software more visible. Commonly, the agents are classified as tutors or tools (Baylor 1999; Chou et al. 2003; Payr 2003; Sklar and Richards 2006) and consequently their embodiment within the learning environment functions as a visual support of feedback provision to guide learners' attention to important aspects of the content and to help them construct their knowledge while interacting with the learning material, e.g. *PPP persona* (André 1996; André et al. 1998), *Herman the bug* (Lester

(1996; 1997a; 1997b; 1997; 1999a; 1999b) and *Human Presenter* (Noma et al. 2000). The importance of the contextualized embodiment was recognized as a clue that associates the schema base with the content domain (Wonisch and Cooper 2002) and therefore establishes a direct visual link to the topic. For example, in medical learning environments the embodiment was represented by an agent (*Adele*) wearing medical clothes (Johnson et al. 2003) and in another environment about the 'recognition of heart attack symptoms', the agent (*Bea*) took the shape of a heart (Silverman et al. 2001).

A further development took place when embodiment became a tool. In this context, either the learners manipulate the agents or their characteristics to observe the results of their actions on the virtual world. Alternatively, the agents are used to encourage learners to practise some learning skills. As a tool, PAs were exploited to facilitate learning some of the difficult subjects, and modify learners' attitudes towards them, such as programming (*Kidsim*, Smith et al. (1994); *ToonKalk*, Kahn (1996); *Alice*, Cooper et al. (2003); Moskal et al. (2004), improve learners' skills (e.g. writing and narration, *StoryStation*, Robertson and Good (2003); *Ghostwriter*, Robertson (2004); *Teatrix*, Machado et al. (2000); Paiva et al. (2001); *Puppet*, Marshall (2002) and encourage their conversational queries (e.g. *I SEE*, Darves and Oviatt (2004). Furthermore, a critical application of embodied agents is their use for therapeutic purposes in special education such as autism (*Baldi*, Bosseler and Massaro (2003); Barker (2003) and cognitive impairments (*TAPA*, Mohamad et al.(2002); Mohamad (2004).

Anthropomorphic agents enabled studies on cultural and social education dimensions, for example the VICTEC (Virtual ICT with Empathic Characters) project (Woods et al. 2003; Hall 2004; Aylett 2005; Paiva et al. 2005; Woods et al. 2007), which was based on the bullying phenomena in schools in Britain, Portugal and Germany, and the interactive pedagogical drama (*Carmen's Bright IDEAS*, Marsella et al. (2002; 2003), which focused on the social problems of the mothers of paediatric cancer patients. More recently, studies from social and cultural psychology perspectives exploring social models, gender, similarity attraction and appearance have been conducted (Baylor and Kim 2004; Baylor 2006; Moreno and Flowerday 2006; Kim et al. 2007).

1.4.1. Computing and design

Developing PA applications has been one of the interests of computing, design and artificial intelligence disciplines that focus on software architecture in order to synthesize the human metaphor by modelling the human agent (Hopkins and Fishwick 2001). Natural-looking animations were constructed using either computational models or psychological models. Chi et al. (2000), for example, developed their EMOTE computational model for generating natural gestures based on Laban Movement Analysis by specifying the parameters of effort, which refers to the information about how the body should act, and shape, which describes the changing forms the body makes in space. Hartmann et al. (2005), on the other hand, based their design of expressive embodied conversational agents on a set of characteristics drawn from social psychology. Unlike Chi et al. (2000), their approach was focused on defining expressivity as

perceived by the users. Moreover, more complicated areas such as personality and culture (Poggi et al. 2005), emotions (Rehm and André 2005a; Ben Ammar et al. 2006; Martin et al. 2006) and politeness (Rehm and André 2005b) were emphasized. Likewise, affective computing tended to predict learners' goals and modify the characters' interaction based on them, e.g. *The Treasure Hunt* (McQuiggan et al. 2006) and *Casey* (Burleson 2006). Using detecting techniques to recognize learner effects, such as skin sensors and eye-tracking (Wang et al. 2007), provides more accurate methods to support the conventional measurement tools, such as questionnaires, although as a learner subjective measure, the latter's effectiveness has been questionable (Bailenson JN 2004).

1.4.2. Multimedia learning

The multimedia learning (Mayer 2005) perspective on the effectiveness of embodied conversational agents is a leading one in the field. The majority of these studies (Moreno et al. 2001; Atkinson 2002; Craig et al. 2002; Mayer et al. 2003; Craig et al. 2004) and their replications viewed the agent as a media element, an image, in the interface and subjected it to investigations related to the cognitive-load theory design principles. These included: the interactivity principle – providing learners with control over the material rather than continuous presentation; the modality effect – the use of a voice with animation rather than text with animation to reduce the cognitive load; the image effect – the use of images unrelated to the content could be a seductive detail (Harp and Mayer 1998) which could result in split-attention effect (Chandler and

Sweller 1991); the personal agent effect – the provision of personalized feedback through agents promotes constructive learning (Moreno et al. 2000); and the embodied agent effect – the provision of non-personalized monologue from agents affects the interaction (Atkinson 2002). Foremost, multimedia learning studies were concentrated on problem-solving and cognitive psychological measures, namely transfer and retention for assessing learning, which emphasized learning as a product rather than a process.

1.4.3. Communication

Communication studies have also enriched the research of pedagogical agents. Studies of animated faces (Waters 1987; Laurel et al. 1990; Sproull et al. 1996; Burgoon 2000) and verbal and non-verbal communication (Cassell et al. 2000; Cassell et al. 2001) have motivated the implementation of talking heads and deictic agents in learning (Lester et al. 1999b; Link et al. 2001; Biswas et al. 2005; Graesser et al. 2005; Nakanishi et al. 2005). Similarly, increased attention was directed towards affective feedback (Okonkwo and Vassileva 2001; Wang et al. 2006). Other studies focusing on accelerating the “symbiotic partnership” (Licklider 1960) between the users and computers share similar ground with the social perspective of learning that tends to increase the partnership between the learner and computer as peer learners (Ryokai et al. 2003) and partners (Hietala and Niemirepo 1998; Holmes 2007). Previous research findings that people apply social rules to computers and treat them as other humans, emphasizing their role as social actors (Nass et al. 1995; Reeves and Nass 1998; Nass and Moon 2000), supported the emergent social roles of agents

which are referred to as “non-pedagogical roles” (Payr 2003) or “less pronouncedly pedagogical” (Gulz and Haake 2006) learning companions (Goodman et al. 1998; Kehoe et al. 2004) and co-learners (Ju et al. 2005). These studies were interested in developing the social bonds between the computer and the learner, and directed the attention on the effectiveness of the social presence and learning process rather than learning outcome.

1.5. Research method

Due to the psychological experimental method that is generally used in HCI and specifically in interface agent research, a comparative meta-analysis was conducted to determine the effectiveness of PAs.¹² Meta-analysis is a statistical procedure to integrate and synthesize results from individual studies (Wolf 1986, p.5; Hunter and Schmidt 1990). It is attributed to Gene Glass (1976), who referred to it as “the analysis of analyses” (1976, p.3). Academically it has become an “accepted practice of evaluating the current flood of conflicting scientific evidence” (Stanley 2001) and is considered “the highest level of analysis” (Papadopoulos and Gkiaouris 2007). This research followed the process defined by (Rosenthal and DiMatteo 2001), who describe meta-analysis as a process “for systematically examining a body of research, carefully formulating hypotheses, conducting an exhaustive search and establishing inclusion/exclusion criteria for articles, recording and statistically synthesizing and combining data and effect sizes from these studies, searching for moderator and mediator variables to explain effects of interest, and reporting results” (2001, p.62). First, an exhaustive search, retrieval and coding of studies

concerning PAs were conducted. Then inclusion/exclusion criteria were established. The characteristics of and effect sizes from the studies were recorded and statistically synthesized and analysed. Finally, effects were explained in relation to moderator variables. The following section describes the procedure (for keywords see appendix 1:a).

1.5.1. Studies retrieval

An electronic search was conducted from May 2007 to July 2007¹³ to identify and retrieve published and unpublished studies in the field of pedagogical agents written in or translated into English and conducted in the 1990s from different disciplines. Five strategies were used in the retrieval process. First, Google and Google Scholar were searched with the following keywords: 'agents', 'life-like agents', 'pedagogical agents' and 'learning companions'. The results of these searches allowed us to locate databases, institutions and author's homepages. Each time a relevant document was identified, the entire database it was located in was searched. This procedure implied a comprehensive search of SpringerLink, EBSCOHost, ScienceDirect, Illumina, ProQuest, Blackwell Publishing, Thomson Gale Databases, ACM Digital Library and IEEE Library. The references sections of the retrieved articles were checked. Finally, 46 researchers were emailed and requested to send or locate other published and unpublished studies, and contacts of other researchers they knew of in the area. Finally, a librarian was asked for to locate unpublished reports and theses.

1.5.2. Studies coding

A numerical coding scheme for systematic recording of study characteristics was formed to analyse the information. Each study was used as the unit of analysis. Studies from the same paper were differentiated by adding a letter to the authors' names (e.g. Atkinson-a). Raw information from retrieved studies was coded into an ACCESS database. This information was used to induce data categories and scales for each coded variable. The statistical package SPSS v.16 for Windows was used to analyse descriptive information. Comprehensive Meta-Analysis Software v.2 was used to perform the meta-analysis. Each study was coded for: 1) study demographics (first author, type of paper, year, type of publication, country); 2) participants' demographics (sample size, gender, average age, standard deviation, course of study, selection, educational level or occupation, level of domain knowledge, ethnicity, institution); 3) learning context (learning environment, content, intentionality of learning, objectives, time in minutes of interaction, evaluation, double-blind scoring, methods of collecting data, learning measures, test forms); 4) experiment setting (design type, conditions, assignment, consent form, experimenter presence and role, duration); and 5) agents' demographics (degree of realism, degree of embodiment, gender, degree of animation, communication style, name).

1.5.3. Inclusion criteria

The following inclusion criteria were applied:

- (a) The papers reported on an experiment comparing some form of embodied agent implementation to a control condition (no agent).
- (b) The study included measures of learning outcomes.
- (c) The study reported enough statistical information to compute the effect size, such as means and standard deviations, p-values, t-statistics and F-statistics, or statements of insignificance.

1.5.4. Analysis procedure

A hierarchal type of analysis (figure 2.) was performed on two levels: the study and the condition. These are explained below. Studies' characteristics were also analysed following the guidelines provided by Lipsey and Wilson (2001) to explore the heterogeneity and validity of studies.

The following procedures were applied in calculating the effect sizes:

- Two *independent groups*, control group and treatment group, and one *dependent variable* (learning measure) were within each study. The control group refers to non-agent based systems while the treatment group refers to agent based systems. This general approach was adapted to answer the general question of whether the embodied agents are effective on learning.
- Studies with multiple *independent groups* (e.g. control group and/or treatment group) with uneven sample sizes were pooled together by calculating the weighted mean and the pooled standard deviation for each condition. Although the results might not be interpretable in relation

to certain characteristics at this stage, this enables us to present the overall picture before moving to narrower questions (Rosenthal and DiMatteo 2001; Hunter and Schmidt 2004, p.456) (for equations *a* and *b* see appendix 1:b).

- Descriptive statistics, raw means and standard deviations of each *dependent* measure were entered separately and then aggregated together. Other statistics were used when applicable.
- Effect sizes were calculated from scores as this is the dominant scale for measuring learning achievement. The majority of studies used post-testing as an evaluation instrument and therefore it became the main source for computing effect sizes. Separate analyses were conducted focusing on transfer and retention because they were frequently measured.
- Results from the random effect model that estimates the mean effect size of the population were presented. This is because the studies included were not subjected to homogeneity inclusion criteria. The random model permits exploration of discrepancies in the quality and characteristics of the studies, and allows generalization of the results (Raudenbush 1994, p.307). On the other hand, the fixed model is used when the number of studies in comparisons is small, i.e. two or three, because of the imprecise estimation of the variance based on small number of studies (Hunter and Schmidt 2004).
- Different tests of heterogeneity (Cochran's Q-value, I-squared and tau-squared) were examined. Cochran's Q-value is a statistical test that is

used to assess the heterogeneity among a group of studies. If the Q-value exceeds the degree of freedom (df) of the studies, the test of heterogeneity is significant ($p < 0.05$), indicating variation among studies. This implies that, if the Q-value is equal or less than the df, the test of heterogeneity is insignificant ($p > 0.05$), indicating homogeneity. The I-squared statistic represents the percentage of the total variation between the studies. It has a scale of 0 to 100. The values of 25%, 50% and 75% might be considered as low, moderate and high heterogeneity. The tau-squared test is used to compute the between-studies variation.

- A residual analysis was conducted to identify outliers. A residual analysis represents the distance between each study and the mean effect size. It computes a z-score for each study. A z-score greater than 1.95 or 2.55 is considered an outlier. Whenever outliers or sources of heterogeneity were identified, the data was double checked or/and heterogeneity sources were explained in relation to the provided set of studies. The studies were weighted following the procedure explained by (Borenstein et al. 2009).
- Hedges's g effect sizes for pair-wise comparisons based on a bias-corrected standardized mean difference were used in reporting the effect size. This index was chosen in preference to the commonly reported Cohen's d in the primary studies because of the small sample sizes. Likewise, although both are interpreted in the same way, Hedges's g is inferential and is adjusted for sample size. The common convention was used to refer to the effect sizes (small ≤ 0.20 , medium = 0.50 and large

≥ 0.80). Confidence intervals (95%) were used to reflect the precision of effect sizes.

- *Chronological cumulative analysis* was performed to explore the *sufficiency*. Sufficiency examines the need for additional studies to establish the effectiveness of pedagogical agents on learning. Stability looks at the possibility of additional studies changing the aggregated effect size.
- 'Fail-safe N' analysis was used to assess the publication bias. It computes the number of the insignificant studies that could nullify the effect. The 'trim and fill' (Duval and Tweedie 2000) method, based on random and fixed effect models, was also conducted. It locates and fills the missing studies on the right and left of the funnel plot. The method was based on the standard error and Hedges's g .

1.6. Results

1.6.1. Descriptive results

The following section will report on the results of the descriptive analysis of study characteristics, the meta-analysis and the supplementary analyses.

1.6.1.1. Publication characteristics

Overall, a total of 351 related papers were retrieved, of which 23 papers included comparisons focusing on the effectiveness of embodied agents on learning. These included 27 usable studies for this analysis. The studies were

published by 21 authors belonging to different disciplines, namely psychology and educational psychology (33%), education and educational technology (26%), computing (19%), interdisciplinary and others (e.g. informatics and system engineering) (19%) and communication sciences (4%). Of the studies analysed, 4% were conducted before 2001. A sharp increase took place afterwards as the cumulative percentage rose to 22% in 2001 and 52% in 2003, which reveals a growing interest in the topic. A total of 82% of the studies were journal articles and 19% were conference papers, indicating that they are of high quality and reliability. This is because these publishing organizations apply evaluation and selection criteria by peer-reviewing the submitted papers (for list of included papers see appendix 1:c).

1.6.1.2. Participants' characteristics

The sample sizes ranged from 18 to 228 participants per study with a total of 1852 participants (mean 71.81, standard deviation 47.657). A total of 70% of the learners were enrolled from US institutions, 19% from Europe, 7% from Australia and New Zealand, and 4% from Canada. This indicates that the population of the studies is dominated by one source of population, which could have some implications for external threads of validity that affect the geographical generalizability of findings. Only 48% of the experiments reported the gender of the participants, 33% reported the average age, and 15% included the standard deviation of the age group. The experiments reporting gender proportion revealed more female participants (60%) than male participants (40%).

The majority of the participants were from the university populations (74%), whereas only 19% were school students and 7% were students in different types of learning institutions (mean 1.85, SD 1.68). A total of 70% of the learners from the university population were undergraduate and college students drawn from psychology and educational psychology courses (30%), education and educational technology (15%), computing majors (15%) and other courses (e.g. medicine, humanities and language) (11%). Some 11% of school students were drawn from middle school and 7% were from elementary school. Another 11% of studies did not provide clear information about participants' educational level and/or courses.

About 67% of the studies provided information about the methods of recruiting participants. Commonly, participants were recruited based on their availability in courses (26%), in return for course credits (22%) and by volunteering (19%). Methods of recruiting participants were not clear in 33% of studies.

1.6.1.3. Research design and experiment settings

All of the studies employed a 'between-subjects' design. Most of the studies assigned participants randomly to the experimental conditions (82%) while the other studies did not clarify the type of assignment (19%). Mostly, the studies did not report the duration of the experiments clearly (63%). Some 37% of studies reported the experiment's time frame. Whereas 22% of the experiments were conducted in a single session ranging from 40 to 120 minutes, some 15%

of the experiments followed a longitudinal design involving two sessions that were a week or two apart.

1.6.1.4. Independent variables

Eleven instances were defined, six of which represented the control condition including no and disembodied agents and five were treatment conditions with PAs. A total of twelve studies contrasted the two conditions whereas the other studies contrasted multiple conditions that ranged from three to nine. The disembodied system could take an interface with *Text* only, *Voice* only or *Text and voice*. Moreover, the control groups could take the form of; *Paper-based material*, *Human as a partner* and *Basic program* (e.g. lacked features such as explanations, hints or multimedia elements). The treatment groups could take the form of the following agent's characteristics: *agent with text*, *agent with voice*, *agent with voice and text*, or *two agents*.

1.6.1.5. Agents' characteristics

Further, the characteristics of the embodiment varied between studies in relation to: (a) the appearance of the agent (anthropomorphism, level of embodiment, gender, realism); (b) level of animation; (c) provision of names; (d) modality type; and (e) the role of the agent.

- a. In relation to the appearance of the agent, human-like agents (56%), full embodied agents (67%) and male agents (59%) were more common than other types of agent. Non-human and a combination of two agents

(human and non-human) represented 33% and 11% respectively. Partially or talking-head embodied agents and two agents with different levels of embodiment formed 30% and 4% respectively. Female and neutral agents accounted for 15% each and others contained a combination of the two genders or were neutral (11%). Two levels of realism were investigated. High realism, which included human or animals that had a detailed visual representation, and low realism, which referred to cartoon or less-detailed representations. Pedagogical agents with low levels of realism (70%) were used more in learning environments than those with a high level of realism (22%) or a combination of different degrees of realism (7%).

- b. Equally, fully animated agents (63%) were more frequent than gesturing, facially animated characters (33%), or others (4%).
- c. Named agents (48%) were more common than unnamed (41%). Some 11% of studies did not clarify whether the naming of the agents was used in the provided material (e.g. Microsoft Agents).
- d. Likewise, modality analysis showed that agents with voices were more frequently used in learning environments (48%) than agents using text only (19%), or voice and text (15%). Some studies manipulated the modality of the agent (19%). Out of the 63% of the studies using a voice (independently or with text), 19% of the voices used were human voices and 41% were synthesized voices. Some 22% of studies did not clarify the type of the voice used.

- e. Tutoring agents such as those designed to provide feedback and focus learners' attention on information were more commonly used than training agents that focus on skills development (82% and 7% respectively), companion agents (4%) or agents acting in other roles such as communication (7%).

1.6.1.6. Learning context

a. Environment: About 59% of the computer-based learning materials were interactive multimedia programs and webpages, with different levels of interactivity. Some 22% were presentations and programs with low interactivity, while virtual reality and mixed modes – two or more types of material – represented 7% each and educational games formed 4%.

b. Content: Some 63% of the content of the learning environments was scientific, which included computing topics, mathematics (15% each) and general science (33%). Humanities topics such as arts, education, language and literacy, artwork and history accounted for 26% of the studies. Other topics such as social activities accounted for 11%.

c. Timing: About 59% of the studies included the amount of time set for the interaction with the learning material, which ranged from 180 seconds up to 40 minutes. This differed from one study to the other and ranged from 10 to 20 minutes (15%), 21 to 30 minutes (11%) and 31 to 40 minutes (7%). In some cases the time of learning was treated as a dependent variable (11%). Other time allocations, such as uncontrolled time of interaction, accounted for 15%.

About 41% of the studies did not report the interaction time. A number of studies stated that the time was set as free so the learners could work at their own pace.

d. Objectives and outcomes: The studies mentioned insufficient information about the learning objectives and outcomes to learners or the relation of these to their courses of study. Two types of indicator were used to infer learners' awareness of the objectives and outcomes from 56% of the studies. The first one was that the learners were informed of the objectives and outcomes at minimum that they will be tested or answer questions on their learning after interacting with the learning material (44%), and the second one was that they were provided with pre-training on the topic or the program (11%). The learning objectives and outcomes were not clear in 44% of the studies. Another analysis inferred the relationship between the source of the participants and the content. Approximately 52% of the content was inferred to be related to learners' courses or levels of study and about 26% was unrelated content. The relationship between the content and the learners' courses was not clear in 22% of the studies.

e. Domain knowledge: About 37% reported that participants' knowledge of the domain was low, 19% were inferred to have mixed levels of knowledge and 4% had completed a course related to the topic. Information about learners' backgrounds was not clear in about 41% of the studies.

f. Learning assessment: Learning was usually tested after the intervention through post-tests (63%). Some studies utilized pre-test/post-test methods (26%). The other studies focused on continuous measurement of learning and learning process before and/or during and/or after intervention (7%). About 4% of studies did not provide a clear description of measurement intervention.

1.6.1.7. Measures

Studies usually used more than one learning measure. Transfer and retention were frequently used. Transfer was reported in 44% of the studies while retention was reported in 37% of the studies. Behaviour coding, where learners' behaviour was video recorded and coded, was measured in 7% of the studies. Performance or learning gain, which was used to address the questions that were based on the objectives of the learning topic, was measured in 41% of the studies.

1.6.1.8. Tasks and data collection

Most of the tasks were problem-solving (30%), multiple-choice (26%) and short questions (15%). Writing tasks represented 11% and other combinations or types of question formed about 19%. Data was usually collected through 'paper and pencil' testing (48%). Some 19% of data was collected through the computer, 7% was based on video recording, and 11% was collected through multiple methods. About 15% of studies did not report the methods of collecting the data.

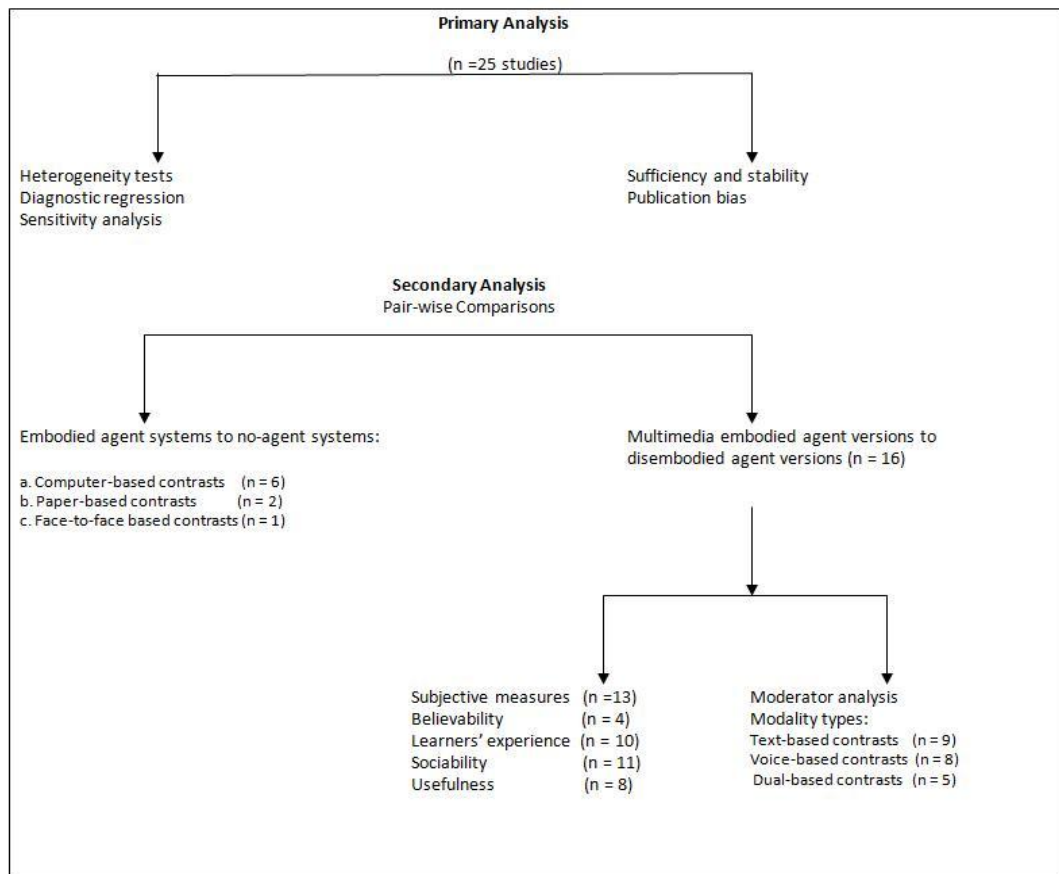


Figure 2 Study analysis structure

1.6.2. Meta-analysis results

1.6.2.1. What is the effect of embodied agents on learning?

A combined effect size for 25 studies, with total participants of 1766 (786 control group, 980 agent group), evaluating the effectiveness of the embodiment of pedagogical agents on learning outcomes through comparing learning measures of intervention with embodied agents to no-agent or disembodied agent systems resulted in a small random mean effect size of 0.272 with a 95% confidence interval (CL: 0.134 – 0.410). A two-tailed test of the null hypothesis was statistically significant ($p = 0.000$, $z = 3.861$) (figure 3). This means that the

embodiment of the agent accounted for only 2% of the variance which is, according to the binomial effect size display (BESD) (Rosenthal 1991, p.134), associated with an increase in improvement rate from 43% to 57%.

The forest plot provides the visual representation of the data. The forest plot in figure 3 shows that each study is represented by a point estimate and its 95% confidence interval within a scale range of -2.00 to +2.00. The symbol of the estimated point indicates the proportional weight provided to each study, and the width of the confidence intervals points out the effect size's precision. The anchor line (0.00) represents no effect ($p > 0.05$). Whenever the confidence intervals include the anchor line (0.00), the p-value is statistically insignificant.

Studies with larger sample sizes are represented with larger symbols and narrower confidence intervals. For example, Xu (2006) is weighted more than the other studies. It has the largest sample size (228) and therefore it is represented by a larger symbol than the others. Likewise, it has narrow 95% confidence intervals (0.176 – 0.700), which means that its effect size is more precise than the other studies. The confidence intervals did not include the 0.00 value and therefore the study is statistically significant ($p = 0.001$). On the other hand, Conati (2004) is weighted less than the other studies. It has the smallest sample size (16) and its 95% confidence intervals (-0.313 – 1.608) include the 0.00 value, which means that it is statistically insignificant ($p = 0.186$). Figure 2. shows that only 6 studies out of the 25 analysed reached the statistical significance ($p < 0.05$).

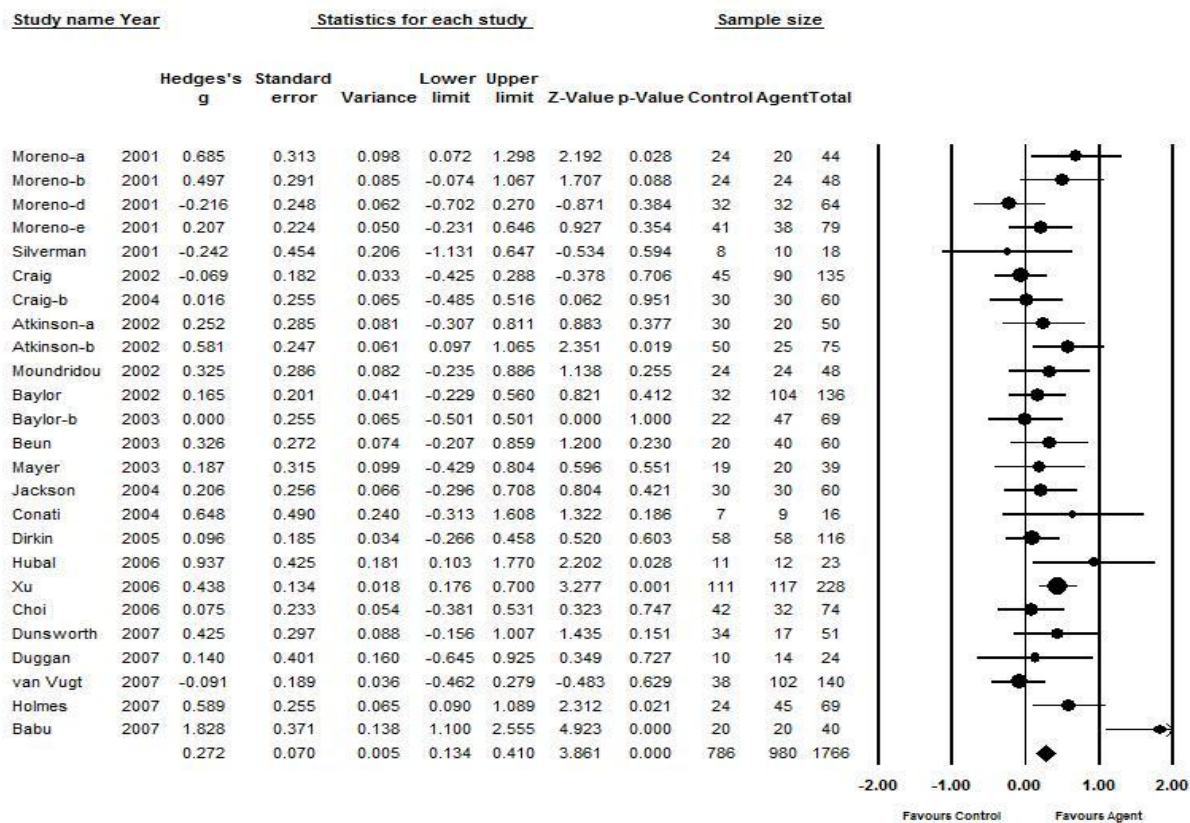


Figure 3 Forest plot of meta-analysis of PA (25 studies)

1.6.2.2. What are reasons for the obtained contradictory results?

1.6.2.2.1. Evidence of heterogeneity

The heterogeneity tests were statistically significant (Cochran's Q-value = 44.474, df. =24, p = 0.007), suggesting variation in effect sizes across the studies. I-squared indicated that there was a relatively medium proportion of variation (46%) between the effect sizes which ranged from negative to large (-0.242 to 1.828). This difference could be attributed not only to the within studies variation or the random error proposed by the fixed model but also to a significant discrepancy between studies as indicated by tau-squared = 0.053.

Therefore, a *residual analysis* and *sensitivity analysis* were conducted to identify the source of variation between effect sizes.

1.6.2.2.2. Residual analysis

Figure 4 shows the standardized residual bar graph and the p-value of the *residual analysis*. The analysis identified the study of Babu (2007: 1.828) as an outlier with a standardized residual of 3.61 ($p = 0.00$). Interestingly, however, double checking these studies showed that effect sizes are influenced by the type of comparison used. Two types of comparison could be realized, *adequate comparisons* and *inadequate comparisons*.

- 1) *Adequate comparisons* were defined as both the control and treatment groups having similar versions of the learning material with manipulation of the agent's embodiment only. These are the studies in the upper part of the bar (16 studies). The effect sizes ranged from negative to small effect sizes.
- 2) *Inadequate comparisons* were defined as manipulating other features of the control group's version than the agent's embodiment or using different learning material. These studies were in the lower part of the bar. The effect sizes ranged from medium to large. The characteristics of the studies showed that effect sizes were influenced by excluding hints, explanations and personalized comments (Atkinson-a 2002: 0.252; Conati 2004: 0.648), or allowing less interaction and personalization (Moreno-a 2001: 0.685; Moreno-b 2001: 0.497; Xu 2006: 0.438) in the

computerized version of the control group. Larger effect sizes were obtained for studies using paper-based material for the control group (Hubal 2006: 0.937; Babu 2007: 1.828). The large effect size in the study of Babu (2007) was due to learners practising a physical performance with the agent whereas they practised an interview with a conversational agent in the study of Hubal (2006).

In conclusion, the contradictory findings of the research in PA were obtained by biasing the results through inadequate comparisons.

Study name	Year	Statistics for each study		Residual (Random)		
		Hedges's g	p-Value	Std Residual		P-Val
Moreno-d	2001	-0.216	0.384	-1.48		0.14
van Vugt	2007	-0.091	0.629	-1.26		0.21
Craig	2002	-0.069	0.706	-1.20		0.23
Silverman	2001	-0.242	0.594	-1.02		0.31
Baylor-b	2003	0.000	1.000	-0.81		0.42
Craig-b	2004	0.016	0.951	-0.76		0.45
Choi	2006	0.075	0.747	-0.62		0.54
Dirkin	2005	0.096	0.603	-0.61		0.54
Baylor	2002	0.165	0.412	-0.36		0.72
Duggan	2007	0.140	0.727	-0.29		0.77
Mayer	2003	0.187	0.551	-0.22		0.83
Moreno-e	2001	0.207	0.354	-0.21		0.84
Jackson	2004	0.206	0.421	-0.20		0.84
Atkinson-a	2002	0.252	0.377	-0.06		0.96
Moundridou	2002	0.325	0.255	0.15		0.88
Beun	2003	0.326	0.230	0.16		0.88
Dunsworth	2007	0.425	0.151	0.42		0.68
Moreno-b	2001	0.497	0.088	0.62		0.54
Xu	2006	0.438	0.001	0.65		0.52
Conati	2004	0.648	0.186	0.70		0.48
Atkinson-b	2002	0.581	0.019	0.94		0.35
Holmes	2007	0.589	0.021	0.94		0.35
Moreno-a	2001	0.685	0.028	1.08		0.28
Hubal	2006	0.937	0.028	1.39		0.16
Babu	2007	1.828	0.000	3.61		0.00
		0.272	0.000			

Figure 4 Residual analysis

1.6. 2.3. Embodied agent and disembodied agent contrasts

Figure 5 shows the *adequate comparisons* from the 16 studies. The mean effect size is trivial (0.098, 95% CL: -.021 - 0.216). Both the tests of null hypothesis

and heterogeneity tests were statistically insignificant ($p = 0.106$, $z = 1.618$; $Q = 10.667$, $df. = 15$, $p = 0.776$). The variance between effect sizes and studies was zero. This indicates that, within these contexts, the embodiment of the agent was not effective.

Using transfer as a learning measure resulted in a small effect size (0.227, 95% CL: 0.008 – 0.053) for 8 studies (Moreno-d 2001: -0.067; Atkinson-a 2002: -0.050; Craig 2002: 0.162; Mayer 2003: 0.187; Moreno-e 2001: 0.310; Moundridou 2002: 0.325; Dunsworth 2007: 0.353; Atkinson-b 2002: 0.581) with statistically significant tests of the null hypothesis ($p = 0.010$, $z = 2.562$) and statistically insignificant tests of heterogeneity ($Q = 4.842$, $df = 7$, $p = 0.679$). On the other hand, using retention as a learning measure resulted in a trivial effect size of 0.073 (95% CL: -0.158 – 0.304) for 7 studies (Moreno-d 2001: -0.366; Craig 2002: -0.097; Van Vugt 2007: -0.091; Dirkin 2005: 0.096; Moreno-e 2001: 0.104; Beun 2003: 0.326; Dunsworth 2007: 0.834). Both tests of the null hypothesis and heterogeneity tests were statistically insignificant ($p = 0.534$, $z = -0.622$; $Q = 11.805$, $df = 6$, $p = 0.066$).

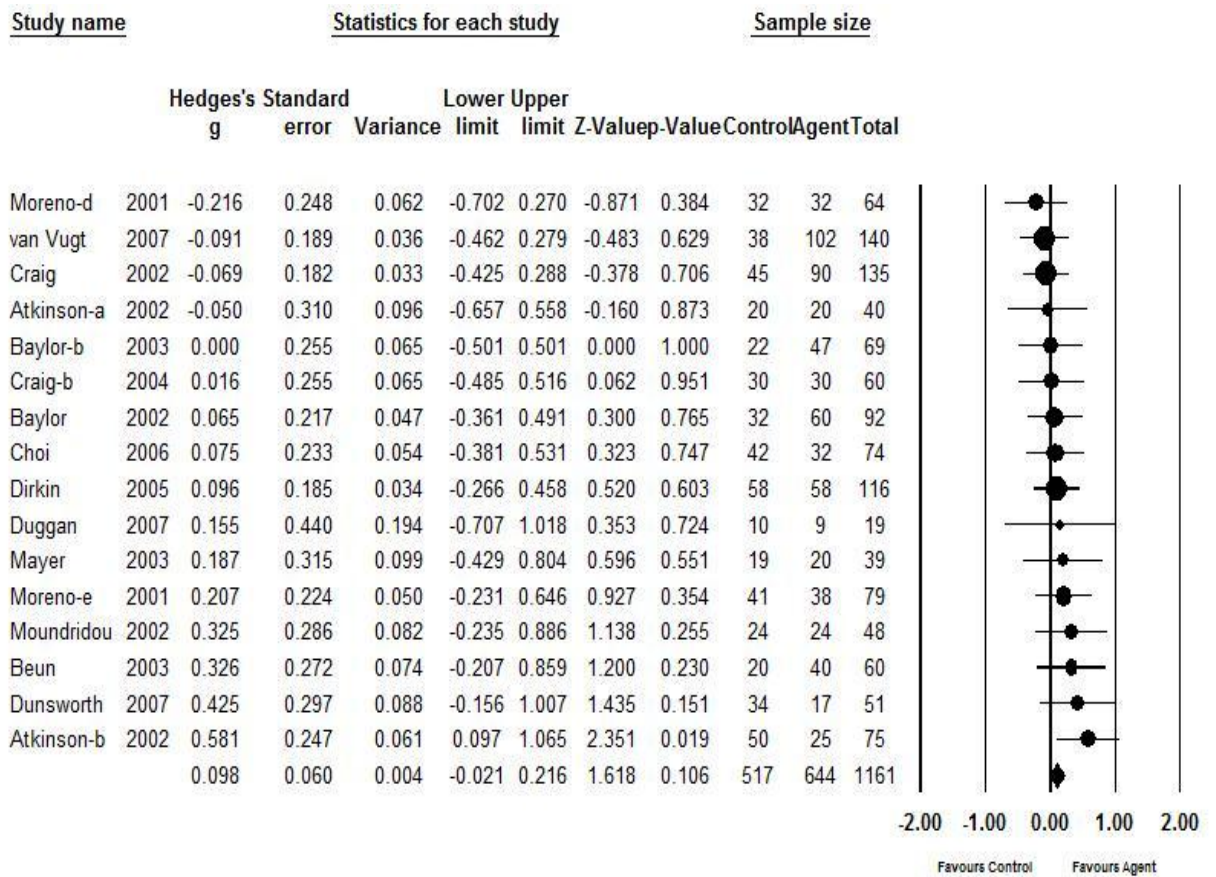


Figure 5 Forest plot of embodied versus disembodied agents (16 studies)

1.6.2.3.1. Modality analysis

The hierarchal breakdown provided three major types of interface comparison based on modality type: *Text* (9), *Voice* (9) or *Text and voice* (5).

a. Text interface versus agent interface

Effect sizes for conditions comparing disembodied agents communicating through text to embodied agents were examined. A total of 9 comparisons resulted in a small mean effect size of 0.264 (95% CL: 0.054 - 0.473) with

statistically significant tests of the null hypothesis ($p = 0.014$ and $z = 2.465$) (Figure 6.).

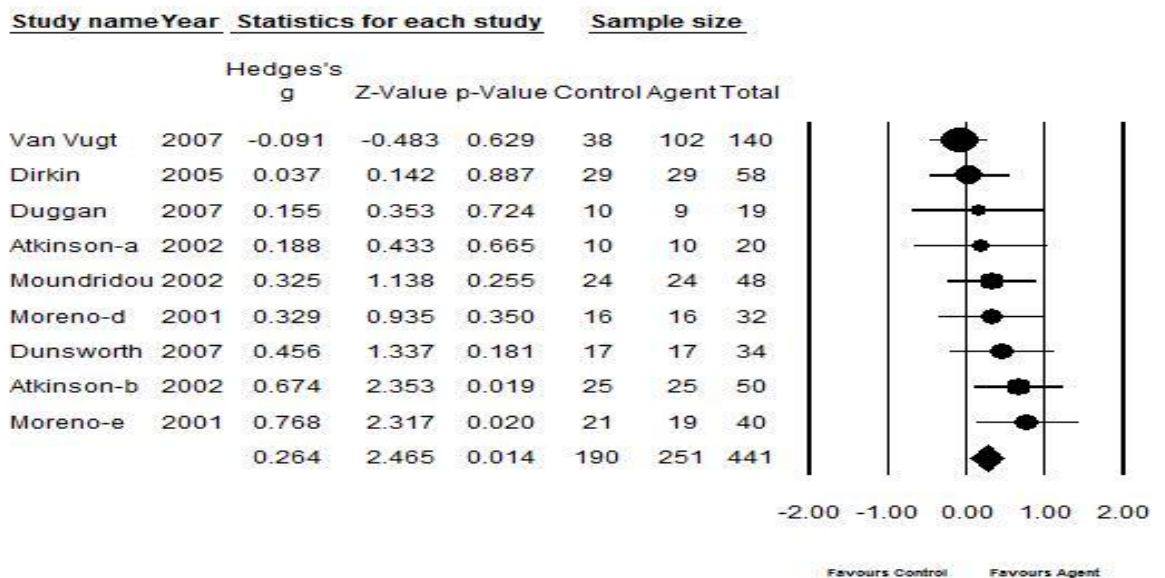


Figure 6 Forest plot of text interfaces versus PA interfaces (9 studies)

A further breakdown of the agents based on the modality used by the agent produced three comparisons where *Text* is compared to 1) *Agent with text*, 2) *Agent with voice*, and 3) *Agent with voice and text*. The most frequent combination is contrasting *Text* to *Agent with voice* conditions (7 studies), which had a medium mean effect size of 0.610 (95% CL: 0.337 - 0.883) with statistically significant tests of the null hypothesis ($p = 0.000$, $z = 4.372$) favouring the agent (Figure 7.). Moreover, the effect size of four studies (Atkinson-a 2002: -0.183; Moreno-e 2001: 0.182; Moreno-d 2001: -0.019; 2007: -0.091) comparing *Text* to *Agent with text* is -0.035 (95% CL: -0.307 - 0.237) with statistical insignificant tests of the null hypothesis ($p = 0.800$, $z = -0.253$) in favour of the *Text* interface. Only one study (Dirkin 2005) compared *Text* to

Agent with voice and text and got a trivial effect size of 0.037 (95% CL: -0.472 - 0.546) that was statistically insignificant ($p = 0.887$, $z = 0.142$).

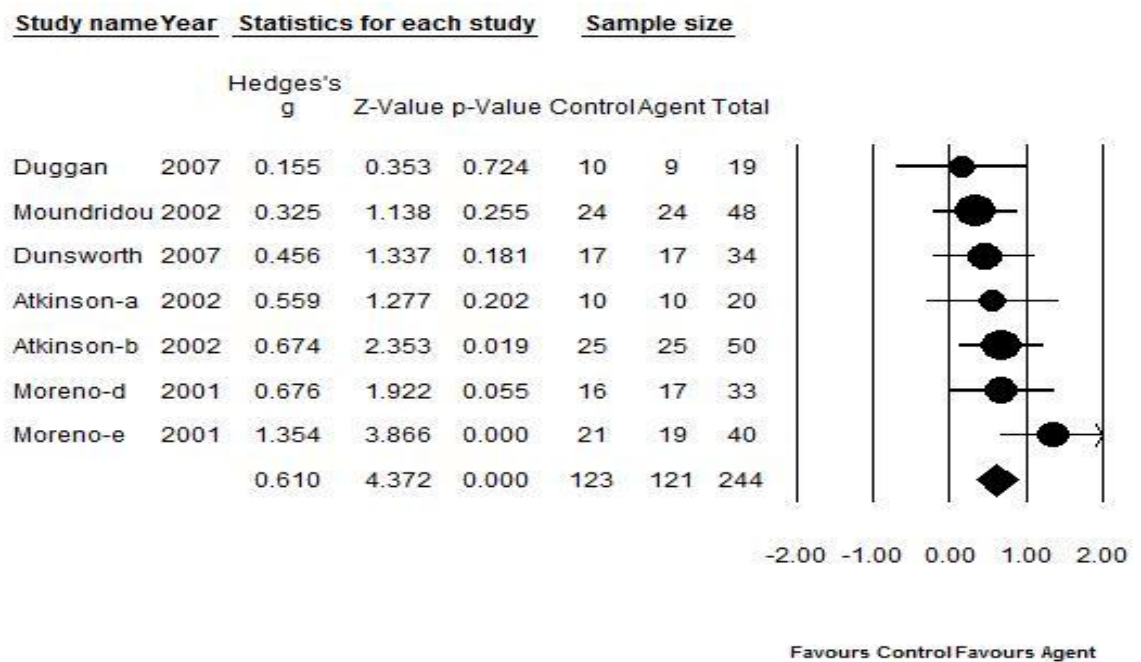


Figure 7 Forest plot of text to agent with voice contrasts (7 studies)

b. Voice interfaces versus agent interfaces

Figure 8 shows a total of 9 studies and compares the effectiveness of *Voice* interfaces to *Agent-based* interfaces. This resulted in a mean effect size of 0.001 (95% CL: -0.229 - 0.231) and statistically insignificant tests of the null hypothesis ($p = 0.992$, $z = 0.010$).

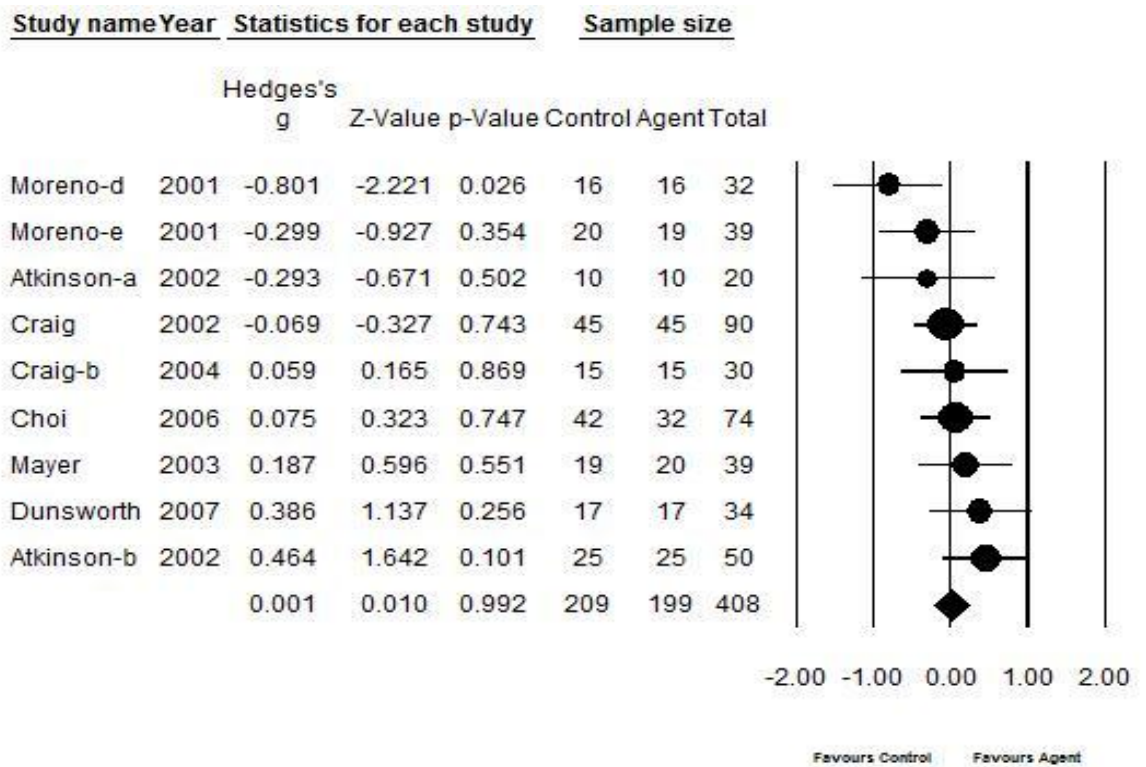


Figure 8 Forest plot of voice interfaces verses PA interfaces (9 studies)

A breakdown, similar to the previous one, was made. Although the greatest number of contrasts (9 studies) compared *Voice* to *Agent with voice*, the mean effect size was small (0.092, 95% CL: -0.100 – 0.284) and statistically insignificant ($p = 0.347$, $z = 0.940$) (see Figure 9.).

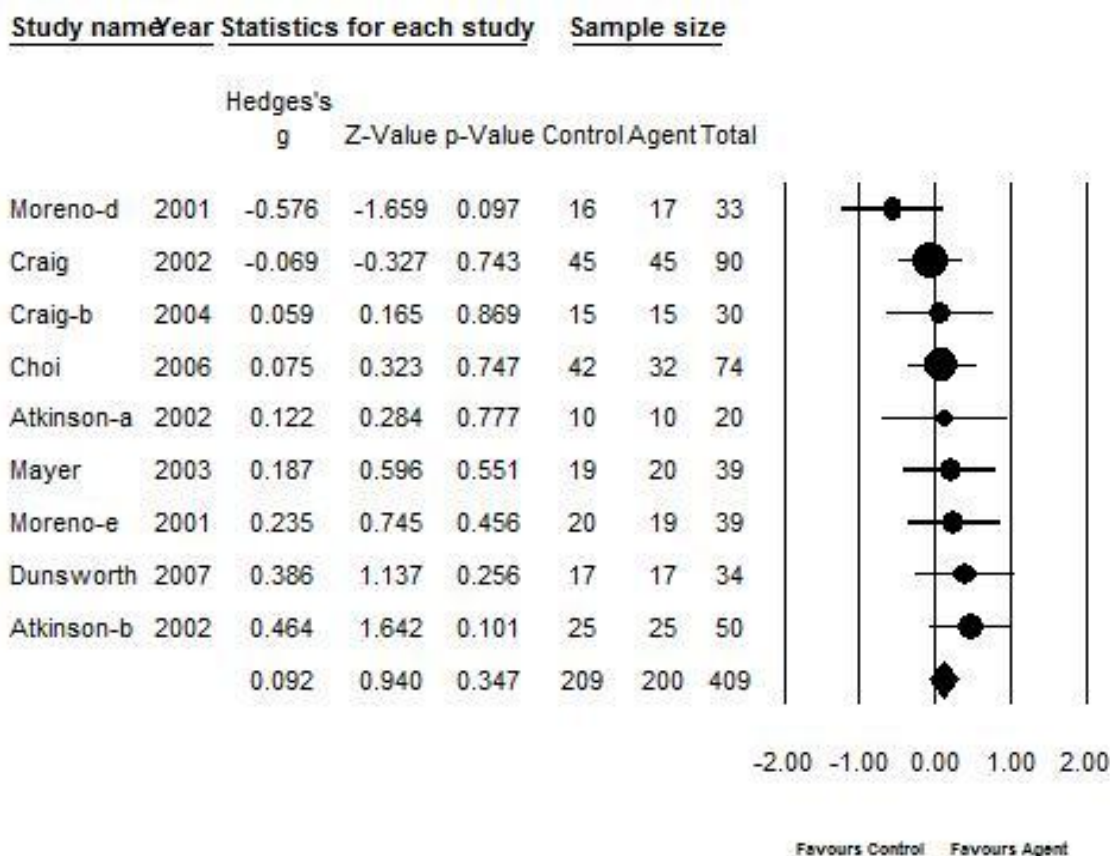


Figure 9 Forest plot of voice to agent and voice contrasts (9 studies)

On the other hand, the 3 comparisons of *Voice to Agent with text* (Moreno-d 2001: -1.026; Moreno-e 2001: -0.833; Atkinson-a 2002: -0.708) favours the *Voice* interface (-0.868, 95% CL: -1.291- -0.444), which is statistically significant ($p = 0.000$, $z = -4.017$).

c. Dual-modality interfaces: TV versus ATV

The mean of the combined effect sizes derived from five studies comparing *Text and voice* (TV) interfaces to *Agent with text and voice* resulted in a small

effect size (0.115, 95% CL: -0.122 - 0.352), which was statistically insignificant ($p = 0.342$, $z = 0.951$).

1.6.2.3.2. Subjective measures

Figure 10 shows the combined effect size for 13 studies, evaluating the effectiveness of the embodiment of pedagogical agents on subjective measures. This resulted in a small mean effect size of 0.060 with a 95% confidence interval (CL: -0.075 – 0.196, $p = 0.384$, $z = 0.870$). The subjective measures were coded and categorized in relation to: a) agents' believability; b) sociability; c) learning experience; and d) perception of usefulness.

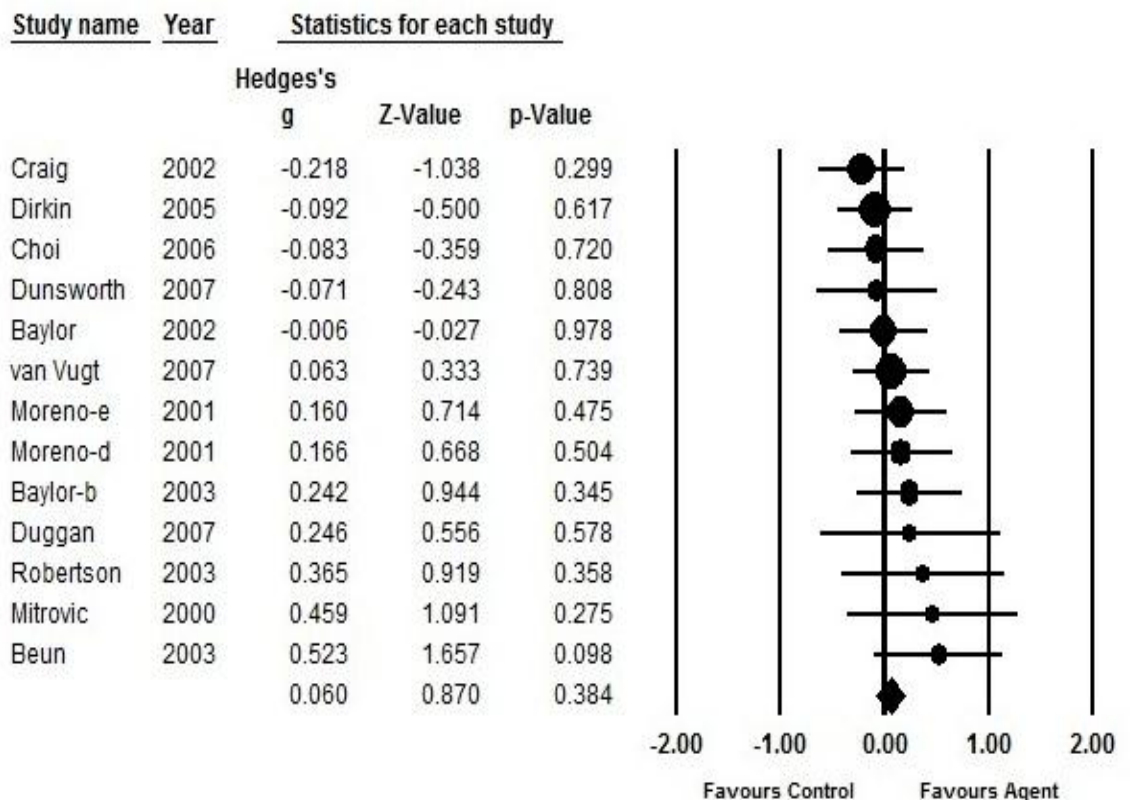


Figure 10 Forest plot of PA's effect on subjective measures (13 studies)

- a. **Believability:** Learners' perceptions about the believability of the agents contained measures related to the values of the character (e.g. aesthetics, credibility, human-likeness). The mean effect size of four studies (Baylor 2003: 0.254; Choi 2006: -0.243; Van Vugt 2007: -0.326; Beun 2003: 0.523) was negative (-0.062, 95% CL: -0.294 -0.170) and statistically insignificant ($p = 0.602$, $z = -0.522$). This indicates that the learners were more likely to perceive the agents as unbelievable. It should be noted, however, that these studies used agents with low degrees of realism (Baylor 2003; Choi 2006). Although Van Vugt (2007) used a realistic agent and unrealistic one, both effect sizes showed negative directions when compared to the no-character condition (-0.223 and -0.417 respectively).
- b. **Sociability:** Sociability included emotional reactions towards the system such as satisfaction, enjoyment, friendliness, interest and motivation. Figure 11. shows that a small effect size (0.078, 95% CL: -0.035 – 0.276) resulted from combining sociability measures of eleven studies. The tests of the null hypothesis were statistically insignificant ($p = 0.293$, $z = 1.051$).

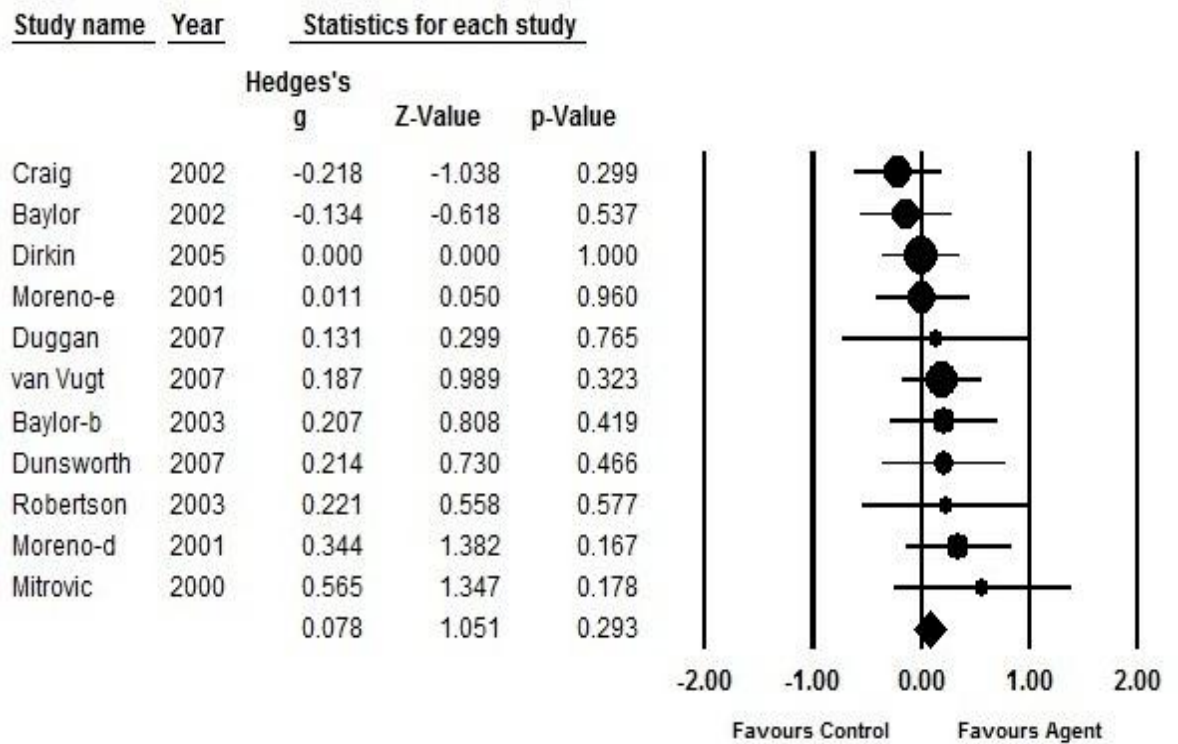


Figure 11. Forest plot of PA's effect on sociability (11 studies)

- c. **Learning experience:** Learners' perceptions of the learning experience contained measures relevant to task difficulty, effort and self-efficacy. Figure 12 shows a negative mean effect size (-0.012, 95% CL: -0.166-0.142, $p = 0.881$, $z = -0.150$) was obtained for 10 studies. The embodiment did not have an effect on learners' experience.

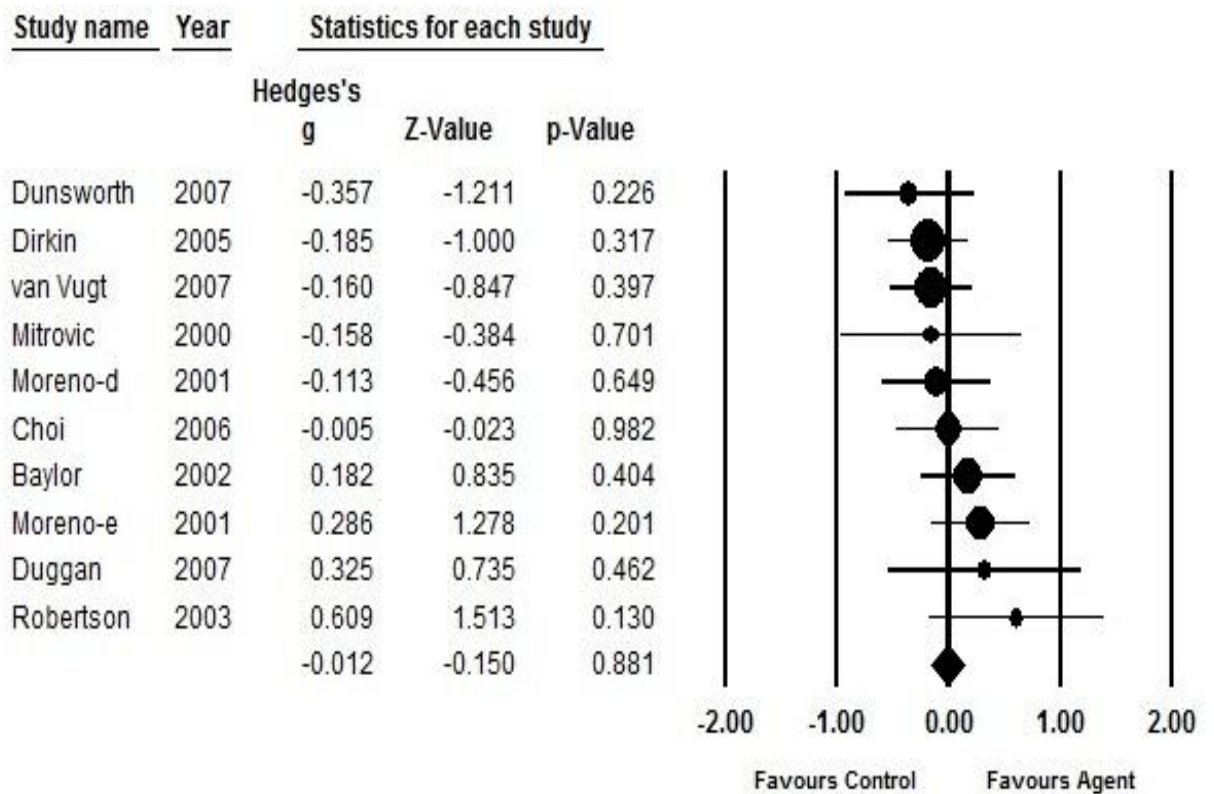


Figure 12. Forest plot of PA's effect on learning experience (10 studies)

- d. **Usefulness:** Learners' perceptions of usefulness included measures related to the usefulness and helpfulness of the material and feedback. Figure 13 shows a small mean effect size 0.245 (95% CL: 0.022-0.468, $p = 0.031$, $z = 2.157$) of 8 studies was obtained.

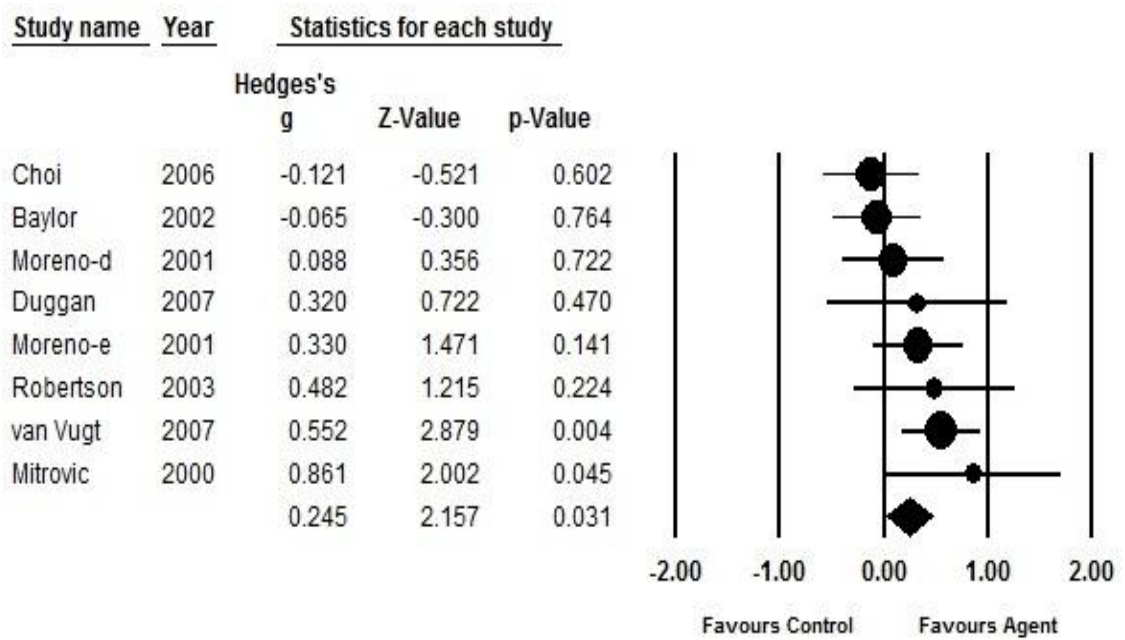


Figure 13. Forest plot of PA's effect on usefulness (8 studies)

1.6.3. Publication

Sufficiency of studies and stability of results

An ongoing argument in research is the 'editor's bias' toward publishing significant results and suppressing insignificant results and the acceptance of publishing papers based on their methodological quality (Hunter and Schmidt 1990, p.508; Mosteller and Colditz 1996; Daniel 1998). Consequently, this might bias the results and therefore they become unrepresentative of the entire population the sample is drawn from. In order to explore this issue, three procedures were applied.

First, the chronological cumulative analysis is applied to investigate if additional studies will change the estimated effect size or not. It indicated that small effect

sizes were obtained since 2001 when the first studies were conducted. The variation in effect sizes almost vanished with the addition of new studies from 2001 to 2007. Therefore it is unlikely that additional studies will produce different evidence or change the estimate of the mean effect size dramatically. Evidently, this is supported by the small difference in the effect sizes estimated by the fixed and random models (0.250 and 0.272 respectively). This means that the estimated effect size of the sample studies and the mean effect size of those studies distributed in the population it was drawn from are relatively close.

Second, 'Fail-safe N' method is used for the assessment of availability and publication bias of the samples used in the analysis. It showed a symmetric view which indicated the absence of publication bias and it detected a number of 166 required studies to set the combined 2-tailed p-value to exceed 0.050. In the context of pedagogical agents this number of studies is considered large for three reasons:

- First, the field addressing pedagogical agents is recent. Analysing 288 papers (including reports) out of the 351 retrieved papers revealed that only about 23% of studies were published prior to 2001.
- Second, only 37% of these papers, which equals 106, were evaluation papers, of which 51% were journal articles and 43% were conference papers. This means that the majority of the papers were published and peer-reviewed.
- Third, most of the comparison retrieved papers (30), including the excluded papers based on not reporting enough data and methodological

problems (7), were published and peer-reviewed (journal papers 70%, conference papers 23%, reports and others 7%). The 7 PhD dissertations included one paper usable for the analysis and this has a corresponding published paper. This reflects that the argument, based on publishing significant results only, is invalid since even less quality papers and PhD theses are published and the findings are mixed.

Third, the 'trim and fill' method based on the random effect model of looking for studies on the right and left showed that there were no missing studies. This ensures that the sample included in the analysis is representative of the population. However, using this method with the fixed model showed that two studies might be missing on the left side of the mean where the impute point estimate was 0.212 (95% CI: 0.11670 – 0.30729) (Figure 14.).

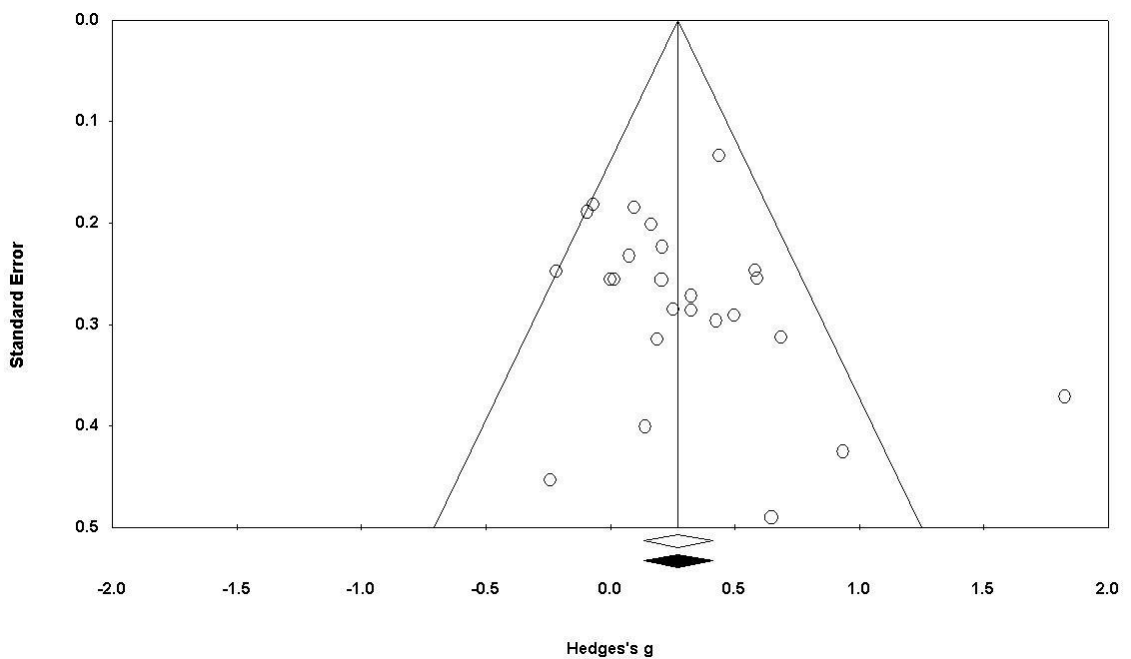


Figure 14. Funnel plot of standard error by Hedges's g

1.7. Discussion

The benefits of anthropomorphized interface agents in learning environments are debatable. Traditional narrative literature reviews have already shown concern about the methodological shortcomings of the primary studies that could mislead the findings. The meta-analysis and the analysis of the studies' characteristics allowed the identification of a few factors that may be responsible for contradictory findings. The discussion section has two purposes. First, it presents a discussion of the results and, second, it elaborates on the methodological shortcomings and misconceptualization of embodiment.

1.7.1. Discussion of the results

1.7.1.1. The effect of embodied conversational pedagogical agents on learning

Embodied conversational agents have a small effect on learning, which means that their practical advantages are limited. Our findings showing small effects, supporting the previous study by (Yee et al. 2007). Yee et al.'s study presented the effects of the agent's representation on behavioural and task performances. The analysis involved 25 studies. It addressed a larger number of contexts regarding task performance, including the agent's influence on participants' discussions and decision making, participants involved, and the agent's role. The authors found that studies using performance measures yielded small correlation effect sizes ($n = 17$, $r = 0.09$; $z = 2.37$, $p = 0.02$). The Hedges's g effect size was converted to the correlation effect size in order to compare it

with the previous result. The results of this meta-analysis showed little improvement ($n = 25$, $r = 0.14$; $z = 3.85$, $p = 0.00$). Moreover, the results of the analysis *did not confirm the persona effect of embodied agents*. No effect of PA was found on learners' subjective evaluation of perceived believability or sociability. The fact that the contextualization of the agents in learning environments did not provide much advantage over the decontextualized contexts raises important issues about the patterns of contextualization.

1.7.1.2. Multimedia learning principles

The moderator analysis was only applied to studies that manipulated the 'embodiment' of PA. It was based on multimodal contrasts of adequate comparisons. The analysis confirmed the strength of the voice modality over textual representation of information (Mayer and Moreno 1998; Moreno and Mayer 1999). The comparisons between conditions showed that the embodiment did not have an effect on learning as the effect sizes were associated with the provision of acoustic information regardless of the image of the agent. Comparing *Text* to *Agent with voice*, the *Agent with voice* condition was superior to the on-screen *Text* condition, but this effect disappeared when *Voice* was used in the disembodied version instead of *Text*.

The results are consistent with the cognitive load theory (Chandler and Sweller 1991; Jeung et al. 1997), which advocates that the presentation of multiple sources of information requires learners to search for referents to mentally integrate and understand them. Following the dual-processing hypothesis

(Mayer and Moreno 1998) this could imply that visual representation of the agents' image and textual information overloaded learners' working memory. The comparisons of *Text* or *Voice* to *Agent with Text* indicated better achievements for the mono-media conditions. In this case, the embodiment of the PA was not considered as part of the content, and therefore the learners' searches became unrelated to their learning. This reflects that the effort spent in the process of integrating the visual representation of the agent with the content and other sources of information might not be needed, and could result in interference with their learning.

The effect of the embodied PA on perceived usefulness and learners' experience is limited. The learners might realize that they receive feedback or help through the character while searching for referents to mentally integrate the elements of the environment. The character, being unlinked directly to the learning content, might attract their attention as they spend time to give it meaning and realize its form. In this sense, it might be interpreted as a visual indicator similar to images of arrows and flashing effects. The system becomes useful and possibly more responsive than a system without any visual indicators but not more than a system with simple indicators, as some studies found (Van Mulken et al. 1998; Lester et al. 1999a; Choi and Clark 2006). However, complexity might arise when the learners try to understand and interpret the different actions and behaviours of the agent.

1.7.2. Discussions of methodological shortcomings

1.7.2.1. Factors influencing PA evaluation

The residual analysis split the studies up into two categories which clarified the reasons for the contradictory results highlighted by previous research. The studies that manipulated the embodiment of the agent yielded a trivial mean effect size. This signifies that the embodiment did not have an effect on learning. On the other hand, the studies that have medium or large effect sizes were based on manipulating other factors such as explanations, hints, personalization and interaction in the versions of the control group. This makes the results biased toward the embodied agent-based system. The largest effect sizes were obtained by studies using paper-based materials for the control group where the results cannot be attributed to the embodiment of PA due to the differences between the learning environments and learning materials.

The manipulation of the previous factors and the use of different learning environments are caused by the ambiguity in identifying the characteristics of interface agents. This perplexity might actually be related to the lack of an agreed definition of software agents (Jennings and Wooldridge 1996; Franklin and Graesser 1997). However, as (Russell and Norvig 1995) point out, “the notion of an agent is meant to be a tool for analyzing systems, not an absolute characterization that divides the world into agents and non-agents”. Therefore two points could be raised. First, the previous characteristics are generally related to pedagogic strategies (i.e. explanation and hints) and ITS systems (personalization and interaction) rather than being specifications of embodied

agents. Second, the evaluation of the technical upgrading from non-agent to agent-based systems differs from the aim of evaluating the social agency of the system's interface. In other words, if two systems have an identical interface, and were developed to interact with the user in an identical way, then whether they implement agent or non-agent technology is not relevant to social agency evaluation studies.

1.7.2.2. Embodiment: What was embodied?

This section argues that the 'embodiment' itself was not situated or contextualized and thus its evaluation was limited to representation. In particular, it was not seen as a 'vehicle to learning'. 'Human' embodiment briefly refers to the study of the body, which is perceived as the vehicle of being in the world (Merleau-Ponty 2002). Embodiment, then, intertwines both the *body representation* and its *being-in-the-world*. In other words, the body is always contextualized and thus as we cannot separate the body from the mind, we cannot separate it from the context. Perception, affection, understanding and learning are based on bodily experience and corporal involvement with the surrounding environment. The states of the body, that is its gestures, movement and postures, that occur during social interaction, from a psychological perspective, play central roles in processing social and emotional information in the social situation (Barsalou et al. 2003, p.43).

The main motivation for the virtual embodiment of software agents was influenced by Brooks's approach towards artificial intelligence (AI). Brooks

(1991) argues that AI should have “visual representation” that enables it to co-exist with people or be embodied in the world and be seen by people. This approach towards intelligence challenges the view held in AI for decades. The latter advocates that intelligence is ‘disembodied’. The intelligent tutoring systems (ITS) focus on reproducing the human tutor by designing conversational interfaces that provide instructions and verbal feedback. Software agents are *embedded* in the material and their behaviours change according to the changes in their world.

Online, multimedia learning, focusing on the integration of media elements such as sound and pictures in the presentation of material, perceives virtual embodiment as the *graphical representation* of real or fictitious life-like forms. The *graphical representation* displays animated communication acts such as facial expressions and gestures which give the impression that it is alive. Software agents become *embodied* in this sense. Their behaviours are visible. However, as the studies’ characteristics reveal, their main functionality has not changed. Their sense organs are only used to point things out and name them (Turing 1950, p.456).

It follows that the ‘virtual embodiment’ was conveyed as an ‘image’ – a media element. It is regarded as a pointer or an arrow. It is not a *context requirement* which means it is not critical for the content and does not convey knowledge. In these instances it can be substituted by other media forms where ‘human’ characteristics can also be expressed, i.e. in text, graphs, icons, voice, animation, multimedia or virtual reality (Chou et al. 2002). The ‘embodiment

effect' was evaluated as a 'mental image effect'. This provides a rationale for the robustness of multimedia learning replications through multimodal comparisons. Other studies reported that inexpressive, simple embodied agents that perform simple tasks can reveal the persona effect (Lester et al. 1997a; Mitrovic and Suraweera 2000). Likewise, text was also perceived as being as sociable as an animated social agent (Dirkin et al. 2005). Evidently, "we need not be too concerned about the legs, eyes, etc. ... provided that communication in both directions between teacher and pupil can take place by some means or other" (Turing 1950, p.456).

1.7.2.3. Embodied learning and embodied learners

The growth in 'embodied' PA research fosters increased awareness of the importance of 'embodiment' to human (-like) embodied cognition but for no obvious reason (Ziemke 2003). Analysing the studies' contexts reveals that learners and learning were perceived as being 'disembodied'. Learning was accomplished through disembodied processing of information, and measured through post-tests. It was perceived as an outcome of a process rather than a process in itself. Perception, affection and experience were measured through post-judgment methods. Current approaches of learning such as constructive learning and learner-centred approaches highlight the importance of the process, social and situational contexts rather than performance outcome (Sugrue 1997, p.6).

Learners could be identified as agents that process information cognitively through vision and audition. Although the learners interact physically with the computer, their bodily activity was not seen as an element of information processing. Their embodiment was not perceived as a 'vehicle of learning'. It is this lack of providing and evaluating information related to the 'situatedness' represented in participants' embodiment, physical activities, behaviours, affects and experience of being in the learning context that affects the definition of the role of 'virtual embodiment' and the new potentials it bears.

1.7.2.4. Researching embodiment

Researching the virtual "embodiment effect' in virtual contexts should be based on theories that view the embodiment as a 'methodological figure'" (Jackson 1994, p.223) or a standpoint to analyse the world. This implies change in culture, self and experience, and can be used for its analysis. 'Embodiment' should be perceived as a *context requirement* where the aim of the human metaphor could be seen as making abstract ideas graspable and concrete (Low 1994). Reeves and Nass (1998, p.252) point out that "social and natural responses come from the people, not from the media themselves" and "ultimately, it's the pictures in our heads that matter, not the ones on the screen". Likewise, theories of embodied cognition highlight that "empathy, or understanding of another person's emotional state, comes from mentally 're-creating' this person's feelings in ourselves" (Niedenthal et al. 2005, p.186).

Fewer studies have used other measures in evaluating the embodiment in PA research than the conventional comparative experimental method. For example, the studies of Hubal and Day (2006) and Babu et al. (2007) situated the embodied agent in face-to-face contexts of interview training and social conversational protocol. The large effect sizes for both studies cannot be attributed to the embodiment of the agent since the comparisons themselves were inadequate. Although both studies reported changes in the behavioural performance of learners as an outcome of the interaction with the agent, indicating a process, there is no description of this process or experience itself. Babu et al. (2007), for example, reported less variation in learners' behaviour after their interaction with the embodied agent.



Figure 15. The immersive virtual reality social conversational protocol training system. This system uses two networked PCs for speech and gesture recognition, and visual rendering. A data projector displays the life-sized virtual

humans on a large screen. The participant's head, hands and waist are tracked in 6DOF using a Polhemus Fastrack electro-magnetic tracker.

Hubal and Day (2006) found better response times for the participants interacting with the PA than the response times of the participants using books where the former participants have taken less time to respond to questions in the real interviews.

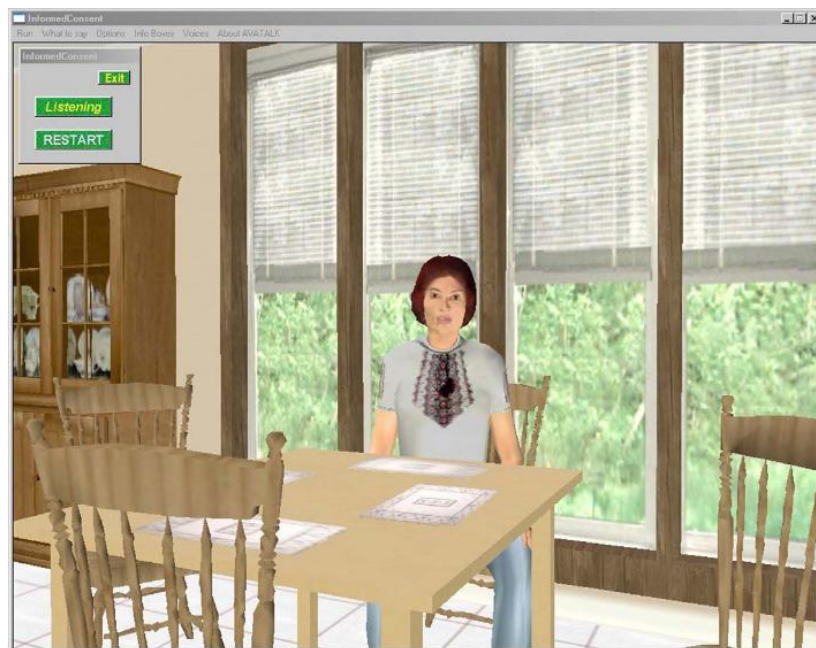


Figure 16. The virtual environment for health dialogue consent form. This shows a country household with a virtual agent using conversational gestures and natural language recognition components.

All these findings indicate a model of unconscious imitation and suggestion within the process; however, focusing on the outcome resulted in decontextualization of embodied affects and perceptions. Some of the other studies in PA had already described some of the behaviours of learners

interacting with PA. Ryokai et al. (2003) used a character to improve children's language literacy through storytelling. The children and the system shared some physical materials, such as a castle and figurine. They reported that the children (5 years old) were engaged with the character, treated it as a partner, acknowledged its role and coached it. The study showed improvement in their language. *Teatrix* (Machado et al. 2000; Paiva et al. 2001) used a collaborative environment to build a story on a virtual stage. Learners built a harmonized character by deciding its role and personality, and then controlled its interaction in the story. The authors (Prada et al. 2002) describe how learners' personalities develop within this social context. They were establishing skills and solving problems related to co-ordination and collaboration while selecting the characters and deciding their actions.

1.7.3. Disciplinary bias

This displacement of the embodiment of agents in HCI applications generally could be attributed to disciplinary bias. The potentiality of the technology is to inform us of new embodied behaviours that could facilitate performance not only from interacting with the technology itself but also in acting in the real world. There was substantial information about the 'virtual agent embodiment' – which is reduced to image – but a lack of information on the 'real agent embodiment' and the 'embodied interaction' between the two worlds. Indeed, as the field calls for more research, the same circle goes on where lived experience or embodied interaction is ignored, favouring outcomes and where newer studies follow the same comparative experimental design to add new insignificant findings, e.g.

Wei (2010). The lack of consideration of participants and their culture could result in invalid design.¹⁴ Disciplinary bias has resulted in replications in areas such as methods, population, content and assessment techniques.

1.8. Conclusion

The main problematic issues with the research of 'embodiment' in HCI are: first, the reduction of 'virtual embodiment' to image or visual representation; second, the reduction of the participant's body and experience to 'mind' in order to apply experimental studies to determine its effectiveness as a multimedia interface element; and, third, the reduction of embodied effects to the reflected, measurable and representational. Within this, the research missed what it set out to evaluate: embodiment and embodied effects; embodied perception and affection. In order to overcome these shortcomings, and find different ways of perceiving and evaluating embodiment in HCI, I cannot but, first, turn away from HCI itself. Away from HCI, I intend to explore the 'embodiment' paradigm in new media and cinema in relation to lived experience. This is the aim of the second part of my research as it focuses on Mark Hansen's work, specifically his book *New Philosophy for New Media* (2006), in which he engages in theories and debates of embodiment and embodied effects. I expect the investigation to inform us of a different and, in relation to our current account, new perspective of embodied interaction between humans and computers.

2. Chapter Two: The ‘Centre of Indetermination’

Between New Media and Cinema

2.1. Introduction

In the last chapter, the experimental phase of this transdisciplinarity approach attempted to provide an ‘objective’ level of knowledge about embodied interaction between machine and human. It was shown that this interaction is a central theme in HCI, which has led to enhancing the computer through embodying the interface with the design of embodied conversational agents (ECAs). Addressing the evaluation of the two-way embodied interaction in the field of learning represented by pedagogical agents has revealed two things. Firstly, disciplinary bias has resulted in reducing the virtual embodiment to a media element, which is a graphical image. Secondly, it emphasizes the methodological shortcoming of ignoring human embodiment in favour of reflective evaluations, thus limiting the embodied interaction to outcome evaluations. Research in PAs keeps supporting these contradictory findings, stating that virtual embodiment is not effective (Bowman 2011), while other investigations continue varying other aspects of educational pedagogy strategies such as gender, feedback and type of messages indicating a loss of interest along with a loss of any promising benefits of virtual embodiment (Arroyo et al. 2011; Feyzi-Behnagh and Azevedo 2012; Veletsianos 2012). However, the finding that the embodiment of the interface is not effective is ‘true’ only as long as the question entails such reductions of embodiment. What motivates this research is the view that such findings are not satisfactory and,

further, that researchers should not be satisfied with them. What is required, then, is not conducting more studies at the same level which, as we have seen, would only add to the contradictory stream of studies, but a reframing of the question of effectiveness to 'constitute' the problem of embodiment. Prioritizing this problem in question reformation means investigating the constituents of embodiment (i.e. embodied perception and affection) and making them the determining factors of the embodiment's 'indetermined' effectiveness (i.e.. generalizing the probability level that is based on verbal measures that substitute embodied interaction). The 'indetermination' here means that effectiveness is a relation that varies based on the participating elements of the situation and not a fixed relation or outcome restricted by a generalizing principle of binaries; effective/ineffective. In this sense, we admit to variation rather than determination in human-computer interaction.

Focusing on embodiment, this thesis moves away from such determinism to explore embodiment in new media and current philosophical trends. This phase of my research (chapters two and three) represents the philosophical level of the transdisciplinary approach. It focuses on the analysis of Mark Hansen's work which advocates "a phenomenological concept of embodiments" (Hansen 2000, p.29) that moves beyond representational and cognitive models. This model is presented throughout his theoretical and experimental work and is taken as the basis for criticizing other philosophical work. Reading Hansen's work is stimulating for focusing on embodied effects that are not considered or observed in HCI experimentation and thus could be taken as a starting point for

the exploration of the embodiment in contemporary works. This exploration could be useful in identifying ways for the design and evaluation of virtual embodiment. Discussions of embodied effects, that are embodied perception and affection, are elaborated in Hansen's book *New Philosophy for New Media* (2006) which is based on his theoretical analysis and criticizes artists and theorists for privileging the artwork over the body in what he calls the "aesthetic equation" (Hansen 2006b, p.28). Here, Hansen also provides an analysis of the experimentation with the 'close-up' represented by digital facial interfaces, which in the first chapter, following HCI terminology, are called embodied conversational characters or agents. This book is also a central part of my analysis because it is marked by Hansen's arguments against Gilles Deleuze's transformation of Bergson's concept of embodiment into the cinema, which is incompatible with Hansen, but might be a valuable resource in extending our understanding of embodiment in HCI. Hansen, as Guerlac (2006, p.193) enthusiastically notes, reverses the direction of Deleuze's reading of Bergson's theory of embodiment. This could be viewed in support of the reversal of the privileging balance in the aesthetic equation.¹⁵

Generally, Hansen (2006b) argues that Gilles Deleuze has disembodied the "centre of indetermination" that is the living being by locating perception and affection outside the subject and in the machine assemblage of cinematographic images.¹⁶ Assemblage is a Deleuzian concept that refers to a composition of relations between heterogeneous components that could be natural or artificial.¹⁷ Hansen argues that "the montage cut and the frame – both

central in the first volume of Deleuze's study – remain homologous to the diminution that constitutes perception on Bergson's account" (2006c, p.6).¹⁸ This diminution is referred to in Hansen's book *Embodying Technesis* (2000) as Bergson's "dissolution of the mind-matter distinction", which Hansen aims to eschew "by decoupling human freedom from the capacity to translate material stimuli into mental representations" (2000, p.72). However, regardless of his stated disagreement with Bergson in his previous book, in *New Philosophy for New Media*, Hansen foregrounds the rubric of the "Bergsonist vocation", which focuses on deploying Bergson's embodied understanding of the centre of indetermination and redeeming it from the "assault Deleuze wages against it".¹⁹ Therefore, Hansen makes the following fundamental distinctions. First, Deleuze equates the framing function as homologous to the body function, that is perception (2006b, p.6) and, second, the placement of affection as a subcomponent of perception-image, consequently reducing affectivity to affection-image; whereas Hansen claims that Bergson sees affection as a "phenomenological modality" in its own right. In turn, Hansen takes this argument as the theoretical basis for his exploration of new media art.

Exploring Hansen and Deleuze's arguments of embodiment transformation in cinema is important in two ways. Firstly, it identifies a transformation of embodiment to technology as a mutual interest between HCI and Deleuze. Chapter one demonstrates a similar movement from abstract mental-models of interaction to embodied interfaces illustrated by the virtual embodiment of characters and agents, which is perceived as a way of advancing the

humanization of the computer. As pointed out previously, embodying the computer is supposed to make its interactions visible thus increasing its social presence. A great influence on the notion of this transformation of embodiment comes from the communication studies pioneered by Reeves and Nass advocating the “media equation” that emphasizes that people treat media as real human beings or social actors (Reeves and Nass 1998). Secondly, the argument Hansen establishes against Deleuze is related to our previous conclusion that the experimentation of HCI has ignored the embodied participant and embodied interaction in favour of investing in technology. For Hansen, Deleuze has ignored the spectator in his analysis of cinema, as chapter four of this thesis will show, while for us HCI has ignored the embodied participant by focusing its evaluation on reflective measures after the real time interaction.

Hansen’s account of new media artworks, especially his analysis of experimentation with digital facial interfaces, follows a different model of embodiment. This model is based on defining embodied experience in technological situations in relation to the experience of *Erlebnis*, which is understood as short-lived experience. This experience is weaved into a patriarchal discourse where the female body and embodiment is transferred to technological materiality. This forms the basis for the technological situations in Hansen’s work, which are physical intercourses (interaction with technological interfaces) and pregnancy (dynamic interaction in virtual environments). This analysis, focusing on embodied perception and affection in new media, reveals

how such a model restricts Hansen's account and brings up inconsistencies in his reading of other philosophers and theorists, leading to ambiguous theoretical discourse and analysis. These inconsistencies are due to the bending of different theoretical works and philosophical concepts to reproduce the same model or situations. Hansen's account has a resulting lack of clarity of terminological and conceptual explanations (e.g. virtual as organic quality, virtualization of body and place within the body) and an obscure introduction of other authors' concepts (e.g. Daniel Stern's concepts of affective attunement and vitality affect). It also seems to depart from some of the theorists (e.g. Bergson, Deleuze and Varela) in that foregrounds as the theoretical foundation for its debate an inadequate, unclear or partial interpretation of their work (e.g. in regarding perception, affection and self-affection). The next section contains an overview, firstly, of Hansen's model of embodiment in technological situations and secondly Deleuze's transformation of embodiment in cinema.

2.2. Embodiment in new media

Hansen is interested in theorizing the correlation of the aesthetics of new media with a strong theory of embodiment in contemporary media artists' work. Similar to HCI research, he considers embodiment as the 'newness' of the new media. Newness here does not mean in opposition to 'oldness' of media but as an expansion of it.²⁰ Mark Hansen's project is to move criticism and analysis of embodied interaction with technology from a purely discursive articulation, dominating both human embodiment and technology within theoretical and scientific cultures, to more concrete material or corporeal embodiments.

Hansen's project is twofold. First, it entails positioning technology or technological materiality beyond writing or technesis (Hansen 2000, p.26), and second, situating phenomenological (or corporeal) embodiment as the new paradigm in the interaction with technology. Generally, three consistent characteristics feature in Hansen's works. Firstly, he places technology as a vehicle or an agent for embodied experiences and material evolution. Secondly, he introduces a split between the body and cognition or representation, and the mapping of the technology directly to bodily experience. Thirdly, he accentuates the primacy of the bodily experience as the site of investment in the interaction with technology. Here, I outline Hansen's projects based on these elicited traits

Hansen's work describes technology as a vehicle or an agent for embodied experiences and material evolution. The theoretical critique Hansen pursues in his book *Embodied Technesis: Technology Beyond Writing* (2000) stresses the relocation of technology within both theoretical and scientific cultures. Hansen claims that theoretical and scientific studies have "reduced" embodied reality to our interaction with technology. He offers a critique of *technesis*, which he defines as "the putting-into-discourse of technology." Hansen links his critique of technology with feminist accounts by relating *technesis* to "gynesis", a term coined by Alice Jardine to mean "the putting of woman into discourse" whereby women are reduced to abstraction and language (2000, p.86). *Gynesis*, according to Hansen, is used to broaden the understanding of textuality rather than providing a model for thinking about women. *Technesis* "advances a reduction of concrete technologies in the service of a generative, deconstructive

textual model” (2000, p.86). This model is motivated by “situating the technology as the “other” within thought as a defense against a “radical material alterity of technology” (2000, p.87). This reduction imposes a discursive abstraction on embodied reality where the translation into text of technology fails to capture its concrete worldly embodiment and “the abstraction created when technology is constrained to fit the textual figure of the machine” (2000, p.87). Hansen maintains, “*technesis* purges technology of its materiality” and thus the latter “cannot deliver the experience of otherness it promises” (2000, p.88). Hansen’s use of the word “materiality” here entails “the social, economic, psychological, and political realities attached to the technological infrastructure” (2000, p.54).²¹

Thus, Hansen maintains that the more robust contextualization of technological materiality in culture is in its reproductive function as an *agent* or a vehicle of “the material complexification of the cosmos” (2000, p.48). Hansen defines this material complexification in relation to his analysis of the work of Lyotard where the latter,

Eschewing traditional strategies that reductively trace technology to factors internal to human culture and society, he argues that technologies, while continuing to develop in response to specific human needs and within specific cultural contexts, both express and contribute to a process of material complexification unrelated in any essential way to human pursuit (2000, p.66).

Accepting the role technology plays in material complexification, Hansen asserts a different position from Lyotard’s cosmological perspective. He points out that Lyotard’s analysis is “a result of his effort to ally his thinking *rhetorically*

with the cosmological perspective he claims to be explicating” (2000, p.67-68)²² and thus it falls under the major reduction exercised by theory on technology, which is *technesis*. Hansen insists that Lyotard “tries his best to coax us into aligning our perspective with it [the cosmological evolutionary perspective]” where for Hansen “we must struggle most zealously against just such a cosmological alliance” (2000, p.68). Instead of arguing for such alliance or theoretical privilege with the human being, technology should be perceived through its experiential reality and thus accorded “a heuristic, rather than a perspective role” (2000, p.68).

Technology, for Hansen, “*is and is not* cultural in the restricted sense” (2000, p.58). Technologies are perceived as cultural for being autonomous vehicles for the secondary evolution of cosmos. They are “crucial vehicles of a nonteleological, *natural* or cosmological evolutionary process that is only secondarily or tangentially ... subject to the more local demands of our cultural moment” (2000, p.71). Technologies have a “qualified autonomy” (2000, p.56) where they contribute directly to “the autonomous process by which matter ‘self-complexifies’” (2000, p.37). Technology, then, also plays a mediating role in “forging a root sensuous contact between the alienated human individual and the constantly complexifying cosmos” (Hansen 2000, p.257). However, technology is not cultural as it does not create any “theoretical significance” of this matter’s complexification (2000, p.257).

The second feature of Hansen’s work is the body/brain or cognition split and the mapping of technology directly to bodily experience. In the context of *Embodied*

Technesis, this split appears between the history of science and technology. Hansen affirms that scientific studies, like theoretical critics, reduce embodied reality through the development of simplified inscriptional models of reality (Hansen 2000, p.28). Yet, the field of science studies still provides the opportunity for a non-reductive engagement with technology (2000, p.26) and thus, his critique intends to expand and supplement this engagement with scientific practice which he understands as, “an ongoing and imperfect negation with an unpredictable, ‘noncompliant’ material domain” (2000, p.26). The role of the history of science, according to Hansen, is to provide the “theoretical significance of matter’s complexification”.

To respect this duality [between science and technology], we will need to sketch a history of technology that serves to distinguish it from, rather than assimilate it to science, insofar as they function as *agents* of material evolution, technologies impact us as material forces without being mediated through preconstituted cultural codes. Accordingly, the history of technology foregrounds the *practical* impact of matter’s complexification in a manner that is, admittedly, culturally relative but that does not view this impact exclusively as the creation of culture; the history of science, by contrast, focuses on the particular modes of cultural understanding developed to explain – or more exactly, to produce- the theoretical significance of matter’s complexification (2000, p.56).

Two events have particular significance in both histories respectively: the thermodynamic and industrial revolutions. The first, which marks a shift in the history of modern science, emphasizes the split between energy and matter. This means that the representations of energy - which have come to be based on abstract mathematical modelling, are no longer relevant to phenomenal embodied experience. The second, which marks a shift in the history of modern technology, has accelerated technological modifications that “impact us at the

level of our prerepresentational embodiment” (2000, p.59) and “without the mediations of either scientific theory or popular cultural fantasy” (2000, p.59). The industrial revolution shifted the energy from humans to machines, which started to perform tasks that were carried out by humans and nature (2000, p.60). The distribution of automated machines resulted in “a practical destabilization of the human measure that prevailed in classical machines” (2000, p.61).

The trends observed above, where theory heads towards textual discourse, science advances towards abstraction, and autonomous technology develops towards embodied materiality, confront us “with the dissolution of the harmony or continuity between our representational capabilities and the material structure of the world” (2000, p.59). Hansen insists on differentiating the role of embodiment in technological situations from those roles in cultural accounts. In the former, “we can experience technologically generated material complexification without the mediation of representation” (2000, p.73). Simply put, the representational models can no longer grasp the excess of technological impact on the human body thus resulting in an “experiential alienation” (2000, p.71). This alienation is fuelled by “the technical contamination of molecular agency of desire” where “technology embodies the very contact between humankind and the world on which societal forms are themselves constructed. It thus conditions the movement of desire itself” (2000, p. 235). Therefore, embodiment has a primacy over cultural construction that

separates 'bodily practice' from conscious intellection and modes of representation(2000, p. 51).

embodiment is not the product of logically ordered nonverbal sequences of actions and movements designed to achieve specific, if not always acknowledged, cultural goals; rather, embodiment here involves a far more passive, undirected, and indeed emergent adaptation to new, largely unanticipated, and certainly unthematized alternations in the material flux underlying and conditioning the cultural horizon of experience (2000, p. 50).

Hansen emphasises that, "by decoupling human freedom from the capacity to translate material stimuli into mental representations, we open entirely new possibilities" (2000, p. 73). These possibilities relocate technology's impact on the "noncognitive and nondiscursive *affective* bodily life" (2000, p. 30), that acts "below the threshold of representation" (2000, p. 55) and affords reactions to the technological situation on the level of the nervous system rather than cognition, that is, by stimulating the "nervous systems to "learn" in an emergent and completely practical way" (2000, p. 73).

The third feature of Hansen's analysis is that he accentuates the primacy of bodily experience as the site of investment in the interaction with technology. To emphasize the shift in experience from representation to embodiment brought about by technology's impact, Hansen insists on a model of corporeal mimesis based on Walter Benjamin's theory. In the modern economy of experience, this model advocates the shift from the experience of *Erfahrung* (which means reflective experience that occurs over time and is derived through observation) to the experience of *Erlebnis* (which refers to isolated, mentally or cognitively

unprocessed and immediate experience) in the interaction with technology.²³ With this shift, and due to the experiential alienation of the human, the corporeal experience of shock has become the norm governing the interaction with reproductive technology. The shock which is related to the economy of experience, here, “designate[s] the corporeal impact of a vastly accelerated lifeworld on the physiology and neurology of individuals” (2000, p.257). *Erlebnis* as Hansen states, comprises the “experiential modality” most appropriate for this world governed by this model of shock” (2000, p.235). Hansen insists on a corporeal shock rather than the ‘dialectical’ shock provoked by dialectical images focusing on historic-political redemption arguments. The latter are linked with the *cognitive* experience of dissonance. (2000, p.257). This is because the corporeal shock “is made to designate what is most fleeting and transitory – those shocks that impact us immediately and corporeally without entering the psyche, leaving traces, or producing representations” (2000, p.239). The corporeal shock and the isolated and immediate experience (*Erlebnis*) are linked to a relatively similar mode of memory, which is ‘voluntary memory.’ Unlike ‘involuntary memory’ that “involves the recollection of experience that has been safely preserved,” voluntary memory “links us with the past in a way that does not depend on the faculty of interiorizing thought- that bypasses psychic mediation as such” (2000, p.242). It is dissociated from and located *outside* the individual psyche (2000, p.244). This dissociation between experience and the psyche allows voluntary memory’s function “to protect the psyche from shock stimuli” (2000, p.244). Reproductive technology, on the other hand, exteriorizes voluntary memory into images. According to Hansen, it

operates “a progressive exteriorization of voluntary memory from the human body to the machine” and “makes this physiological dimension into an object of collective experience” (2000, p.250).

This object of “collective experience,” is important in Hansen’s work relating to the role of the autonomous reproductive technologies of matter complexification, the prioritization of the embodied and affective experience of mankind, and the constitution of this experience within the realm of *Erlebnis*. To represent this phase which is the material evolution of the cosmos, in his analysis, Hansen supplements the shift of experience to *Erlebnis* with the replacement of text by image as a medium of experience. This phase he refers to as “the postlinguistic, postarchival stage”.

Just as technological modernization produces a shift in the mode of experience, from *Erfahrung* ... to *Erlebnis* ..., it also brokers a shift in the medium of experience, from nonsensuous linguistic correspondences to embodied and practical mimetic activity- what one recent critic aptly calls “contact sensuousity” (Hansen 2000, p.236 quoting Taussig 1993).

This is exemplified by emphasizing the tactile dimension of film, which re-functionalizes language as “an instrument of communication”(2000, p.261). The film tactility forms a kind of embodied communication that turns the focus away from the image to affect (2000, p.260).

In summary, Hansen’s critique of technesis should not be taken as a *rejection* of technesis but as a call for ‘embodying technesis’ as his book title indicates. Hansen’s account highlights the importance of going beyond the ‘putting of

technology into discourse' dominating high theory to the 'putting of the discourse into technology,' which should dominate scientific practice, which, as pointed out previously, his critique tends to support. To go from words to deeds, Hansen draws attention to technological materiality and autonomy and also its role in the embodied interaction with mankind. Thus, Hansen privileges a model of embodied experience characterized by the following elements: being short-lived (*Erlebnis*), alienating, inducing corporeal shock and being momentary.

2.2.1. Artwork analysis

Hansen's analysis of new media, virtual realities and artworks is a constant application of this theoretical critique while embodying his model of technesis where he stresses the difficulty to historicize media independently from the evolution of the human, and emphasizes the prolonged necessity for mediating the biological exteriorization/actualization process of the human being (2006c). As such, media supports the transduction between the virtual defined as "the capacity, so fundamental to human experience, to be in excess of one's actual state"(Hansen 2006b, p.50) and the medium or environment of actualization.²⁴ The digital form of media becomes of intrinsic worth to the human in mediating such transduction because of the autonomy of its code. The digital code is formless and can be executed and informed only when coupled with the human body, becoming accessed and processed, thereby becoming open to virtualization, differentiation and singularization. However, the enabling of this singularization means displacing media as the source of experience, as we

have observed in our previous account, to be sourced by human experience and viewing it instead as an extension of human embodiment.

Hansen's analyses of artworks exemplify the separation between science as a field of cognitive representation, modeling and technology as an agent of material complexification in *Embodied Technesis* through applying a separation between the subject and the artwork in his following books, *New Philosophy for New Media* and *Bodies in Code* (2006). In the former book for example Hansen (re)deploys the embodied dimension in interacting with new media interfaces such as Digital Facial Interfaces (DFI), these are types of interfaces that have a relative similarity to the embodied conversational agent interfaces (ECA) in chapter one but they are designed to elicit purely aesthetic effects. The DFI are represented by eight artworks where a division is realized between female/male images that rearticulates the corporeal/dialectical shocks. The first four artworks Hansen uses represent interacting with female images: *Dream of Beauty 2.0* (Kirsten Geisler 1999), *My Kissing Vinoodh (Passionately)* (Inez van Lamsweerde 1999), *Portrait One* (Luc Courchesne 1990) and *Touch Me* (Alba d'Urbano 1995). The other four artworks represent the interaction with male images: *Colour Separation* (Mongrel 1998), *If/Then* (Ken Feingold 2001) and *Sinking Feelings* (Ken Feingold 2001), and *Huge Harry* (Arthur Elsenaar 1997). This change in the *gender* of the image is accompanied by a shift in language and linguistic capacities. While the female DFI Hansen's uses lacks language and conversational aspects, thus exhibiting limited dialectical interaction, all the selected artworks of the male DFI have language, exhibits verbal and nonverbal

communication. Another shift between the two groups is in the *function* of the image. The analysis of the 'male' DFI represents the 'genetic element' of the image, where affectivity is seen as a medium of the interface that catalyses "affective heterogenesis" (Hansen 2006b, p.159). However, the female DFI and their materiality are identified as vehicles of "embodied heterogenesis" (2006b, p.30) (of matter complexification of the cosmos). This analysis does need not to expand the comparison of patriarchal or political issues that might be involved in Hansen's account but it aims to focus on the transformation of Hansen's model of embodiment into artworks. The previous two elements, corporeal shock and embodied affectivity, inform us that Hansen's model of interaction is limited to female images. This is not all. As Hansen's model in *Embodying Technesis*, addresses technology in its generic form, as well as the technological whole (e.g. its history, materiality and embodiment), then, the application of his model goes beyond the embodied interaction with female images. Rather, it is the technology that is female or woman (this is in accordance with Hansen's reference to gynesis as 'the putting of women into discourse').²⁵ Identifying the female image as the site of the embodied model informs us that the participant in the embodied interaction account is a male participant. It also informs us that the "qualified autonomy" to which Hansen limits the reproductive technology's cultural role is the pregnancy phase. Thus, Hansen's analysis of artworks could be divided into two parts: the first one is the male/technology (where technology is feminized or represents a female) physical interaction and second technology (female)/image dynamic interaction, which he transforms into virtual reality environments. Focusing on Hansen's analysis of the female images as the

elicitors of corporeal shock, he insists on mapping this matter or materiality to the participant's embodiment; that is the affective response to the image – rather than the cognitive or dialectal.

this digitally generated image, ..., does not need us, will continue to exist in total indifference to our efforts to engage it, and can have meaning for us only to the extent that it foregrounds the source of our affective response- our constitutive embodiment, which is to say, the profound divide between its materiality and our own (Hansen 2006b, p.143).

The participant's efforts are seen as attempts to establish, in vain, conversational contact with the image. This experience is illustrated through the interaction of the participant with *Dream of Beauty 2.0* (Kirsten Geisler 1999) and *Portrait One* (Luc Courchesne 1990), where the participant tries to initiate a conversation with the images but he only feels his irrelevance to the images' world (2006b, p.138) or realizes that his "social assumptions" are threatened with contamination (Hansen 2006b, p.140). While the first image responds only with sounds and mocking smiles, the second one detaches herself from the conversation. The dialectical contact failure brings with it the participant's experiences of alienation which catalyses an "intolerable affective reaction" (2006b, p.143). The other two images elicit the same affective reaction but while the still image of *My Kissing Vinoodh (Passionately)* (Inez van Lamsweerde 1999) does not allow a 'ready bridge' for physical contact between it and the exploratory viewer, *Touch Me* (Alba d'Urbano 1995) makes this contact concrete in that it "does more than simply use digital technology to expose the bodily dimension of image perception; it engages participant- viewer tactilely with the informational materiality of the digital image" (2006b, p.141).

Foregrounding this tactile dimension and the embodied affective response as the basis for the interaction fits with Rushton's argument that for Hansen,

the significance of new media does not lie in the qualities of its objects, but rather in our responses to it. The specific qualities that make new media new have little or nothing to do with the properties of those media, and have everything to do with what they allow subjects – those who encounter new media objects – to achieve (Rushton 2008, p.122).

Rushton's point that the variation in qualities and properties of new media has little to do with the embodied experience accords with Katherine Hayles' point that for Hansen, vision cannot

be allowed to be the dominant perceptual sense, or even on a par with privileged faculties that (not coincidentally) are much more difficult to automate, particularly what he calls "affectivity" (Hayles 2008, p.105).

As Hansen has already bracketed the technology within the role of being a vehicle of reproduction, and mapped its impact to sensorimotor shock, it seems that the response of the subject in technological situations is already predicted. This response as we have previously seen is the result of "the punctual shock of the confrontation with the alien digital and the contaminating seepage of the protracted engagement with the virtual persona". What the digital image (of a female) allows for Hansen is "a new mode of framing or the actualizing of the virtual" (2006b, p.75) and a virtualization of the participant's body. Virtualization, which Hansen bases on Gerogio Agamben's definition of potentiality (2004a, p.361), could be understood as the body's existing but un-actualized potentiality to be in excess of itself and to create the new (Hansen 2004a, p.361; 2006b,

p.146). Affectivity's definition here is limited to the interruption of the sensorimotor circuits and so it does not expand to emotions and feelings (embodied affectivity is discussed in chapter four but here it is noticed that the embodied experience does not go beyond the experience of *Erlebings*).

Another account based on this relationship between embodiment and technology but extended to technologies that involve racial issues occurs in the digitizing of the racialized body in Hansen's book *Bodies in Code*. A body-in-code is defined as a body "whose (still primary) constructive or creative power is expanded through new interactional possibilities offered by the coded programs of "artificial reality""(Hansen 2006a, p.38). New media, here, preserves its context as a vehicle for, let us say, heterogeneous images that is images showing racial differences and thus eliciting different racial affects and responses. The agency of digital technology is explored in its being a mechanism for "*ethnic* differentiation" where Hansen declares that "ethnicity has *always* been technical" (2006a, p.162), and for forging a "whatever body" that is a racialized image without identity through the experience of impropriety (which could be understood as a form of the experience of *Erlebnis*). This analysis does not aim to expand the argument of the racial issues in new media but it focuses on the deployment of Hansen's analysis of the interaction between new media and human. Since Hansen's books are focusing on new media, the racial context could be seen as supplemental to the corporeal model in technological situations, which represents the shift to the experience of *Erlebnis* in the modern economy of experience. It could be read as another aspect of the

patriarchal culture Hansen embeds or embodies in his discourse of technology (female) where it participates in the reproduction process but as pointed out previously, for Hansen, it does not create the “theoretical significance” of the production. To apply this model, Hansen focuses on artworks of artists that utilize racist techniques such as those techniques used by artists like Keith Piper which deploy the relationship between new media, race and image. For example, these artworks identify the racial image with violence and thus present social difference as a “universalization of the violence” (2006a, p.157). This universalization is the result of a “racial epidermal schema” that refers to the stereotyped images imposed on the black body by white society (2006a, p.156). These images influence the black body’s perception and identification of itself; especially when identification is understood as a lived and felt embodied experience of the racial difference. Hansen states,

Identification not only crucially involves subrepresentational processes of bodily life, but these latter- insofar as they comprise the processes through which the effects of differences are actually lived or felt – are what makes differences matter (2006a, p.152)!

In this sense, the black person identifies his/her self only from the outside (2006a, p.152) and experiences his/her body as an object of the white man’s gaze (2006a, p.151). In other words, its embodiment is reduced to image. For the white body, its imposition of the “racial epidermal schema” or stereotyped images on the black body becomes a source of “an anxiety-inducing, phobia image” as it interrupts the white man’s efforts to “preserve the illusion of imaginary integration” (2006a, p.155)! The black body acts “as *the corporeal reminder of the biological itself*, as the dimension of the living ... that simply

cannot be denied, no matter how forceful and complex the mechanism of projection may be” (2006a, p.155). Therefore, for Hansen, as long as the digital image deploys this reduction of the embodiment of the black body to his appearance, it actualizes the bankruptcy of the image and exposes “the utter incongruence of the black body with any form of embodied life” (2006a, p.157). The image becomes the site for violence because for the black man it represents its reduction and for the white man it is an obstacle to his humble aim of integration. Similar to the DFI, the racial image, then, induces an embodied experience (identification and anxiety) and elicits an embodied response (violent reaction).

Another characteristic of the works utilizing racial techniques is “the universal addressability” (2006a, p.168) that is the addressing of everyone black and white alike. Hansen celebrates Piper’s work,

I would suggest that Piper’s concrete engagement with technology as a site of dedifferentiation and universality [among viewers] must be understood in the dual mode of confrontation and invitation. The result is a significant complexification: not only is the address to black subjects nuanced in a way that routes self-perception through perception by the other (that is, through the surveillant and/or consumerist gaze), but also the address is opened in an unprecedented way to nonblack, nonminority white subjects (2006a, p.159).

Being universal, these technologies can fulfill Hansen’s aim in prioritizing embodiment over cognition, and the rethinking of the subject’s identity in relation to the image or, in this context, the racialized image these technologies deploy. Thus, Hansen stresses that these technologies “catalyze an experience

of impropriety” (2006a, p.168) which “dethrones the image in favor of embodied excess” (2006a, p.149). Moreover, defining affectivity as the medium for the experience of impropriety of life (2006a, p.148), the confrontation with these stereotyped images results in the experience of incommensurability that mobilizes the “viewer affectivity as a mechanism for experiencing the excess of embodiment and for deploying it toward the forging of a collective “whatever body”” (2006a, p.149). In this sense, affectivity, in both, the confrontation with the DFI and the universal racial technologies, is utilized to “engage with the digital processes of image production” (Hansen 2006b, p.137). Most importantly, in this account, is that the forging of “whatever body,” which, here, refers to the raced image, is identified as “a singularity without identity.” The deprivation of any identity prevents its identification with or interpellation of the subjects interacting with the universal technologies. At the same time, as it is the biological reminder that constrains these subjects’ excess of embodiment, thus leading to anxiety and incongruity, it can become the site for their violent exertion. Hansen declares,

Stripped of any positive meaning for the subjects that it would mark, the raced image can function all the more effectively as an instrument of control. Without the power to interpellate subjects as raced subjects, the raced image can no longer broker processes of identify formation and struggles for social recognition and, in effect, remains in force solely as an instrument for social techniques for identification, classification, and exclusion. The result is a profound paradox of our contemporary moment: the subjects targeted by these racist techniques can only misrecognize themselves in the images that, for this reason, manage all the more effectively to exert their violence upon them (2006a, p.172).

To achieve this identity-less singularity and delimit the subject's excess of embodiment three points could be considered. First, new media can facilitate the experience of impropriety through an identity/body split (*generalization of identity passing*), where racial identity is identified as "a performance of pure conviction" without bodily foundation (Hansen 2006a, p.145). In this sense, racial identity is "a purely disembodied simulacrum", that is an imitation of an imitation of the other imitating the person (2006a, p.146). Acquiring an identity becomes "to 'pass,' to perform or imitate a role, norm, or stereotype that is itself a cultural performance" (2006a, p.145). Second, the reinvestment of the embodied excess requires an identity/image decoupling (*suspension of visibility*), which forms "the precondition for a reinvestment of the body *outside* the image" and facilitates "the performance of identity beyond the constraints imposed by physical appearance" (Hansen 2006a, p.143). In this way, universal technologies expose "the bankruptcy of identity categories as a prosthesis for our bodily singularity" (2006a, p.168) and, thus, help to rethink identification beyond image visibility.

Third, the reinvestment in embodied excess through catalyzing the experience of impropriety requires an image/body 'absolute discontinuity' (*erasure of the lived body and attempting multiple representations*) in online identity play. The discontinuity between the racialized image and the lived body of the subject can go with the problem of thinking racial difference through interpellation defined as "the hailing of the embodied individual that confers identity and agency" (2006a, p.148) and forces "a *wholesale* replacement of the lived body with a new

prosthetic body” (2006a, p.146). As interpellation takes place “always at the expense of some dimension of embodiment,” (2006a, p.148) it constrains bodily excess through identification based on identifying the black body with the biological. Due to universal addressability in online identity play, the racialized image that is the text-body cannot have,

... analogical correlation with the flesh-and-blood body of the user outside the virtual space; put somewhat differently, it lacks all force to compel the subjection of this latter body. (2006a, p.144).

Adding to the previous point the suspension of visibility that preconditions the interaction with universal technology, this “absolute discontinuity” leaves no racial bodily markings on the player or participant. As Hansen expresses:

The absolute discontinuity between the materialized body and the lived body means that there is simply no possibility for embodiment to form a site of resistance within the process of interpellation; insofar as it constitutes a prosthetic body that replaces the lived body, passing can leave no bodily residue that could be made visible or otherwise rendered culturally intelligible (2006a, p.145).

All these factors mean that the racialized image or “whatever body” forged by racial technologies deploys a singularity but without identity as these images fail to interpellate the subject with identity. Hansen also explores the type of affectivity that fills the gap between the subject and the ‘raced image’, which he identifies as “affective confusion.” That is “the experience of one’s incongruity with oneself” (2006a, p.168) which means one’s embodied excess in relation to one’s *fixed* identity. This incongruity comes from work (e.g. Piper’s) which “confronts us with this incongruity *in the other* – the other’s incongruity with itself – in a way that compels us to recognize it in ourselves” (2006a, p.169).²⁶

This re-embodies the racialized images as a bodily affect, “as an affectivity always in excess of the image’s desire to fix the body (and the body’s capitulation by the image)” (2006a, p.169).

The second aspect Hansen mobilizes from his theoretical account into his analysis of artworks, in particular those artworks utilizing virtual reality environments, is the “qualified autonomy” of technology due to its role in the process by which matter ‘self-complexifies’ or bodies-in-code are constituted. This autonomy and process in relation to the transformation of the female body and its reproduction role could be understood as a transformation of pregnancy. Thus, what characterized this analysis in both books is “the passage from interactivity to dynamics” (2006b, p.167) where a dynamic coupling takes place between the image’s environment and body. The body or participant, here, refers to a female as this account moves from embodied subject-technology interaction to technological autonomy. Virtual environment (VE) or the digital any-space-whatever (ASW) which Hansen defines as an internal bodily spacing or framing – and not a type of technical image – that can be “felt only by the body” as it lacks any contact with human activity (2006b, p.205), shifts the interaction “from the empirical deployment of touch to its infraempirical basis in primordial tactility” (that is infratactility or self-movement defined as the body’s action on itself) (2006a, p.122).

Hansen criticizes the accounts foregrounding vision and visual perception in the analyses of virtual reality environments, (Hansen 2006a, p.165; 2006b, p. 118). He advocates a *functional* perspective (2006a, p.117) based on

nonrepresentational and non-visual affectivity (2006a, p.112). Perception, instead of being a matter of representation, is redefined as “a process of construction or data-rendering that takes place in the body-brain” (2006b, p.167). It gains its embodied basis through the “mapping of space *into* the body, through a conversion of an external, geometrical space into an internal, dynamic space” (2006a, p.122). On the one hand, the body and the internal space “are dynamically coupled so that change in bodily motility ... necessarily correlate with changes in lived spatiality” (2006a, p.134). On the other hand, the dynamism of this space; that is “the spacing of the embodied organism” within the body (2006a, p.177; 2006b, p.122), is the source of affectivity or sensation in these environments. This self-movement of the materialization is the “infralinguistic body.” The infralanguage forms the “infraempirical basis for sensory exchange” and concerns “the production of spatiality by the body” (2006a, p.257) that converts forces into affects (2006a, p.190). In the previous accounts the infralinguistic body could be understood as the cosmos. The

spatializing power of the body [infralanguage body] exemplifies the more general capacity of the infralanguage to decode forces into affects, to convert information originating in a material environment into meaningful experience-experiences capable of affecting the body (2006a, p.191).

To summarize, by ‘embodying technesis’ Hansen’s aim is not a rejection of technesis but embodying a certain model of technesis in the interaction with technology. This model of technesis conjures up technological materiality, its operational perspective and the corporeal experience of *Erlebnis*. The model is projective in that it transforms the female body to technology and projects a

certain subjective, patriarchal views in the interaction with it. By putting this model into technological situations, Hansen's work positions technology in direct contact with the subject's embodiment but denies the technological impact on the subject's cognition. The interaction places the human in relation with the materialization of images and the environment. However, as Hansen restricts the interactive experience with new media to *Erlebnis*, an immediate short-lived experience, he prioritizes the excess of embodiment over the image.

In *New Philosophy for New Media*, Hansen argues against Gilles Deleuze's transformation of Henri Bergson's theory of embodiment to cinema. Such transformation, Hansen insists, has disembodied the centre of indetermination and, thus, he intends to reverse Deleuze's reading of Bergson's centre of indetermination. The term 'centre of indetermination' is taken from Bergson's book *Matter and Memory* (1896) and refers to the living being. Deleuze has borrowed the term in his transformation of Bergson's work to cinema. The next section elaborates this transformation whereas the difference between Hansen's and Deleuze's accounts in relation to perception and affection will be discussed in the following chapters.

2.3. Deleuze on cinema

Colebrook (2006, p.15) points out in her defense of the philosophy of Gilles Deleuze that "the essence of the cinema" for Deleuze is "what cinema might be: its power or potential". For the cinema to give a body, it needs a body to take or take from. That is its "revolutionary potential, a potential to transform the ways

in which perception orders its images, and thinking is only when it is creative, when it does not repeat the already formed and recognized” (Colebrook 2006, p.15). It is the human body, then, in which Deleuze defines the power and potentiality for an embodied cinema. This transformation proposes a mystification between the cinema and the real world that motivates analogical thoughts of Deleuzian cinema such as “the cinema is not a cinema”, “the camera is not a camera”, “it is not mechanism, it is machinism,” a body, world or life- therefore suggesting another level of metaphoric complexity between cinematic technology and philosophical liberation. This mystification and complexity is welcomed for being a consequence of Gilles Deleuze’s contribution to philosophy and film theory.

Deleuze’s approach is that cinema can transform philosophical thought, which means his analysis of films (and the understanding of this analysis) does not stand side by side with his other philosophical books such as *Difference and Repetition* (1968) and *A Thousand Plateaus* (1980) but within them. In cooperation with Félix Guattari, he puts forward an essential contribution to philosophical thought, which defines philosophy as the creation of concepts. Taking concept-creation as the essence of Deleuze’s philosophy, Deleuze studies have always focused on understanding Deleuze’s concepts. Philosophical concepts, for Deleuze, have specific characteristics. A concept is active, creative and transformative. This is because a concept as a whole or a unit consists of variables that change based on the situation or problem (Stagoll 2005, p.50-51). The concept has reached a state where it can be defined but its

components are always in a process of becoming. Because of their becoming, concepts create possibilities for thinking beyond what is already known or assumed and allow the expansion of difference in thinking by forming new connections with other concepts. Becoming, fragmentation, and multiplicity are central for understanding any Deleuzian work. The sources Deleuze uses in his work are themselves seen as a contribution to current philosophy. This is because Deleuze tends to revive and interpret the work of philosophers termed as “traditional figures” (Colebrook 2002, p.3) in a way that differs from mainstream Western thought, which is focusing on being and presence (Colebrook 2002, p.3). The complexity and also the contribution observed in Deleuze’s work are not because these works are the resources for Deleuze’s work per se but because Deleuze brings those resources to his own work. In other words, he returns to those philosophers who seem to be virtual sources of the past, or of historical memory, and extracts from their work elements or points that become immanent in his own work. It could be argued that extraction in Deleuze’s context has a special meaning as selecting the qualities of certain points and empowering them to form a field of singularities or ‘any-whatever’. As Ian Buchanan states, “one can safely say D & G’s work has consistency but not constancy- concepts change their meaning between books, indeed sometimes within books” (Buchanan 2008, p.1). The above characteristics are consistent in Deleuze’s work as Buchanan’s quotation suggests but they are not constant because on the relation or the in-between always constitutes: that which changes (a molecular field is one of Deleuze and Guattari’s concepts used in *A Thousand Plateaus* (1980) to refer to this changing layer) due to the

terms or concepts participating in its formation, and that which is constant (a molar field that refers to the state of reaching a totality or a structured organization through which it can be defined). In this sense, any relation emerges as a new one.

The two cinema books, Deleuze has written, *Cinema 1: The Movement-Image* (1983) and *Cinema 2: The Time-Image* (1985), have been developed within a philosophical view that allows the transformation of thought beyond the experience and thus as “a processual system” that is “an open-ended practice of making concepts” (Colman 2011, p.22). It creates new concepts such as movement and time images. Colebrook points out this potentiality of philosophical transformation in Deleuze’s project,

Confronting cinema will open us up to a new philosophy, and it will do so not because we apply philosophy to films, but because we allow the creation of films to transform philosophy (2002, p.29).

The difference between the two statements is essential because the application of philosophy to films requires the breaking of philosophical thought into theories, approaches or frameworks, aims and objectives. In other words, it becomes a methodological thought and, in doing so, it loses the main character defining Deleuze’s philosophy, which is the relational movement between the broken pieces that constitutes their molecular becoming and opening. Unlike methodological thought that is based on what is induced or deduced from a field of study, philosophy as creation of concepts for Deleuze is “not the acceptance of already formed images of what counts as good or commonsensical thinking”

(Colebrook 2006, p.1). Rather the deduced or induced, first comes from a relation and then proceeds by creating a different relation. Deleuze makes this point clear as he states, “it is obviously not through the influence of science that our relationship with the brain changed: perhaps it was the opposite, our relationship with the brain having changed first, obscurely guiding science” (2005b, p.204) The guide and the guided is not procedural but relational. The cinema that transforms philosophy is the one that is relational. Here, films are not seen by the totality of their frames or the number of images they deploy but by the relations these frames, images or the films as wholes co-form among themselves and between them or/and their relations to the outside.²⁷

In order to avoid the technicality of such philosophical transformation that admits the latter to segmental application, and simultaneously, to avoid the mere transformation of the technicality of the body, which could be limited to its organs and functions rather than powers and relations, Deleuze turns to Henri Bergson’s theory of embodiment. This transformation makes the cinema homologous to the human body and, thus, affords it an embodied reality of movement and duration through which it can perceive, affect, act and create difference. In his first volume of Cinema, that is *The Movement-Image*, Deleuze states “with the cinema, it is the world which becomes its own image, and not an image which becomes world” (2005a, p.59) but in the second volume, that is *The Time-Image*, this shifts to conceive that “the cinema does not just present images. It surrounds them with a world” (2005b, p.66). In the first statement, Deleuze draws on Bergson’s conversion of matter and body to images where

the cinema can be said to provide an opaque screen that turns the unperceived image of the world into a perceived one with light and materiality.²⁸ Such placement enables the world to be represented.

The second statement shows progression from presenting the image of the world to instigating new images, consequentially, bringing about a different world or images. Thus, Deleuze's cinema is not of representation but of difference - a world that can only be composed by the cinema's body; the way its camera sees and moves, the way it is shot and frames, it closes-up to things or moves closer to or further away from them. This is a body that has its own organs that function relatively in a similar way to the human organs- or at least this is what defines the concreteness that we can make the most of them, starting from what we are familiar with, from a habitual stand (as in the case of Hansen's transformation), from that which we do not put into question. Nevertheless, while some of us are caught in the question of similarity and difference, others proceed to that which makes those bodies different. Moreover, what makes them different is not that which is not similar to us but that which marks their peculiarity or singularity. It is that 'whatever' we cannot attain. Because although the difference could be elicited between the elements (between body and body or eye and eye in human and cinema), it is only included in their wholeness in the whole of a human system and cinema system; their bodies, functions, qualities and relations, the way they compose and decompose, act and react. That is the undoing of mere repetition or, more precisely, redefining repetition as inhabited by difference, where the materiality

is the envelope of the spiritual that involves coexistence and virtuality (2004, p.106).

It is in the whole, the spiritual that the difference is included although it is subtracted from the repetition of the elements (2004, p.106). This understanding of the Deleuzian-Bergsonian account as a repetition inhabited by difference enables us to appropriate Deleuze's work in cinema by not considering it as homologous with the flux of the universe but as, in itself, a flux of the universe. That is the cinema does not only represent images of the world from without but adds to them images from within so it is capable of depicting embodied constituents such as perception and affection. This embodying of the cinema using Bergson's theory elevates the cinema not only from being a representational medium of appearances but also from being a merely communicative medium. As an individuated being in the world, it can relate and thus create a world of wholeness that can expand beyond the image.²⁹ The image and the cinema are each a being for and in 'itself'. Each being not for or addressing anyone as such moves them from independency to relationality and therefore from being to becoming. Yet the becoming-being and being-becoming are inseparable, but a continuity of each other.³⁰ In other words, a manifold autonomous organism that exists for itself, but its very existence is in its relational and thus continuous variation. Colebrook recognizes such singularity,

In order to understand what is cinematic about cinema we need to ask how cinema works. It takes a number of images and connects them to form a sequence, and it cuts and connects sequences using the inhuman eye of the camera, which can therefore create a number of competing viewpoints or angles. What makes cinema cinematic is

this liberation of the sequencing of images from any single observer, so the affect of cinema is the presentation of an 'any point whatever'. Our everyday seeing of the world is always a seeing from our interested and embodied perspective (2002, p.31).

The '*any point whatever*' or the 'any anything whatever' where the *whatever*, as Giorgio Agamben states, "relates to singularity not in its indifference with respect to a common property (to a concept, for example: being red, being French, being Muslim), but only in its being *such as it is*" that is "for its being-*such*" (1993, p.1-2).³¹ Singularity is what comes with Whole difference or the different Whole as a point of intensity (affect and quality) rather than extensity (perception and quality) where the former is durational and the latter is spatial as Bergson's thesis in *Time and Free Will* (1950) shows (this is elaborated in chapter four of this thesis). The cinema for Deleuze is the liberation of the natural setting, natural perception and affection. Although Deleuze indicates that "certain great movements are like a director's signature" (2005a, p.22), he advocates that even though the genuine creation cannot but return to its creator it also cannot but separate from it. As such, the composition becomes a new entity where its aesthetic resides in its singularity and deterritorialization; basically, it is the aesthetic of *difference*. The cinema does not provide possibilities in that it does not "double like with like" (2004, p.263). As such, it is the doubling of human eye with human eye, human movement with human movement, and human perception and affection with human perception and affection. Body is what provides the cinema its visibility whereas time and movement characterizes its subjectivity without granting it any characteristics. This is because the notion of 'becoming', keeps the cinema as 'becoming-

cinema' where it identifies with its histories and the world of realities, a world of virtualities that prevents its decline and reserves its cinematic whole.

The cinema creates virtualities. Deleuze's definitions of the virtual tend to propose its being in embryonic states (e.g. a structure, pure recollection) and therefore it could be differentiated, multiplied, and in continuous change even within virtual contexts. The virtual for Deleuze is real as it is completely determined but not a whole (1994: 209) as it lacks the relation of the actual existence. Its content, as a structure is determined by differentiation but its actualization is expressed through differentiation, which becomes a genuine creation (1994: 212). Whereas differentiation holds the singular points and the varieties of relations, differentiation pertains to the qualities and the quantities actualizing the varieties and points.

The concepts of movement and time are central to the two volumes of Deleuze's books on cinema. Both volumes *The Movement-Image* and *The Time-Image* stress duration as if cinema is a being in time. '*The Movement-Image*' presents time in indirect way:

Thus time is subordinated to movement and represented only indirectly through the agency of movement in two ways. First it is reduced to a constant (in Muybridge's case, 1/100th of a second), repeated as equidistantly spaced intervals. Second, it is restricted to a line of action; it flows only through rationally segmented, contiguous movements. Time serves here as the measure of space and movement; it can only be "seen" through the intermediaries of space and movement (Rodowick 1997, p.8-9).

In this volume Deleuze celebrates the cinema wholeness as a 'machinism' of the presentation of the planes of immanence, which are defined as movement

established within, between, across and over systems, that affects them and prevents them from being absolutely closed. The cinema as the “machine assemblage” (2005a, p.61) of the movement-image becomes in itself a plane of immanence which establishes movement and relations between images, objects and frames and opens them to duration and the open whole. Crediting the camera with extracting movement from objects promotes its cinematographic movement-image as an advantage of the machine’s ‘natural perception’ (that of being presented in a single movement and duration) over humans’ halting natural perception. Moreover, the cinematographic consciousness is perceived in dividing duration according to objects and sets and uniting them in a single identical duration, which is immanent to the universe. Eventually, everything transduces out of its boundaries to the realm of virtuality to communicate with other systems in the universe; the whole film and the frame moves out-of-field, perception moves to a gaseous state where the reaction could take any-point-whatsoever in the universe, and affection to a cursed force fragmenting the whole and relegating it to dedifferentiation.

Ronald Bogue (2003) has noted the triad in Deleuze’s cinema books in his elaboration of Deleuze’s classification of signs and images where the latter has used “Peirce’s three modes of being ... as tools for developing and extending Bergson’s three types of movement-images” (2003, p.67). Deleuze states, “and each one of us, the special image or the contingent centre, is nothing but an assemblage of three images, a consolidate of perception-images, action-images

and affection-images” (2005a, p.68). Bogue identifies six movement-images x three signs for a total of eighteen signs in the cinema books (2003, p.65-69).

The focus of the coming text is not to expand on the signs account but to point to a different type of tripartite in relation to perception and affection images. Deleuze’s account seems to start from embodied reality to virtual reality, a becoming or relational one, and finally a transition takes place. Of any three forms of progress, the middle one is the signalled one as Deleuze insists, “the essence of a thing never appears at the outset but in the middle in the course of development when its strength is assured” (2005a, p.3). Cinema itself follows this trilogy as it starts from giving us instances or movement-images, which are mobile sections and not images “to which movement is added” (2005a, p.3). At that point of duration, the cinema has its own problematic of reconstituting movement, which is related to its being ‘new’ and, thus, its shot is limited to fixation and depends on combining the shooting and projection apparatus (2005a, p.3). The cinema has thus developed from projecting instances to actualize movement, to a system that “reproduces movement by relating it to the any-instant-whatever” (2005a, p.6). This advancement as Bogue explains, is related to a change where instead of time being viewed as “a string of indivisible, quintessential moments,” which are poses, it is now seen as “a sequence of equidistant, indifferent, and interchangeable instants” (2003, p.22) that are sections.

Deleuze, here, refers to a change in the *meaning* of the notion rather than the notion or principle itself (2005a, p.6). There are moments and there is a

movement. It could be said that the moments actualize the movement as an ideal synthesis of selected poses or privileged instances. But, for Deleuze, it could also be said that the moments now belong to the movement and are immanent to it (2005a, p.6). There is a section of movement and the moments are selected snapshots based on a “sensible analysis” of the movement (2005a, p.6). The snapshots give the impression of the movement’s continuity. There is no opposition between the synthesized (transcendental) and the analyzed (immanent) as any moment could be privileged, extracted and become any-instant-whatever.

Deleuze refers to Eisenstein who extracts “moments of crisis” from movements, which are termed the “pathetic” (2005a, p.5). Being ‘extracted’ does not mean that they are torn away from the movement so that the latter does not belong to them any longer. Rather their singularity has gained a power peculiar to them, which Deleuze refers to as ‘a qualitative leap,’ that differentiates them from other singular points and allows them to make their own conjunctions.³² The accumulation of instances is through quantitative process but the extraction is qualitative (2005a, p.6).

Similarly to other arts where poses or forms of a dance, ballet or mime are abandoned in favour of movement (2005a, p.7), the cinema allowed certain remarkable and singular movements such as the mime of Charlie Chaplin to obtain a continuity and space, thus changing even our conception of what power a mime has. The essence of cinema is in this formation of any-instant-whatever and thus it participates in the birth and formation of the new, whether

this is a new way of thinking and perceiving, of giving new meaning and affects, or of philosophizing (2005a, p.7-8).

The final stage is that “movement expresses a change in duration or in the Whole” (2005a, p.8). The duration never stops changing. Deleuze’s reference to Bergson’s example of putting sugar in a glass of water and waiting explains this point. Bergson explains the waiting as an expression of duration, as mental and spiritual reality. In this sense, the cinema’s focus, for Deleuze, could be seen within the internal movements and relations among images, objects and frames, and then its relation as a whole to the open universe. But, then, Deleuze asks whether Bergson has overlooked the physical reality of the subject. Would not this also have meant that the change of the whole, besides being objectively in continuous change, is subjectively determined? The subject who changes the whole by speeding up the movement, which expresses the change in the whole:

If I stir with the spoon, I speed up the movement, but I also change the whole, which now encompasses the spoon, and the accelerated movement continues to express the change of the whole (2005a, p.9).

For Deleuze, Bergson here wants to demonstrate the qualitative change expressed by movement in the whole, that is, a change from the water containing sugar lump to sugared water. Deleuze differentiates between two types of movement: translation, which takes place in the qualitative change objectively without subject interference and transformation, which is related to the subject’s stirring. The subject could wait, move the spoon in a slow or fast motion, or move the glass in a circular way, in which case the subject also

identifies and selects the objects, duration and movements to change the whole. The subject does not only *accelerate* the movement but actually inputs a *difference* by proposing a different movement than the one that existed between the objects in the 'natural' setting. This is important point when we consider Hansen embodying *technesis* as an interactional model that deploys a constant model of embodiment based on functional perspective, thus, although the technology, media or even the terms or concepts change, the relations and the new are predictable achievements. Simply, Hansen's perspective is interactional while Deleuze's is relational. The former is determined by a perceptual view where change is determined by the subject's action (this will be seen in investigating Hansen's view of embodied perception) while the latter presupposes a prepersonal level (this will be expanded in the next part of the thesis which elaborates Gillbert Simondon's concept of becoming that has a great influence on Deleuze's philosophy). For the mean time, this difference informs us of Hansen's motivation to liberate the subject from Bergson's and Deleuze's model of embodiment.

The same triad is deployed in perception and affection. It should be noted that in all cases, the middle form is the form of becoming or the creation of singularity. Perception, in its first form, is embodied as a subjective image and its varieties based on how the camera's vision (cinema eye) isolates, selects, transforms and reflects it. Between it and its objective image *there is a comparison* defining it to be from the set and the latter external to the same set. Here, the frame "isolated and solidified the image" (Deleuze 2005a, p.82). Then,

the second form of perception is an image of a liquid perception actualizing the camera consciousness as it flows across the frame (2005a, p.82). Between it and its objective *there is a relation* defining “the possibility of passing from the subjective to the objective pole” (2005a, p.79). This passing is the transitory of a molar state to level its molecular state as the latter gets subjectivised. Between the molecular of liquidity that signals a state of flowing and becoming, and its objective as a molar of solidity that the former reforms or effaces (2005a, p.82), there is an ongoing interplay of relations as the molecular’s merging forms new relations. The final form of perception is the gaseous perception, “defined by the free movement of each molecule” (2005a, p.86). This is the going “beyond perception” (2005a, p.85) that is the liberation to the imperceptible which is different from going “beyond the limits of perception” (2005a, p.86) where the limits still impose a definable boundary of perception found by liquid perception. The imperceptible is of material nature, thus, it is ‘pure perception’ of matter itself and its physical movement. Pure perception is the image itself (this difference is established between the French school and Vertov) (2005a, p.86). Between the subjective and objective images *there is* ‘any point whatsoever’ and what ‘*whatsoever*’ seems to designate, here, the erasure of subjectivity, that is de-subjectifying, where molecules do not condensate in any form of subjectivity. There is no subjective molecule because once the solid layer is effaced, the liquid changes into gas and evaporates due to external powers. Deleuze defines this objectivity as “to see without boundaries and distances” (2005a, p.83). It is the chaotic state of perception.

The affection-image applies the same progression starting, first, from affects as being an embodied entity expressing quality or power and constituted by a “combination of a reflecting, immobile unity and of intensive expressive movement” (2005a, p.90). It is the face, or the close-up of the face of any object that captures or takes part in the “absolute change” (2005a, p.98) that expresses “a mutation of movement which ceases to be translation in order to become expression” (2005a, p.98). This ‘mutation of movement’, which is a micro-movement, appears as “each part taking on a kind of momentary independence” (2005a, p.91) before joining the crowd. While ‘mutation’ might refer to the movement that is taking place without consciousness’s knowledge, ‘momentary independence’ marks each part’s individuality and degree of willingness to relate to other parts and participate in this intensive movement, depending on the particular case. This explains the movement’s successiveness that allows the differentiation in quality by which the Power passes. Therefore, affective movement is collective, intensive and successive (which is Bergson’s qualitative progression as discussed in chapter four of this thesis).

The face has two poles. First, it has a (reflecting) surface that is its ‘outline’, which runs between its different parts (e.g. eye, nose and mouth) on the immobile plate. Second, it has a trait that is its ‘content’ carried by its fragmentary parts and broken lines as intensive micro-movements. Although not in strict terms, the outline-face is a reflexive or reflecting face dominated by a fixed thought “without becoming” (2005a, p.92). The links between the face and

the thought are arbitrary (2005a, p.92), thus the links between images have associative or anticipatory roles (2005a, p.93). It expresses “a pure Quality” that is “common to several different things” (2005a, p.92). In other words, a pure Quality such as the ‘white’ or ‘hard’ face links a number of images that the white or hard quality are found in. On the other hand, the intensive-face expresses a pure Power defined as “a series which carries us from one quality to another” (2005a, p.93). There is another movement in Deleuze where the medium shot and the full shot are treated “as *close-ups*” (2005a, p.110). This movement is not away from the close-up but it is a movement towards the close-up, where the space or background joins in.

The second type of affection-image that represents its genetic element is the spiritual affect presented directly through *any-space-whatever* as pure potentiality. This space is characterised by fragmentation, which allows heterogeneity and thus succession among its parts (the face and the space have the same characteristics: fragmentation, successiveness and intensity). In this sense, it also identified with power and quality and is similar to the face. Affection-image then, progresses qualitatively (as will be described in chapter four) to relate heterogeneous elements in a virtual field of relations or connections that is its collective aspect. The space starts to be constructed fragment by fragment.³³ Singular points (e.g. the bridge views, the rain drops) start to sympathize with each other, change their nature, lose their concepts, join in and become pure quality, that is affects (2005a, p.114).

Deleuze uses Joris Ivens's works *The Bridge* (1928) and *Rain* (1929) to exemplify how a set of singularities makes up the 'any-space-whatever' as pure quality or power.³⁴ The drops of the rain, the images they reflect and the movement they follow join the space while the rapid montage of the multiple unrelated shots of the bridge become the singularities that make it seen in itself as a pure quality. It is a process of sympathy and qualitative progression, as discussed later in this thesis, which makes the space heterogeneous, defined not by its magnitude and metric relations but by those 'fragments' or 'elements' that join or do not join in. The intensification goes beyond the metric coordination of the space and the states of the singular points (beyond the lines and flesh) so that "any-space-whatever" can present an affect that corresponds to the body (2005a, p.112).

Finally, we turn to the impulse-image and the 'originary world' of naturalism. Naturalism uses the real, actual milieu as "a medium of a world which is defined by a radical beginning, an absolute end, a line of the steepest slope" (2005a, p.128). This is the "originary world". For naturalists, the milieu and the originary world are immanent, as they do not separate the geographical and historical milieu from each other (2005a, p.129). This world is beyond any-space-whatever. The impulse depth emerges from the depth of the body, that is the milieu, and its space is an 'originary world'. "An impulse is not an affect" (2005a, p.127) as the body does not constitute it and thus cannot feel or express it. Rather, it constitutes the body as one of its slaves, fragments it to "heads without necks, eyes without faces, arms without shoulders, gestures without

forms” (2005a, p.128) and uses its intelligence to obey its choices. Similar to the imperceptible perception, it shows no differentiation between the elements anymore. The quality, which has related the body and the space previously, is now intensified. It has turned into a force to take over, so that nothing could satisfy it, as such, the affect and action, both, become powerless (2005a, p.127). But unlike the external force that marks the transition of perception from liquidity to gaseous, the transition of affective quality to impulse marks an internal force. If there is anything that differentiates the “psychological motivations” from the “physical law of gravity” (Bogue 2003, p.83), it is the turning of motivation to energy and this to uncontrollable gravity force that the individual cannot seize itself from except with another dramatic force. It is a slaving force.

If an “originary world” is comprised of “non-formed matter, sketches [*ébauches*, rough forms, vague outlines] or fragments [*morceaux*], traversed by non-formal functions, acts, or energy dynamisms that are not even related to constituted subjects” (2005a, p.123), and if its fragments are seized by energy, then this is because it is a chaotic world where the subject is only a matter of force that marks its death. It is for this reason that the impulse is the death drive. An originary world has “an inherent temporality of decline”(2003, p.83) ending in destruction. Originary worlds do not rise to form new beginnings because such upward movement, such elevation, requires the gain of a *moment* of subjectivity- Deleuze does comment that the naturalists have come close to time-image (2005a, p.131). There is no way but to decline, to go towards the

end to begin. Yet, the time-image has never occurred in the naturalist films because this 'time' itself in these films has become inseparable from the curse of the mainstream of the force.³⁵ These moments of subjectivity or time-images have to await a war that seizes new worlds and beginnings for the actual world and seizes the cinema from the 'originary world' of demon forces.

These moments occur in a virtual world of memories, dreams or irrationality as a disturbance of the present after which the possessed subject, who is a prey to acting and reacting to any point whatsoever, remembers, awakens or contemplates. That is why the time-image is "an image of thought and an image that must be read" (Bogue 2003, p.165). Alas, it will be carried away by the force of possessing subjects and passes unthought and unrecognized as a movement-image. It thus 'occurs.' It is not doing, it is not what thinking and contemplation brings, otherwise its nature is perceptual, but it 'occurs' as a dream while the body is a sleep, as a vision between actions, or a déjà vu between the doings. This 'occurrence' is called the direct presentation of time, which characterises the second volume of Deleuze's books on cinema that is *The Time-Image*.

Rodowick emphasizes that the movement from movement-image to time-image is not evolutionary but he asserts that the change is due to the new, postwar understanding of the relation between time and thought (1997, p.12). The time-image is irrational in that, "the interval no longer forms part of the image or sequence as the ending of one or the beginning of the other." Therefore, "it no

longer facilitates the passage from one image to another in any decidable way” (1997, p.12-13).

In defining and elaborating different time-images in cinema such as the crystal-image, sheets of the past, peaks of the present and the powers of the false, Deleuze relies on Bergson's theory of recollection and memory. The analysis in this thesis aims to focus on the two constituents of embodiment: perception and affection and to introduce time-image mainly in its direct relation to Hansen's analysis of temporality and affectivity, which is described in chapter four. Therefore, it will not provide detailed analysis of the time-image. To outline the basics of the time-images, it is important to notice, first, that it is a virtual image. The memorized, pure, past recollections (the seeds of time) get selected based on attentive recognition, which refers to the movement of returning to the same object that constitutes pure, optical-sound images' descriptions that replace or erase it, or select certain features of it (2005b, p.43). These optical-sound images are actually “the disturbances of memory and the failures of recognition” (Deleuze 2005b, p.52). The pure past recollections or virtual images differ from the mental images in that, as pointed out previously, they ‘occur’ to consciousness rather than being in the course of actualization in the present (2005b, p.77). The pure past recollections develop into another set of ‘recollection-images.’ This fills the gap of subjectivity, the interval between action and reaction is now filled by affection-image, on the one hand, and recollection-image of the past on the other hand (2005b, p.45). Thus, the second aspect of the time-image is subjectivity. Deleuze affirms that

subjectivity is never ours, it is time, that is, the soul or the spirit, the virtual. The actual is always objective, but the virtual is subjective: it was initially the affect, that which we experience in time; then time itself, pure affectivity which divides itself in two as affector and affected, 'the affection of self by self' as definition of time.' (2005b, p.80)

The pure virtual, the pure recollections of the past are actualized in 'recollection-images,' which correspond to perception-images (2005b, p.54), but instead of extending into movement to be perceptual reactions, they enter into relations with other images such as optical (sound) images, and psychological states.

The third characteristic of the time image is that it is relational but this relation is not a linkage between two images, rather they are non-commensurable. Relations are formed between two terms that differ in nature such as the physical and mental, the objective and subjective, the imaginary and real, and the actual and virtual. The relation is a round point of indiscernibility or indeterminability formed between each pair of terms which coexist simultaneously (Deleuze 2005b, p.7/44). Being a round point designates reciprocal reflections where "there is no virtual which does not become actual in relation to the actual, the latter becoming virtual through the same relation" (2005b, p.67). The same for the past and present time where for the former the sheets or the region of the past such as childhood or maturity co-exist, so we can jump to the past and then to a selected sheet or an event could exist in the present of past, present of present and present of future simultaneously. Besides the presentation of the incommensurable and the indiscernible, there is the direct presentation of the cut or interval itself that is irrational and is dealt with in chapter four.

The cut or the interstice, between two series of images no longer forms part either of two series: it is the equivalent of an irrational cut, which determine the non- commensurable relations between images (Deleuze 2005b, p.205-206).

In summary, then, Deleuze applies Bergson's theory of embodiment to cinema, but he does not restrict the cinema or his own transformation to Bergson's theory. His transformation follows three stages starting from embodied reality, passing through becoming (which is the essence of every stage), and ends in a transition (open duration, imperceptible, originary words, and irrational cuts).

2.4. Summary

Hansen advocates a model of embodied experience based on *Erlebnis* that is a short-lived experience, characterized by alienation and a corporeal shock in the interaction with technology. His work implies a mind/body polarization where he maps the technological effect to the body but rejects such effects on cognition. Hansen transforms the female body to technology, and explains embodied interaction based on its operational functions. The engagement with Hansen's work introduces another account of technological embodiment which is Deleuze's approach to cinema.

Deleuze's work shows that the transformation of embodiment in technology should not obscure the qualities and potentialities peculiar to the technology itself. Three stages are explained in relation to the cinema and its images showing how the cinema has its own ways of perceiving and affecting. The middle stage, that is 'becoming', is considered as the essence of each image. The first stage is embodied (movement as perception, face/close-up as

affection), then becoming (liquid perception and any-space-whatever) and finally transition (imperceptible and impulse/originary world). The next two chapters investigate embodied perception and affection in order to identify ways in which they can be designed and evaluated in HCI.

3. Chapter Three: Embodied perception: From representation to enaction

3.1. Introduction

This section investigates Hansen's concept of embodied perception and the consequences of Hansen's inconsistent reading of Bergson's theory of perception in *Matter and Memory* (2004). This leads to: 1) reduced implications of the impurity of perception by affection. This is due to Hansen's attempts to draw a dualism between perception and affection that either takes the form of orderliness or annihilation of perception from the lived experience; 2) a derision of Deleuze's reading of Bergson while providing a different interpretation which implies a deterritorialization of Bergson; and 3) explaining Bergson on the basis of the neurophenomenological view, which is obvious in his reference to Francisco Varela whose approach is incompatible with Bergson in some areas. Ultimately, Hansen has departed from the Bergsonian theory that he claims to be central to his book, and his work is fundamentally influenced by the neurophenomenological perspective seen in the work of Varela, whose approach is in turn indebted to phenomenology (Merleau-Ponety, Husserl and Heidegger). Secondly, Hansen's redefinition of Bergson's embodied perception results in the King Midas golden touch effect.³⁶ That is, the participant's action excludes all that interests it in the world.

In his book *Matter and Memory* (2004), Bergson describes matter and the universe as images. This makes his theory of perception of interest in imagining

technologies, especially for Deleuze and recently Hansen. Deleuze starts his first volume on cinema by elaborating on the three theses of movement contained in Bergson's Book *Creative Evolution*. He emphasizes that Bergson's contribution to the cinema actually occurred "before the official birth of the cinema" - and even outside Bergson's own purview of cinema as illusion- in the first chapter of *Matter and Memory* (Deleuze 2005a, p.3) where he describes movement as mobile sections or as movement-images. This is an idea which Deleuze adapts for his own thesis on cinema, as presented previously.

Hansen, on the other hand, seems to be interested in Bergson for his description of an 'embodied perception' which is 'impured' by memory and affection. ('Impured' is used in the translated text of *Matter and Memory* to give an opposition to the word 'pure.' Bergson speaks of 'pure perception' but this perception is 'impured' by affection and memory, which means that it never occurs in its pure state). As pointed out in the introduction, Hansen is clearly against the mind-body dissolution Bergson's theory implies, and maintains mind/body, subject/object polarization. Yet, he claims to posit an update of Bergson's theorization of the 'embodied selection' from *selecting* pre-existent images to *filtering* information and creating images directly – a process through which the body enframes the formless digital information and thus deploys its own constitutive singularity (2006, p.3).

3.2. Bergsonian image

Bergson uses the term 'body' in two ways. Firstly, as a reference to its unified state with the brain as a 'perceived matter' that is living matter, and secondly, in its dualist state, that is in relation to the distributed functions between the body and the brain. Bergson crucially draws boundaries between the *image* and the *body*, which is the object of the image. In fact, Bergson has used the term 'body' to address the image he calls "my body", and the representation, "the image of the body". As an image, independent from perception, the body is a 'being' in itself that is undifferentiated from all the other images in the universe. For this reason, Lawlor points out that the pure Bergsonian image has no affection mixed with it (2003, p.4) but it is defined by its extension and objectivity on which the order of our perception depends. Yet it can be distinguished from other images by affective identification, which is a localized speciality within the image itself.

Yet there is *one* of them [images] which is distinct from all the others, in that I do not know it only from without by perceptions, but from within by affections: it is my body (Bergson 2004, p.1).

As matter,³⁷ an aggregate of images, its presence is based on its solid materiality which differentiates it from some bodies (e.g. atoms) by allowing it to be perceived, that is, acted upon. In *being perceived* it becomes a representation, an *image of the body*; it cannot create representations or, in other words, perceive itself or other images.

You may say that my body is matter, or that it is an image: the word is of no importance. If it is matter, it is a part of the material world;

and the material world, consequently, exists around it and without it. If it is an image, that image can give but what has been put into it, and since it is, by hypothesis, the image of my body only, it would be absurd to expect to get from it that of the whole universe. My body, an object destined to move other objects, is, then, a centre of action; it cannot give birth to a representation (2004, p.5).

Following this conversion, Bergson works on his theory of perception. Bergson has used the term 'indetermination' to express the indefinite variability or uncertainty within both the universe and the living being. He posits that the living being's activity is surrounded by a 'zone of indetermination' that allows a prior estimation, of the number and distance of things with which it is in relation.

The degree of independence of which a living being is master, or, as we shall say, the zone of indetermination which surrounds its activity, allows, then, of an a priori estimate of the number and distance of the things with which it is in relation. Whatever this relation may be, whatever be the inner nature of perception, we can affirm that its amplitude gives the exact measure of the indetermination of the act which is to follow. So that we can formulate this law: Perception is master of space in the exact measure in which action is master of time (2004, p.23).

But the living being itself is a 'centre of indetermination', which implies a positive reciprocal relationship between the zones of indetermination and the indetermination of the possible actions - where the zones' indetermination increase the richness of perception but exceed any representations pointed out by the nervous system. In this sense, the presence of the living being does not equal the totality of the representations it extracts from the world, since there are the suppressed parts of those objects that do not hold its interest.

Now if living beings are, within the universe, just 'centres of indetermination,' and if the degree of this indetermination is measured by the number and rank of their functions, we can

conceive their mere presence is equivalent to the suppression of all those parts of objects in which their functions find no interest (2004, p.28).

Bergson used this indetermination to deduce conscious perception. Bergson elaborates on perception types (automatic and voluntary) and processing (pure, conscious and actual perception). Bergson starts with *pure* perception, which exists only in theory, as an objective state that is not influenced by duration and memory and, therefore, it is defined as the instantaneous reaction to images. Pure perception is external as it is one of the objects which gets influenced by encountering a reactive image (the image called 'my body') that changes their actions in a way that interests it. Further, Bergson explains the difference between movements or reactions to stimulation influenced by the body or the brain, where those of the former kind are more automatic (reflex), sourced by the spinal cord, and those of the latter kind are more voluntary activities, determined by brain intervention. Possible actions from both nerve elements in the cortex (brain) and spinal cord (body) are identified as perception centres that differ in the degree of complexity (2004, p.10).

In a word, the more immediate the reaction is compelled to be, the more must perception resemble a mere contact; and the complete process of perception and of reaction can then hardly be distinguished from a mechanical impulsion followed by a necessary movement. But in the measure that the reaction becomes more uncertain, and allows more room for suspense, does the distance increase at which the animal is sensible of the action of that which interests it (2004, p.22).

Regarding perception in relation to space or distance and time, the body deals with real actions those that require less distance, and immediacy. Thus, it is

seen as *the centre of real actions*. When the distance is increased and the time becomes uncertain, the actions are defined with *virtual actions* of conscious perception. The brain deals with these actions and is therefore responsible for the selection, delay and transmission of movement to the motor mechanisms. .

Conscious perception primarily expresses two things. First, the isolation of what interests the living being from the external influences of things that pass through it and, second, the reaction to these isolated influences.³⁸ The isolated influences, which are converted to pictorials,³⁹ become our representations of the perceived things.

I should convert it [the image called a material object] into representation if I could isolate it, especially if I could isolate its shell. Representation is there, but always virtual being neutralized, at the very moment when it might become actual, by the obligation to continue itself and to lose itself in something else. To obtain this conversion from the virtual to the actual it would be necessary, not to throw more light on the object, but on the contrary to obscure some of its aspects, to diminish it by the greater part of itself, so that the remainder, instead of being encased in its surroundings as a thing, should detach itself from them as a picture (Bergson 2004, p.28).

Our representation is always 'virtual' by the very fact of being isolated from the whole and converted. This representation determines the possible actions upon the objects. Being established on a virtual basis, these actions are virtual. It becomes, then, that our conscious perception of matter, that is representation, is less than the presence of matter.

Lawlor indicates a difference between phenomenology and Bergson, represented by the distinction between the image and the representation, where

the representation is less than the image. It is a decomposition of the whole and differs from the image in degrees rather than nature (2003, p.9-10), whereas presence is the image as it appears and not in its idealistic form.

It is true that an image may be without being perceived; it may be present without being represented; and the distance between these two terms, presence and representation, seems just to measure the interval between matter itself and our conscious perception of matter (2004, p.27).

Finally, Bergson identifies the *actual* perception in relation to the degree of utility. That is to say, that it lies in the selected action that prolongs into activity.

As Roy puts it in his book *The New Philosophy: Henri Bergson* (1998 [2008]):

'natural' perception does not aim at a goal of disinterested knowledge, but one of practical utility, or rather, if it is knowledge, it is only knowledge elaborated in action and speech (Roy 1998 [2008], p.160).

Bergson indicates that, "perception as a whole has its true and final explanation in the tendency of the body to movement" (2004, p.41). This *tendency* towards movement is the *virtual* action of perception that is formed by converting the isolated influences to pictorials that had turned into our representation of the object. Perception then could prolong⁴⁰ into actual action where the latter, representing the 'degree of utility', is seen as the measure of our perceived 'degree of reality'.

We had every right, then, to say that the coincidence of perception with the object perceived exists in theory rather than in fact. We must take into account that perception ends by being merely an occasion for remembering, that we measure in practice the degree of reality by the degree of utility, and, finally, that it is our interest to regard as

mere signs of the real those immediate intuitions which are, in fact, part and parcel with reality (2004, p.71).

Perception, then, ends by remembering and prolongs into an action that is carried out by the body. Bergson asserts that,

Thus, neither in perception, nor in memory, nor a fortiori in the higher attainments of mind, does the body contribute directly to representation (Bergson 2004, p.300)

This is an important point that differentiates between the phenomenological account and Bergson – which also can be detected in Hansen’s account of perception. For Bergson, perception is the determinate of the body’s activity. As Lawlor insists, “when perception has vanished the body cannot extract from external objects the quality and quantity of movement in order to act upon them” (2003, p.17). Tonner explains, that for Bergson, the human’s practical activity expresses the substitution of the real and internal organization with external representation. Tonner presents this as one of Merleau-Ponty’s criticisms of Bergson. For phenomenology, knowledge, history and perception are conditioned by being in the world and there is no absolute knowledge as Bergson suggests.

The fundamental difference can be put as follows: whereas Bergson sees in this metaphysical intuition of the whole the transcendence of the relative and the attaining of the absolute, the phenomenologist will, while recognizing its significance from the first person point of view, maintain the relativity of this perspective. Our lived experience can be as vivid and as singular as Bergson has here outlined and never transcend to an absolutely apprehended metaphysical reality (Tonner 2009, p.315).

Although both phenomenology and Bergson prioritize lived experience, Bergson advocates durational time as the free creative becoming over practical activity, whereas phenomenology advocates practical activity over duration:

...concrete lived experience finds its highest expression in the experience of duration as opposed to the world of our practical activity. For the existential phenomenologist, our lived experience is fundamentally oriented by our world of practical activity (Tonner 2009, p.316).

The activity is seen by Merleau-Ponty and existential phenomenologists as the relativity of being in the world. For Bergson this activity is 'impured by' memory. Tonner (2009) pinpoints the difference between the phenomenological views of Hamilton, Merleau-Ponty and Bergson. He simply states that,

if Bergsonism is displaced by phenomenology then this reintroduces a fundamental relativity into philosophy (Tonner 2009, p.309).

3. 3. Deleuze's reading of Bergson

Deleuze's reading follows the same differentiation – pointed out above – between the *image*, the *body* and the *perception of the body*. The *body* is distinguished from the *image* for being a subject or an object that carries out, or submits to, movement (2005a, p.62). He refers to the "perception of the body" as a "special image".⁴¹ Deleuze entitles the brain the "living image" because it occupies the *interval* between the actions, those which are received, and reactions, those which are executed, and accords it the privilege of being the "centre of indetermination" formed in an acentred universe of movement-images only by the fact that it is constitutive of a "special image" and is indissoluble from it (2005a, p.64).

And the brain is nothing but this – an interval, a gap between an action and a reaction. The brain is certainly not a centre of images from which one could begin, but itself constitutes one special image among the others. It constitutes a centre of indetermination in the acented universe of images (2005a, p.65).

Bearing this in mind, Lawlor supports Deleuze's position: "when Bergson speaks of the role of the body, he is really speaking of the brain, because the brain creates representations" (2003, p.17). The brain is the instrument of analysis of vibrations and their distribution as well as an instrument of selection which puts the received vibration in relation to a particular chosen motor mechanism therefore allowing communication. It is contained in the material world and so it works by suppression of this world. It follows then that the 'centre of indetermination' for Deleuze is the mental *representation of the body*. In agreement with Bergson, Deleuze confirms that the cinema lacks centres of reference,

...but the cinema perhaps has a great advantage: just because it lacks a centre of anchorage and of horizon, the sections which it makes would not prevent it from going back up the path that natural perception comes down. Instead of going from the acented state of things to centred perception, it could go back up towards the acented state of things, and get closer to it (2005a, p.60).

The "centre of anchorage," here, refers to the body as a centre of action or for anchoring the perceptual reactions. Deleuze identifies this lack as advantageous based on Bergson's own argument in *Matter and Memory* – which differentiates it from the phenomenological account – where for Bergson pure perception begins from other bodies and, then, through sensorimotor experience, it limits itself to the body as the centre (2005a, p.64). This

sensorimotor experience, or as Bergson calls it, “education” (2004, p.61), leads to associations between affective sensations, perceptual images and actions. This enables the body to anchor an automatic reaction towards acquired perceptions (this is different than body’s perception identified with spinal cord which is transformed into movement but not reaction). Hence, Deleuze identifies the action-image where action is the *delayed reaction* of the ‘centre of indetermination’ so that it is not a reflexive or automatic reaction carried out by the body. This action is the actual perception, which is defined by the sensorimotor activity. This is subjective in relation to an assumed end or result.⁴² Regardless of its lack of natural subjective perception the cinema’s sections, mobility and framing variability enables it to travel in both directions from pure perception to subjective perception,⁴³ that is from centre to peripheral and vice versa.

Here, Deleuze seems to differentiate between the human body and the cinema’s body where the latter does not react automatically to stimulus as the former does. The body has a representation, a ‘special image’, and this representation of the body is the centre of perceptions or representations, but of course the cinema’s ‘special image’ is not a representation of a human’s body but that of a cinema’s body, which is the centre of cinema’s perception and informs us about what the cinema’s body can do. The perception of the thing, then, is reflected by the ‘living image’ and is framed by the ‘special image’ which “retains a partial action from it, and only reacts to it mediately” (2005a, p.65). It is subjective because it “subtracts from the thing whatever does not interest it”

(2005a, p.66). Hence we have a perception-image as the first avatar of the movement-image (2005a, p.66). After this transformation, Deleuze elaborates not only on the types of subjective perceptions of cinema (discussed in section 3.5. revisiting the enaction approach) but also on different types of perception-images the cinema can produce as a movement-image as described in chapter two in relation to Deleuze's cinema.

In summary, the "centre of indetermination" of the cinema for Deleuze is not the human body as in the case of Hansen but the cinema's body itself (e.g. its apparatus, cameras, frames, shots and montage) and the main difference identified between these two, at this point, is that the cinema does not produce automatic reactions to its perceptual images. Therefore, the question of whether Deleuze has disembodied the centre of indetermination, itself becomes invalid. The human's body and the cinema's body are not identical but homologues (as pointed out in chapter two). This means the cinema is a centre of indetermination similar to the living being which is a different centre of indetermination. On the other hand, from our previous account of Hansen, it seems that this automatic reaction is the body's perception (e.g. the corporeal shock). This could be seen as one of the consequences of the mind/body polarization where the reaction is reduced to movement (which Bergson identifies with the spinal cord).

3.4. Hansen's interpretation

3.4.1. *The enactive approach*

Hansen's interpretation determines the body as the 'centre of indetermination', differently from Deleuze, in what he comes to call the "body-brain achievement". Hansen clarifies that his use of the term 'embodiment' implies an understanding of the brain's cognitive activity drawn from Francisco Varela (2006b, p.3 n 2). Varela studies the 'mind' as the cognitive activity that occurs in a special place in the immediate present. This differentiates him from the cognitive science studies which have placed the mind in the brain meaning cognition is understood as a neural activity. He puts forward the example of Marvin Minsky's model of mind consisting of 'agents' working on small-scale problems, organised into agencies or societies.

It is important to remember here that, although inspired by a fresh look at the brain, this is a model of the *mind*. In other words, it is not a model of neural societies or networks; it is a model of the cognitive architecture that abstract (again!) from neurological detail, hence from the 'wet' of the living and lived experience. Agents and agencies are, therefore, neither entities nor material processes; they are abstract processes or functions (Varela 1995, p.324).

Therefore, Varela advances his philosophical stance by focusing on naturalizing phenomenology. By that he means viewing phenomenology (lived experience) and cognitive science (natural) as 'mutually constraining'. He foregrounds mutual cooperative or collaborative development at both cognitive/neurobiological and phenomenological levels of phenomenon descriptions where each enlightens the research and the elaborative progress

of the other (Gallagher and Varela 2001). In his book *The Embodied Mind* (1992), Varela is concerned about cognition and the situated human experience. The questions he poses throughout his chapters – “What is cognition?” “How does it work?” and “How do I know a cognitive system is functioning adequately?” – guide his inquiry. The first step Varela takes to radicalize his project is by proposing the enactive approach. The ‘enactive approach’ to cognition aims to highlight that cognition depends on the cognitive agent’s bodily sensorimotor capacities which are situated and embodied in biological and cultural contexts (Varela et al. 1992; Varela 1995). Furthermore, these agents exhibit autonomous activities based on their self-organizing neuronal activity.

Cognition as a self-organizational process refers to its endogenous nature or self-reconfiguration through synchronization of its constituents in real-time, and its development based on the stream of sensory events and experience-dependent changes (Lewis 2005, p.173). Perception consists of ‘perceptually guided actions’ that entail a structural coupling between the senses and motion and then the sensorimotor body and the situation.⁴⁴

The enactive approach tends to explain “how the perceiver guides his or her action in the local situation”. Varela supports his view of ‘perceptually guided actions’ in the case of vision by a comparative experiment taken from Held and Hein (1958) where the latter encaged a group of kittens in baskets exposing them to light in certain conditions. In each pair, one cat, inside the basket, can move around freely, pulling the basket of the other cat. When the two cats were

freed from the baskets, the first cat behaved normally while the other behaved as if it were blind. For Varela this study emphasizes that objects are not seen through visual extraction but rather by enaction or visual guidance of action (Varela et al. 1992, p.175). Accordingly, the perceiver is conceived as *embodied* because his perceptually guided actions are determined by recurrent patterns between the sensory and motor systems. These patterns form learned communication patterns, which are called 'lawful linkages' or common principles. In turn, the world is dependent on this activity.

Moreover, Varela defines cognitive systems by their 'operational closure' as autonomous systems, which void the representational concept and require the enactment concept.

A system that has operational closure is one in which the results of its processes are those processes themselves. The notion of operational closure is thus a way of specifying classes of processes that, in their very operation, turn back upon themselves to form autonomous networks. Such networks do not fall into the class of systems defined by external mechanisms of control (heteronomy) but rather into a class of systems defined by internal mechanisms of self-organizing (autonomy). The key point is that such systems do not operate by representation. Instead of representing an independent world, they enact a world as a domain of distinctions that is inseparable from the structure embodied by the cognitive system (1992, p.139-140).

Varela, therefore, concludes that "cognition consists not of representations but of embodied action" (1995, p.336). The autonomous system has to find its way to the next moment by acting appropriately from its resources where the cognitive activity of the immediate moment forms the source of creativity. Accordingly, the autonomous agent does not have a *priori* representation to

configure future actions and, therefore, it creates unprecedented solutions based on its autopoietic, that is the time-dynamic organic coupling with the context (Hansen 2006b, p.164/195; Depraz 2008) and observing the outcomes of its actions.⁴⁵ The world, then, is not pre-given but coevolves while the grasping mind searches for an absolute, inner or outer, ground; but, faced with failure, it clings to treating everything else as illusion (Varela et al. 1992, p.143).⁴⁶ The perceiver, then, becomes an active agent depending on acquired skills and a common sense of a context-dependent 'know-how' background (1992, p.148) rather than representations.

3.4.2. Hansen: Practical activity

Although Hansen remarks that Bergson explains the body's function as "a privileged image among images" (2006b, p.3), Hansen himself does not clarify or differentiate between the *image*, *body* and *image of body* or between the *body*, *brain* and *mind* functions of the embodiment. Hansen's illustrative examples seem to follow two trajectories: interactive and dynamic coupling with technology.

In examining the work of Jeffrey Shaw, Hansen focuses on the bodily activity of the participant while interacting with the 'technical' environment by manipulating tools such as joysticks or free-activity movement to trigger the 'virtual'. which Hansen insists must be understood as the capacity/quality of human life that is "so fundamental to human existence, to be in excess of one's actual state" (2006b, p.50-51). Hansen's prioritization of the activity of the participant and its

role in actualizing the potential informs us of his position in relation to the accounts of Varela and Bergson. Actually Hansen describes a 'deterritorialization' from Bergsonism, perceived in the coupling between the participant's activity and the image environment.⁴⁷ In other words, the "perceiver-dependent world" Varela describes, and the delimitation of the Bergsonist universe of images:

By emphasizing the dynamic coupling of the image environment and the activity of the body within it, Shaw's initial experiments in expanded cinema already delimit the Bergsonist universe of images into a selective 'virtual' milieu or space specifically correlated with the body or bodies within it (2006b, p.53).

Hansen foregrounds the collapse of perception and bodily action (2006b, p.54/58). He sees this collapse as materializing by increasing the images in the zone of indetermination and placing the body within the space of images where he subsequently insists that, "without the activity of the body within the space of the image, there would simply be no perception at all" (2006b, p.54).

This leads us to understand Hansen's description of the deterritorialization of Bergsonism or what he calls "neo-Bergsonism", deployed by the aesthetic of new media art (Hansen 2006b, p.74) as a reterritorialization of phenomenology or neurophenomenology. If we understand the 'body' according to Bergson, then the bodily functions that collapse perception and action will only be related to immediate real actions, those including the spinal cord and sensory nerves (reflexive movement), and will therefore diminish the process of selection and enframing that Hansen foregrounds.

Consequently, perception, for Bergson, is not the operation of “isolating certain of its [the object’s] aspects, leaving the rest aside” (Hansen 2006b, p.4) or “the product of the body’s filtering of some images and not the others” (2006b, p.162) where perception is seen as the result of practical activity, in a coupling between the body and environment. Perception for Bergson is isolation by ‘suppression’ (Bergson 2004, p.28), In other words, for Bergson, nothing is left aside. That is, all the influences of objects or images pass through the living being but some are isolated, as being reflected but this reflection is affected by distance and time.

This isolation by suppression, allows Bergson's theory of dreams where dreams are conceived as extensions of perception and that follow a similar process, where sensations keep acting in states of relaxation, such as sleep, as in states of tension or action. However, in the states of relaxation they embrace vague outlines (impressions) that get occupied by phantom images, those which were preserved in memory during the states of tension but could not arise because they were subsidiary, peripheral, to the selected images related to the present situation.

When we are sleeping naturally, it is not necessary to believe, as has often been supposed, that our senses are closed to external sensations. Our senses continue to be active. They act, it is true, with less precision, but in compensation they embrace a host of ‘subjective’ impressions which pass unperceived when we are awake – for then we live in a world of perceptions common to all men – and which reappear in sleep, when we live only for ourselves. Thus our faculty of sense perception, far from being narrowed during sleep at all points, is on the contrary extended, at least in certain directions, in its field of operations. It is true that it often loses in energy, in *tension*, what it gains in extension. It brings to us only confused impressions.

These impressions are the materials of our dreams. But they are only the materials, they do not suffice to produce them (Bergson 1914, p.7).

It follows that Hansen, first, put less emphasis on the image called 'my body' as well as on the representation of the body and, second, put more emphasis on the perceiver's activity. Identifying perception with the perceiver's activity and defining it as 'subtraction' evokes the precise effect of the difference between Hansen's definition and Deleuze's use of the word that is 'subtract.' For Hansen, subtraction is of whatever interests the body while, for Deleuze, subtraction is the reverse, that is of "whatever does not interest" the body (2005a, p.66). Reasonably, for Bergson, the actions of the body do not "subtract the relevant image from the universal flux of images" as Hansen claims (Hansen 2006b, p.5). That is because 'subtraction', here, is an actual action that expresses the degree of utility whereas perception is a virtual action that ends by remembering. Moreover, semantically, what is subtracted usually is that which does not hold interest, which means that, for Hansen, the body's activity of subtracting removes the object that interests the body from the world, In this way, gradually the body loses its interests in the world and becomes a body without any interest, that is a 'disinterested' body. The participant's actions seem to have King Midas's cursed 'golden touch' effect where, by touching whatever interests it, it cannot enjoy it anymore.⁴⁸

3.4.3. *Virtual Environments*

Hansen moves to cases where the body could be viewed as an object where it is screened (e.g. Jeffery Shaw's air-inflated dome for works such as

Corpocinema, 1967; *Movie Movie*, 1967) or could give materiality, 'give body', to the image. In such cases the body is placed within a constantly changing space and its movement is one of causality elements (besides other moving objects that change the images). On one hand, this marks the body, when viewed from outside, as an object or image among others and so it takes part in determining the viewers' perception of the image (screening). On the other hand, Hansen claims that this is a subordination of the image to the actions of the performing body, which materializes Bergson's conception of the perception as virtual action. However, Hansen then highlights another deterritorialization from Bergson's conceptualization of virtual actions and perception as determined by distance and time:

Otherwise put, rather than having an existence independent of the potential action of the perceiver, the image exists only in and through the actions of the perceiving body (2006, p.58).

Two issues could be considered there. First, Hansen's understanding that Bergson's conceptualization of perception implies an independence of the image from the 'potential action' where, for Bergson, the image's existence initiates the possible and potential actions of the perceiver. As Bergson sees it, perception exists outside the body and the perceived object reflects our possible action upon it.

The truth is that the point P, the rays which it emits, the retina and the nervous elements affected, form a single whole; that the luminous point P is a part of this whole; and that it is really in P, and not elsewhere, that the image of P is formed and perceived (2004, p.37).

Second, placed within such space, the relationship between the individual's perception, bodily action, the effected change and the image that "exists only in or through the action of the perceiving body" (2004, p.58) becomes unclear. This is because of the existence of other moving images and effects where any movement, conscious or unconscious, causes change. The performer's body actually loses its centrality, which might represent the case of materialistic realism, as Bergson explains it, where in the universe, images, all on the same plane, have mutual relations by fixed laws but no centre. Perception, in this sense, becomes accident and mystery (2004, p.14). In other words, as the images, the bodies and the environment are in constant unstable movement, perception cannot take place due to lack of time to perceive, lack of attention, and lack of conscious correlation between the action and reaction. In addition to that, the image and environment keep changing regardless of the action of the bodies.

Emphasizing bodily activity, Hansen steps further toward embodied framing in new media environments (Hansen 2006b, p.107/110). Although Hansen has not mentioned the 'frame problem' in artificial intelligence, the issue suggests itself. Here, he pinpoints the significance of the shift from vision to bodily action, which is enaction, in differentiating machine-vision from human perception, as well as the embodied human framing. The frame problem could generally be understood as the challenging task in machine simulation of the embodied mind. This is because the construction of rules to process information meaningfully is context dependent and, therefore, the machine needs to take

environmental changes into account in every situation which, currently, seems unachievable. As Hansen points out, both the machine and the human process 'raw' data to generate organized precepts, 'data packets' or images, based on their internal rules. However, unlike the machine, which inscribes information passively, the embodied-cognitive human processes them actively. Following on from this, new media should catalyse a 'splitting' of perception between a '*machanic*' form where a 'vision machine' transforms the activity of perceiving into a computational data, and a *human* embodied form that is placed within an evolving field (Hansen 2006b, p.101). Such environments or fields draw attention to the body-brain achievement that could be understood as 'body-mind' unity where they become naturally coordinated and embodied when the person lets go instead of struggling to achieve a state of activity (Varela et al. 1992, p.29-30).

Hansen's illustrations (e.g. Tamás Waliczky and Mirosław Rogala) demonstrate situations that "constantly change as a result of the perceiver's activity" therefore "the reference point for understanding perception is no longer a pre-given" (Varela et al. 1992, p.173) but it depends on the bodily modalities, tactility, affectivity and proprioception that could even underlie vision itself (Hansen 2006b, p.104). The participant or viewer, being aware of the changing environment, struggles to obtain control over the changes in the image and then starts experimenting with their bodily movement.

By positioning the direct immediate dynamic coupling of the body and image as the aesthetic feature in new media, specifically the virtual reality environment

(2006b, p.167),⁴⁹ Hansen insists that the ‘new’ experimentation with new media does not correlate with any analogical experience (2006b, p.170). This allows Hansen to perceive perception as an ‘operational closure’ process, where the results of a process are themselves the process (Varela et al. 1992, p.139). Therefore, Hansen equates perception with simulation and the image with the mental simulation that is created in the process (2006b, p.170). Here, Hansen foregrounds Raymond Ruyer’s theory of perception and the concept of the absolute survey, which could be taken as an act of reversing some of the points in Paul Bains’s (2002) article ‘Subjectless Subjectivities’, in which he discusses Ruyer’s influence on Deleuze and Guattari. Here, Bains’s article is used to map Ruyer’s work to the account of Hansen. To sum up these points, Bains emphasizes that Ruyer distinguishes his own theory from Bergson’s by insisting “that ‘images’ or sensations are ‘in’ our heads *not out there at the point p of emanation, even if we form a whole with the image á la Bergson*” (2002, p.114).⁵⁰ In other words,

Sensations are brain achievements rather than ‘representations of’. There is no re-presentation of one world but only the multiple worlds our brains achieve. This is not subjectivism – *no philosophical or psychological subject is involved*. The brain or organism as an autopoietic, self-referential, primary true form, is naturally producing a virtual world (or actualizing a virtual world that is real but not actual; the indiscernible oscillation at infinite speed between the virtual/actual; chaosmosis) (Bains 2002, p.108).⁵¹

The absolute survey, according to Bains, postulates that the existence of matter or real extension has “an autopoietic ‘primary true forms’ or subjectivities as indivisible unities” (2002, p.108-109). Visual sensation or perception as ‘true form’ means that the surface (e.g. a table with checked squares) is grasped at

once as an 'absolute unity' without division or space that separates its parts in the physical surface. That is, in visual sensation the distance between the objects is not a real distance (2002, p.110). Moreover, visual sensation does not observe itself but has a primary consciousness that is 'self-enjoyment' – defined as an immediacy without objectivation, with auto-subjectivity that constitutes its own being (2002, p.111). In this sense, even an organism without a nervous system such as the unicellular protozoa has a 'self-enjoyment' or auto-subjectivity and thus can 'see' itself directly without a second consciousness (2002, p.111). Thus, the absolute survey differentiates between a primary 'subjectless' consciousness and a second consciousness of the subject where the latter cannot occur before the former. Bains quotes Ruyer:

In order to 'speak' of primary consciousness, to evoke it, we are obliged to use expressions like a 'form perceiving itself', a 'form that sees itself without eyes'. First, we transform the form into a 'visual image', primary consciousness into secondary consciousness, then we emphasize that there is no secondary consciousness before primary consciousness (Ruyer 1966, p.167, cited in Bains 2002, p.113).

Bains explains that Deleuze and Guattari's relation to Ruyer's work is manifested in their project of "absolute interiorities" and "proto-subjectivities", which refers to a self-referential, autopoietic or self-producing/positing plane of immanence – a plane of existential integrity and at the same time of relations or becomings – without supplementary dimension to that which emerges upon it (2002, p.102). This is, in Bains's view, not accepted easily when thought in terms of dualism where subjectivity is taken as "a gas 'inside' something called the 'body' which now becomes a purely material support" (2002, p.102). Instead

of dualism, Bains perceives Deleuze and Guattari's recognition of qualitative multiplicities of heterogeneous components leading to a fragmentary whole – the molar/molecular distinction in Deleuze's work – that emerges as a unity in multiplicity, an absolute survey, which can only be grasped through "affective pathic awareness" (2002, p.103). The brain here is not viewed as a corporeal organ but also as an indicator of an incorporeal topological surface. This is demonstrated by the progression from the movement-image to the time-image where the latter image "no longer has space and movement as its primary characteristics but topology and time" (2002, p.110).

Hansen argues that Bergson's theory does not apply in new media because of the latter's commitment to the 'monism' between the body and the universe (2006b, p.163). Thus, Hansen specifies Ruyer's concept of absolute survey that is "a sovereign individual autonomy with an intrinsic existential reality of self-referential territory" (Bains 2002, p.102-103) to undo the 'monism' between the body and the work, specifically for virtual reality (VR) environments, "where there is, literally, no 'there' there" (Hansen 2006b, p.162/170). VR marks the "technical supplementation" of the absolute survey or simulation because "the VR interface brings the capacity for absolute survey into contact with the purely computational or digital 'field' of machine vision" (2006b, p.176).⁵² In other words, the priority VR environments afford for human framing functions through the manipulation of some devices which bring the digital images into the view of the participants. This eliminates the distance between the viewer and the image (the image could be displayed from outside) and, in turn, enables the viewer to

survey and grasp the image immediately (2006b, p.170). VR environments that provide nongeometric, nondimensional or typological space forming an “absolute surface” inform what Hansen calls “absolute subjectivity” (2006b, p.196);⁵³ that is, an autopoietic self-referential pure form sensation. Hansen thinks that the cinema is insufficient as “a model for experience” because it cannot account for the primacy of the body-brain status as absolute survey (2006b, p.194). However, this is due to the contradiction Hansen presents in his interpretation. For example, Hansen quotes Ruyer:

A photograph apparatus, in order to capture the entirety of a surface, must be placed at some distance from it, along a perpendicular dimension. A living being, likewise, localizable as a body, must have an eye placed more or less like the photographic apparatus in order to perceive the entirety of the surface and its decorative *pattern*. If I were to see the photograph from the surface of the table, I would be again obliged to place my eyes at some distance from this photograph. It is necessary to be in a third dimension to photograph or perceive a surface (2006b, p.174).

In his interpretation, Hansen claims that, here, Ruyer contrasts and shows the limit of the photographic image (and cinema) in the presentation of absolute survey but, as we see, the quotation does not show such contrast. Rather, it demonstrates the likeness between the eye and the photography apparatus and Bains – referring to the same quotation – points out this likeness: “this is also the case for the camera” (Bains 2002, p.109).

3.5. Revisiting the enaction approach

In the previous section, Deleuze’s and Hansen’s transformations of Bergson’s theory of perception in relation to cinema and new media are examined. We find

that Hansen has departed from Bergson's theory of perception in favour of Varela's sensorimotor approach. Here Hansen defines perception with the participant's practical action through which images are created without any reference to representation. Here, another view of the enaction approach (at its baseline this approach suggests that the living being's perception is based on its actions within its environment through which it forms sensorimotor recurrent patterns that informs its learning), which seems more compatible with Bergson and Deleuze, is presented. This is the enaction approach introduced by Alva Noë (2004). By revisiting the brain activity and representation, Noë's position appears to admit to a non-representational perspective yet not to an anti-representational one. This, on the one hand, lets us overcome the gap Hansen tends to occlude in championing a phenomenological-Bergsonian account based on a sensorimotor approach that voids representation and, on the other hand, restores the brain as the 'moving-image' without giving up the unitary system constitutive of the body, the brain and the world. In this way we can determine that the living being is a centre of indetermination, as Noë expresses it:

the world is made available to us in a way that is determined by the fact that we occupy a tentative and a shifting place within the world (2004, p.86).

The enactive approach towards perception, introduced by Noë, bridges the gap between internalism (perceptual experience depends on neural activity stimulation) and externalism (perceptual experience depends on the external world) by explaining the perceptual experience within a phenomenological perspective. Noë argues that the brain's neural activity or stimulation is

important but it is not enough to produce *all* experiences. Consciousness depends on our dynamic and active interaction with the world (2004, p.211):

the enactive externalism I defend here is compatible with its being the case that the only way the world produces changes in animal consciousness is by producing changes in the brain; that appropriate changes in the brain will produce changes in consciousness, even if the environment is unchanged (2004, p.221).

The second aspect, which is directly compatible with the Bergsonian-Deleuzian account of perception, is that the experiential content of the perceptual experience is represented *virtually*. It is “virtual all the way in” (2004, p.193). We have *virtual representation* of the detailed world which we can access through our sensorimotor knowledge, so we do not need to construct an internal representation of its details (2004, p.50). This virtual content is accessible through the sensorimotor and cognitive skills, through movement and attention. Thus, because experience has content as a potentiality (2004, p.215), Noë insists that:

Experience isn't something that happens to us. It is something we do; it is a temporally extended process of skilful probing. The world makes itself available to our reach. The experience comprises mind and world. Experience has content only thanks to the established dynamics of interaction between perceiver and world (2004, p.216).

This allows Noë to forward amodal perception to solve the problem of perceptual presence where the *out of view* which cannot be actually perceived is present virtually as a whole and thus it is experienced as detailed even if we do not attend to the details (2004, p.61). This experience is mediated by the sense that we know that we can have access to these details through our body

movement (2004, p.86). It is not that we see the thing as a whole but that we experience the thing as a whole.

The enactive approach views perception as the direct encounter of what is 'given' in the world. Simply, "we experience the world by experiencing how it looks" (Noë 2004, p.85). What is encountered is the visual appearance or the *looks* (let us say images) of the objects referred to as their perspectival properties (P- properties). The P- properties (e.g. P-size, P-shape) are spatial features that can be distinguished from the 'actual' properties (e.g. size and shape) in respect to their location in the perceiver's visual field (e.g. the plate looks elliptical from a certain vantage point, a tree looks bigger by being closer to the viewer). These are *real* and *objective* properties of the environment. That is, they are appended by mathematical laws and they are not related to sensations or feelings but depend on the spatial relation between the perceiver's body, the perceived object and the environment. In this sense, perception is mediated by appearance where it is a mode of exploring how things are. The variation of how things are, that is in the object's P-properties can be explored by movement which allows the details of the object to be perceived.

It is because mobile perceivers gain access to variation in perspectival properties as they move about that the actual spatial properties of objects are made available to the subject for experience (2004, p.86).

It is relevant that Noë considers the duality of the perceptual content, which is based on object-dependence (movement of object) and movement-dependence

(movement of perceiver). The former is where experience presents the *world as being* (representational content), as separate from the perceiver's perspective (for example, the plate looks circular, it really does). The world as being is two-dimensional, revealing how things are as a *factual*, world-directed dimension of perception. But "how things look does not *only* depend on how things are" and here comes, as Noë persistently argues, the latter aspect of perceptual content which depends "on the perceiver's relation to how things are" (Noë 2004, p.171). This second aspect is where the world is presented in experience in "a way that always incorporates some reference to how things look or sound or feel from your vantage point" (2004, p.163) (the plate looks elliptical *from here*, it really does). Looks (images) are 'relational properties' between the objects and the environment but they have an intrinsically *perspectival*, self-directed dimension where the variation in their appearance depends on the vantage point the mobile perceiver occupies. Thus Noë highlights:

Perceptual experience is intrinsically perceiver-centred: Visual experience is always experience of things being some way or other from a point of view. Perceptual content has an intrinsically perspectival aspect (2004, p.170).

In a reverse fashion, then, Noë insists that if we count the perspectival properties of the perceptual content then we should count ourselves or our vantage point as well (2004, p.172).

According to the enactive approach, the living being requires sensorimotor knowledge in its interaction with the environment. This sensorimotor knowledge is an essential part of perception. Noë points out that the kitten experiment

mentioned above is “misleading” (2004, p.234). The kitten behaved as blind *not* because it could not use its vision to guide its actions in the environment but because it could not acquire certain sensorimotor dependencies which were necessary to mediate its relation to the environment. This kitten had mastery of other sensorimotor skills that it could use (eye and head movement) but the failure to acquire the required sensorimotor knowledge relevant to the environment, due to its being harnessed, caused a kind of “experiential blindness” which leaves the perceiver “without experience” (Noë 2004, p.10) as the environment become inaccessible to it. Noë points this insufficiency in Varela’s sensorimotor approach out where

The enactive, sensorimotor approach offers an explanation of how it can be that we enjoy an experience of worldly detail that is not represented in our brains (Noë 2004, p.66-67).

But then he insists that

The detail is present – the perceptual world is present – in the sense that we have a special kind of access to the detail, an access controlled by patterns of sensorimotor dependence with which we are familiar (2004, p.67).

This means that the sensorimotor contingencies are not constitutive of perception (Goldman and de Vignemont 2009, p.154), which brings us to the next aspect of the enactive approach. The sensorimotor skill, according to Noë, constitutes a kind of implicit practical knowledge of the patterns of change. The perceiver *knows* that this sensorimotor knowledge or skill mastery mediates its relation to the environment so its perceptual presence of the unrevealed part of

the object or environment requires the relevant sensorimotor contingencies to access it. For Noë,

Perceivers have an implicit, practical understanding of the way movements produce changes in sensory stimulation. They also have an implicit practical understanding that they are coupled to the world in such a way that movements produce sensory change. It is this implicit practical understanding that forms the basis of their readiness to move about to find out how things are (2004, p.66).

In this sense, normal perceivers experience objects as having specific sensorimotor profiles where they *know* that the objects' appearances would vary in precise ways based on their movement. Simply, their movement varies their relation to how things look, even if things have not changed and, on a counterfactual basis, they know that the movement of the object varies the way things look in relation to their vantage point (2004, p.117). This sensorimotor knowledge, Noë insists, is not propositional or inferential but is based on the perceiver's awareness of the properties and states of affairs around them and their *expectations* of sensory effect of movement rather than prior knowledge of the effects (2004, p.118-120). In other words, they "don't apply sensorimotor knowledge *to experience*" (2004, p.194) but they know they can present objects in their consciousness by movement;⁵⁴ movement conditions the presence of the perceptual detail, rather than knowing that the details are in their consciousness.

The presence of detail consists not in its representation now in consciousness, but in our implicit knowledge now that we can represent it in consciousness if we want, by moving the eyes or by turning our head. Our perceptual contact with the world consists, in

large part, in our access to the world thanks to our possession of sensorimotor knowledge (2004, p.99).

Moreover, arguing against dreaming - which is usually considered as being activated by neurals -⁵⁵ being taken as identical to perceptual experience, Noë asserts that dream states are unstable and poor in detail because of their dependence on the neural activity only rather than the stability of the environment, which reminds us of Bergson's previous account.

Dream states are unstable and poor in detail precisely because dream states, unlike normal, non-dream perceptual states, *are* produced by neural activity alone. Actual perceptual consciousness is anchored by the fact that we interact with, refer to, and have access to the environment. The stability of the environment is what gives our experiences their familiar stability. The stability of normal experience is explained by the involvement of the world in our experience (Noë 2004, p.214).

Noë further challenges the question of whether there can be "art of experience" or "*experiential* art" which catches "experience in the act of making the world available. Experience is a kind of activity, an activity that acquires content, as we have seen" (2004, p.176). Noë elaborates on painting as a process in which the world is painted as it is rather than the way it looks. However, the painter, shall we add the 'experiential' painter, paints the world from his perspective as it appears to him. The painter's 'seeing' is characterized by a "dynamic pattern of engagement among the painter, the scene and the canvas" (2004, p.223) where he continuously looks up, paints and looks back again to the world. In other words, it is an ongoing process of copy-and-paste of *looks*, details or images, from one reality to the other in order to reproduce the looking at the looks. Because Noë sees pictures as another reality, as "partial environments" or

simple “virtual space”, he suggests that experiencing a depicted scene does not produce on us a similar effect as if we were in the actual scene, nor does it aim at constructing an internal representation in us similar to the one we might experience in the actual scene, rather it prompts a certain sensorimotor grasp.

The enactive approach suggests a rather different conception of pictorial representation. Pictures construct partial environments. They actually contain perspectival proprieties such as apparent shapes and sizes, but they contain them not as projections from actual things, but as static elements. Pictures depict because they correspond to a reality of which, as perceivers, we have a sensorimotor grasp. Pictures are a very simple (in some senses of simple) kind of virtual space. What a picture and the depicted scene have in common is that they prompt us to draw on a common class of sensorimotor skills (Noë 2004, p.178).

In saying this, Noë insists that doing phenomenology should focus on the active exploration, that is, it should study “the way in which perceptual experience – mere experience ... acquires world-presenting content” (Noë 2004, p.179) rather than facts and states of affairs.

But how does this relate to cinema in Deleuze’s account and the enactive approach of perception? The cinema and its camera as living bodies are like ours but unlike us as Deleuze states:

the sole cinematographic consciousness is not us, the spectator, nor the hero: it is the camera – sometimes human, sometimes inhuman or superhuman (Deleuze 2005a, p.21).

Deleuze explores the complexity of perceptual perspective in cinema in relation to the camera in terms of subjective/objective perception. Defining the objective image as being “when the thing or the set are seen from the viewpoint of

someone who remains external to that set” in contrast to the subjective image where “the thing seen by someone ‘qualified’, or the set as it is seen by someone who forms part of that set” informs directly the question (2005a, p.73), “For what is to tell us that what we initially think external to a set might not turn out to belong to it?”

The objective image is perceived in the camera’s sole presentation of an image without a character’s perspective and the subjective image is the presentation of the same image as the character’s perspective. There seems to be confusion here, in Deleuze’s framing of the problem, between definition of the subjective/objective perception and the camera’s perspective. The problem with such a definition, which Deleuze himself thinks of as nominal, is not actually the movement between the objective and subjective image as he proposes, but whether the camera itself is part of the set or external to it. More explicitly, can the camera capture an objective image, capture the world as it is?

Unlike the painter, the challenge for the camera is to show the world as it is without looking; that is, show the representational content, because it always sees the looks, and it hears the sounds. The camera can have its own perspective either by moving or remaining silent and fixed. If the grass, as it is, is green, then the camera has to travel to find the green grass to fit the representation or someone has to present the camera with the portrait to look at it.

The problem might appear in the form of the viewers' embodiment. The viewer, unlike the camera, knows that if s/he turns he will not be able to get more details. The details are there, but only when the camera moves do they become present, as long as it keeps watching. If the objective image is redefined, it will be redefined precisely within this externality within which the camera's perception departs from the viewer's, where the latter knows that other sensorimotor skills would not bring more details. On one level, this has become the habit of watching, to fix the eyes on the screen. An image that represents 'objective perception' can be no more than the one which is viewed from the viewer's habits of watching. In contrast, habit does not have perception. But the viewer's habit of watching is paradoxical. It sets the body itself as a present-absent site. As a moving image, the body becomes also an image that does not move in its own physical space; it becomes like a paused, flickering image. In other words, the image that represents the 'objective perception' is an image without perception and, in this sense, objectivity is only a component of the experience of watching.

Because of this, it becomes a challenge for the camera and cinema to create an objective image that fixates the viewer on the screen rather than the moving image itself. The cinema is the creation of images not screens. Being 'the society of the screen' is only secondary to being 'the society of the image'. In this sense, the viewer's inability to bring the *out of view* into view meets with the camera's ability to present the 'moreness' of the absent details, can be understood as a limit of viewing. "The limit," Massumi states,

is not unreal. It is virtual. It is reality giving. Since the reality it gives is a movement or tendency, the limit may be called a virtual attractor (2002, p.147).

The cinematic image is a movement image that addresses the viewer's movement not only by presenting the details and prompting certain sensorimotor skills in a way similar to pictures, but in its continuous movement to an opening, even to an 'out of field' where the viewer's expectation of the details draws on his sensorimotor knowledge and thus sensorimotor readiness (virtual action). In other words, the sensorimotor grasping is never complete in the presence of the movement-image. The difference is not in the existence or objectivity/subjectivity of perception but it is in the probing activity, which the viewer is always forced to take.

For the camera to work continually to determine the world as it is from an 'indetermined' universe, it has to shoot, close its eyes, travel, open them and shoot; it has to close-travel-open-shoot a determined image. More than one camera can be in the team where each collects shots of the world as it is determined to be and presents it. This is basically because the camera's natural perception is perspectival in the first place. But perspectival perception is human and is defined by its halts:

for natural perception introduces halts, moorings, fixed points or separated points of view, moving bodies or even distinct vehicles, whilst cinematographic perception works continuously, in a single movement whose very halts are an integral part of it, and are only a vibration on to itself (Deleuze 2005a, p.23).

This potentiality of the cinematic perception allows directors to go beyond the limits of the receptive organs of the human to register new virtual realities and sensorimotor stimulations and skills. Here, what is not natural is constructed in the form of montage.

The objective/subjective binary seems unsatisfactory for the camera's perception. The camera shows the looks and relations of itself, the view within the world, and the character – the viewer of the view. The *looks* of the camera can be considered objective by *only* taking the camera as being 'external to the set'; in other words, what is seen is not seen but presented as it is. So what is objectively there is not the image, 'what is seen', but the event, 'what is happening'. The camera is external to the happening and not to the viewing perspective. Showing the character, that is the viewer of the same view, makes the viewed a shared image, not a shared perspective, between the camera and the spectator; that is, it becomes relational, where the camera shows the relation of the viewer to the image (viewer's subjective viewing) and its relation to the viewer. The camera identifies its perspective with the viewer's perspective by duplicating the latter; the camera is inside the telescope; the camera is the eye.

We have to clarify that while the camera's existence inside the character's telescope duplicates or unites their perspectives, the same cannot be said for the spectator as the details s/he attends to in the image might not be the same as those of the camera or character.⁵⁶ We should wait until the retina and the

screen merge (Manovich 2001, p.114). This waiting will bring new subjectivities to the surface but subjectivity itself is already all over, that is inside and outside.

By considering this question of whether the camera is part of the set or external to it, and our answering it by saying that the camera's perception is perspectival, the next evolutionary framings make their appearances. Deleuze elaborates on these framing types, where the camera has its subjective stand and self-consciousness, nevertheless, he maintains his own concern for the "nominal" subjectivity/objectivity binary (2005a, p.78). For example, in the semi-subjective perception the camera is 'being-with' the characters by taking unidentified perspectives as it sees what they see or shows part of the content.

In obsessive framing,⁵⁷ the camera obtains its self-consciousness, where its distinctive perspective is presented by making it a being, separated from the characters. The camera transforms the perception-image and reflects on it. This attention to the camera's perspective and its relation to the world and the characters has taken framing towards 'making the camera felt' which flourished into a 'cinema of poetry'. The camera waits for the character, watches him entering, hears him speaking, watches him leaving, and continues looking at the space 'which has once again become empty' after his leaving; but now, there is something in the air. In these terms, it sounds as if the camera is the perceiver and the character is one of its perspectival properties; a moving object. That is why to present the world 'as it is' the camera has to look at matter. Unlike the human's objective reality, which is contaminated by a subjective reality viewed from a centre point, it goes beyond the human's perception, to disclose matter's

perception captured by the camera's consciousness. This is the capturing of the objective universal variation, where all images vary in relation to each other with the absence of the subjective image. All the camera extracts from objects, water as a dominant case of a moving movement-image, is movement, which is their liquid perception. Further, the camera's eye can be fixed to stare at matter. This staring for Deleuze is constructed and thus cannot be achieved by a human eye. This is the assemblage of the world through montage. Matter as a moving image shows only its differential; there is no centre of indetermination or a point of view, only viewing points (gaseous perception).

Let us now clarify the difference between Noë's enactment approach in relation to new media and Hansen's analysis. First, Noë's approach retains what has been taken away by Hansen, the image itself, its materiality, its existence and its virtual presence. Secondly, in Noë's view, the participant brings with him sensorimotor skills or knowledge, motor habits, that form an analogical background, which come to bear on whatever new situation or perceptual problem he faces, whether in a real or virtual environment. For example, a joystick is an affordable tool to be used by the hand. The participant, even if he does not know how to use it, has the skills that enable him to explore the way it is used – if not provided with instructions – and to bring the image into view. The participant seems always to be equipped with familiarization strategies that enable him to explore new environments and to acquire new skills.

3.6. Summary

Summarizing the previous argument, we find that the argument Hansen levels against Deleuze's appropriation of reading Bergson in his books about cinema is inadequate. First of all, Hansen has departed from Bergson by voiding the representational concept, central to Bergson's theory of perception, and inverting Bergson's prioritization of perception over practical activity.⁵⁸ Evidently, Hansen's account could be appropriated within the neurophenomenological work conducted by Varela and his enactive or sensorimotor approach. On the other hand, Deleuze has transformed Bergson's work taking into account the difference between the human body and the cinema's in creating images. The main difference between the two accounts is in Hansen's prioritization of the automatic reactions of the body in the human-technology situations. For Deleuze, the cinema does not react immediately but its reaction is always delayed.

A more compatible enactive approach with Bergson's work is introduced by Noë, who elaborates on virtual representation as the content of perception as well as sensorimotor knowledge and skill mastery. The exploration of Deleuze's cinematographic perception informs the reframing of the problem related to subjective/objective perception-image, to be seen in the light of perspective/relation cinematographic framing. This means that new media and virtual realities do not need to give up the image or its qualities to give way to the body. As the body and new media already exist in a mutual milieu, new media can give the body new ways of perceiving and experiencing the world.

The next chapter explores the second aspect of the phenomenological embodied interaction between the human and technology that is explored in Hansen's concept of embodied affection in relation to Deleuze, Bergson and Varela.

4. Chapter Four: From Perception to Affection:

Embodied Affectivity

4.1. Introduction

This chapter explores the second constituent of embodiment in the aesthetic equation, which is embodied affectivity. As pointed out in chapter two of this thesis, Hansen claims that Deleuze has disembodied the centre of indetermination by locating perception and affection outside the subject and in the machine assemblage of cinematographic images. Hansen redefines perception in a way which we find incompatible with Bergson, as chapter three shows. Hansen levels a similar argument, against Deleuze's transformation of Bergson's concept of embodied affectivity to the cinematographic realm - this will be explored in relation to spectatorship and temporality. Hansen claims that he prioritizes affection over perception in interacting or dynamically coupling with new media.

Hansen's analyses of the various case studies mostly conclude either by identifying perception as a subcomponent of affection, affection is impured by perception, or eventually annihilate it in favour of affectivity that "steps in precisely where no perceptual contact can be made" (Hansen 2006b, p.133). As this chapter will show, no support is found for Hansen's claim that Deleuze has disembodied the centre of indetermination. This is supported by Deleuze's account of the shock image. Hansen considers corporeal shock as the fundamental cause of embodied affectivity in interaction with technology.

An analysis of Bergson's 'qualitative progression' of embodied affects shows that Hansen's description of affectivity might be taken as acquired perception that is cause and effect. This is because of his application of a pre-determined type of experience, that is, *Erlebnis* (a short lived experience). Redefining spectatorship in Deleuze as a relation means that it is not restricted to the temporal encounter between the film and viewer. Hansen's analysis of affectivity departs from both Bergson and Varela because of his prioritization of consciousness over affection. The discussion presented in this chapter allows HCI design and evaluation to refocus on embodied affects that progress qualitatively and temporally during the process of the interaction.

4.2. Embodied affection

For Hansen, Bergson's embodied conception of affection is understood as the transfer of "affective power *from* the image *to* the body" (Hansen 2006b, p.130) that takes place while interacting with the image, rather than a quality intrinsic to the image as Deleuze puts it. The example of a facial application is given, which Hansen calls the Digital Facial Image – DFI. New media artworks amplify this transfer through a process of "affective attunement" where the image or "facial signals spontaneously trigger an affective bodily response" (2006b, p.136) and the sensorimotor connection attunes the body to novel stimulus, thus catalysing the affective interruption where no perceptual contact can be made (2006b, p.133).

Rushton (2004, p.356) points out that Hansen conceives that this interaction gives affectivity back to the body, which he understands as marrying facial characteristics to personhood, in order to equate them with person types. As an example, an image of a murderer's face is ascribed as 'evil' and an image from a fashion magazine is attributed to 'beauty'.⁵⁹ For Hansen, rather than liberating affectivity from the body, new media "reinvest the body as a privileged site for experience" (2006b, p.213). Moreover, Hansen interprets Bergson's account of affectivity as the agency of the body over itself - "the capacity of a sensitive element to isolate itself and to act on the whole body as a *force*, or rather, to catalyze the body's action on itself" and therefore open an internal space within the body. This is because it comprises "a separate sensorimotor system internal to the body" (2006b, p.226) where affection emerges "on the basis of another interval altogether" (2006b, p.225).

Affectivity, as Hansen perceives it, is "the capacity of the body to experience itself as more than itself and thus deploy its sensorimotor power to create the unpredictable, the experimental, the new" (2006b, p.7). Affects proceed by this 'sensorimotor power'. Hansen defines Bergson's view of affection as a "phenomenological modality" in its own right. Hansen claims that for Bergson affection and perception are inseparable but they differ in *kind* (2006b, p.130/134). Yet, Hansen maintains that for the Bergsonist embodied affection is considered as "a phenomenological mode autonomous from perception" (2006b, p.130/205). As in his previous account of perception, Hansen emphasizes the role of bodily activity in interacting with the technical

applications where the affection-image is perceived as an interruption of the sensorimotor circuit (2006b, p.6).

We might say that new media art reinserts the body in the circuit connecting affectivity and the face, thereby supplementing what Deleuze calls the 'icon' (the set of the expressed and its expression) with a third term: the embodied activity that produces affect from image and exposes the origin of all affectivity in embodied life (2006b, p.136).

Criticizing Deleuze's inadequate transformation of Bergson's work, Hansen asserts that Deleuze has reduced bodily affection to one specific permutation of movement-image, which is affection-image. For Hansen, Deleuze's interpretation firstly, makes a break from Bergson's definition of affection as phenomenological modality by determining affection as a (sub)component of perception; a particular modality of perception that is "an attenuated or short-circuited perception that ceases to yield an action, and instead brings forth an expression" (2006b, p.134). Secondly, unlike Bergson, Deleuze places affection between perception and action, to *fill* the interval that allows the body to delay reaction, and organize unexpected responses. Therefore, the affective-image or close-up becomes "the external expression of an internal bodily state, the extraction of a 'pure quality'" (2006b, p.134-135). Thirdly, for Hansen, Deleuze breaks from Bergson who identifies "a difference in *kind* between affection and perception" (Hansen 2006b, p.135).⁶⁰

In relation to the perception/affection debate Hansen initiates, for Bergson perception lies between the 'external actions' and 'volitional reactions', to be 'impured' by affective sensation,

Affection is, then, that part or aspect of the inside of the body which we mix with the image of external bodies; it is what we must first of all subtract from perception to get the image in its purity (Bergson 2004, p.60).

But the image can never exist in its purity because for Bergson, *pure* perception exists only “in theory rather than in fact” (2004, p.26). Perception is impured by affection and memory. Although “there is no perception without affection” (2004, p.60), affection differs in function and nature from perceptual actions. Affection is localized at places where the sensory nerves receive the stimuli to signify affectivity.⁶¹ First, in relation to perception, it is distinguished from other objects by the zero distance that exists when the body, itself, is the object of perception. Although in this case it is *an image of the body*, that is representation, unlike other images, the reaction is a real action as it is internally experienced by the body, rather than being a virtual action. Second, in relation to other images when the zero distance between an image and the body (another image) exists, then affection state occurs at that point (e.g. pain) and initiates a bodily action in the form of resistance.

And, consequently, our perception of an object distinct from our body, separated from our body by an interval, never expresses anything but a virtual action. But the more the distance decreases between this object and our body (the more, in other words, the danger becomes urgent or the promise immediate), the more does virtual action tend to pass into real action. Suppose the distance reduced to zero, that is to say that the object to be perceived coincides with our body, that is to say again, that our body is the object to be perceived. Then it is no longer virtual action, but real action, that this specialized perception will express: and this is exactly what affection is. Our sensations are, then, to our perceptions that which the real action of our body is to its possible or virtual action. Its virtual action concerns other objects, and is manifested within those objects; its real action concerns itself, and is manifested within its own substance (Bergson 2004, p.85).

Bergson informs us that the living body:

It [the living body] does not merely reflect action received from without; it struggles, and thus absorbs some part of this action. Here is the source of affection (2004, p.57).

Moreover, Bergson explains that the difference in *kind* between perception and affection is metaphoric:

We might therefore say, metaphorically, that while perception measures the reflecting power of the body, affection measures its power to absorb. But this is only a metaphor (2004, p.57).

The truth for Bergson is that:

We must consider the matter more carefully, in order to understand clearly that the necessity of affection follows from the very existence of perception (2004, p.57).

Following this, then, Rushton (2008) correctly argues that “the all-too-clear divisions between subject and object that Hansen relies upon” in drawing this distinction between Bergson and Deleuze “are clearly non-existent” (2008, p.136). First, Deleuze affirms that affection-image is “both a type of image and a component of all images,” (2005a, p.89) which means that it exists in-itself and in relation to other images. This is consistent with Bergson’s point that there is no perception without affection. Second, Deleuze follows Bergson in affirming that the source of affection is the ‘absorbance’ of part of the external action that does not pass to a virtual action that is perception but coincides with the body and thus it becomes a real action that is affection. And this is what Hansen’s own quote of Deleuze states. Hansen quotes Deleuze:

Indeed it is not sufficient to think that perception – thanks to distance – retains or reflects what interests us by letting pass what is indifferent to us. There is inevitably a part of external movements that we ‘absorb’, that we refract, and which does not transform itself into *either objects of perception or acts of the subject*; rather they mark the coincidence of the subject and the object in a pure quality (Hansen 2006b, p.134-135).⁶²

Third, the Deleuzian affection-image occupies the interval but *not to fill it*, as Hansen claims,⁶³ between perception that is the tendency towards movement, and action. Hansen’s quote from Deleuze confirms that:

Affection is what occupies the interval, what occupies it *without filling it in or filling it up*. It surges in the center of indetermination, that is to say in the subject, between a perception which is troubling in certain respects and a hesitant action (Hansen 2006b, p.134).

For Deleuze, it is the recollection-image that fills the interval. The recollection image is related to Bergson’s account of memory (2005b, p.45) as pointed out in chapter two.

Lawlor differentiates between the role of the body in Bergson’s theory and phenomenology. He asserts that for Bergson all questions are posed in relation to time and not space. Furthermore, the introduction of affection means that the difference between the body and memory is in nature, and that the body, being affected from inside, is conditioned by memory or duration and that is how it produces something new. The interval in matter allows the insertion of memories.

So, if we speak of the Bergsonian body known from the outside by perceptions, we are in the scientific body (and ultimately the body taken up by science when it enters into its remotest aspiration); and if we speak of the Bergsonian body known from the inside by affections, we are in memory (Lawlor 2003, p.16).

Lawler sees that “Bergson conceives the living body as a machine” in that he compares it to a “telephonic desk” (2003, p.16). Lawler even emphasizes Bergson’s selection of the telephonic desk image rather than the computer or artificial intelligence as these are concerned with speed and ‘fastness’ whereas the telephonic desk allows ‘slowness’ and therefore an interval that makes room for spirit (spirit here refers to memory) (2003, p.16). As we have seen in chapter two, this interval is what characterizes the time-image, in Deleuzian cinema, as Colebrook stresses:

...the mind does not respond or react immediately to the world within which it moves, for it delays response and in so doing forms an image of itself. If, for example, the brain receives a stimulus but does not act, it produces affect, and this feeling or immobilization allows for the very slowing down of action which is the thinking itself. Modern cinema takes the very event that made thought possible – the interval or delay – and gives it an image (2006, p.79/80).

This interval or delay is the time-image, that is the between two images where the irrational cut or unrelated image is inserted.⁶⁴ For example the image of the snowy black screen that cut the sequence of images in Alain Resnais’ film *L’amour à mort* (Deleuze 2005b, p.239).

4.3. Qualitative progression

To explore Hansen’s reading of Bergson’s version of affectivity, we must examine Bergson’s sophisticated theory of affectivity, developed in his book *Time and Free Will* (1950) where he elaborates on the qualitative progress of psychic states. “*Qualitative progression*” means that intensities progress through alternation of the nature of isolated heterogeneous yet successive

psychic states, feelings or sensations, and, when they are accompanied by physical movement, through muscle contractions as a way in which the body sympathizes with the sensation or psychic state. Bergson identifies three types of intensities or affects that differ in nature but progress through a gradual “qualitative alternation” of other psychic states and a sympathetic physical and/or moral contraction: the sensations of muscular efforts, the intermediate states and the deep-seated psychic states.

The first one is affected by physical conditions and is linked to an external cause such as “the perception of a movement or of an external object” (1950, p.11). Consciousness portrays the sensation of effort as quantitative by overlooking its fundamental psychic state, which exists “previous to its manifestations, but in smaller volume, and ...in a compressed state.” However, when the muscular effort appears to our consciousness, it is manifested in a magnitude that expresses its sphere of action (1950, p.21). This is because, our consciousness translates to the sensation of effort what it can capture in the first instance, and what it captures is only the movement of the muscle contractions resulting from the force. The psychic force itself escapes its purview (1950, p.21-22). Thus, Bergson insists that “some movement is carried out somewhere: otherwise there is no sensation of effort” (1950, p.22) as consciousness would not be able to catch it.

The movement itself is not ‘a moving towards’ but a gradual alternation of a number of other peripheral sensations as they change their nature – or their colour – in sympathy with the sensation of effort and in this sense it is

qualitative and heterogeneous. Other muscles, each in its own right, sympathize with the localized point in which the force occurs, contracting to take part, to participate in bearing the effort. The estimate of intensity is a parallel correlate to the number of the participating muscles and sensations. The more participants, the more intense the sensation is (1950, p.25). The spreading movement is the outcome of these alternations and contractions and not the cause of them. Yet, the eye of the consciousness only counts this as it appears on the surface; an outward movement or spatial spread, and interprets it as intensity.

We maintain that the more a given effort seems to us to increase, the greater is the number of muscles which contract in sympathy with it, and that the apparent consciousness of a greater intensity of effort at a given point of the organism is reducible, in reality, to the perception of a larger surface of the body being affected (1950, p.24).

The second type of intensities are the intermediate states, which are systems of muscular contractions co-ordinated by either reflective ideas such as attention or by unreflective ideas or psychic tension, such as violent or acute emotion (1950, p.27-28). Unlike sensation of muscular effort where the movement is the result of the effort, in the intermediate states, the movement is part of the state that expresses it in terms of space (1950, p.27). The physiological movement of the intensity accompanying voluntary attention or psychic tensions expresses the feeling of the muscle contractions underlying them. That is to say: while in the former case the contractions are participatory – muscles take part in sympathy with the point affected – in the latter one they are what express the emotion or idea itself. As such they constitute its descriptive account.

Although the emotion is irreducible to this account as it has a psychic element pertained to it – thus defining its intermediate state between sensations of effort and deep-seated psychic states – without this contraction account the so called “emotion” has no intensity (1950, p.29-30).

As in the case of muscular effort, the intensity of these emotions depends on the number and the qualitative change of the participating peripheral sensations and muscles. But their intensity depends on another element, which gains them a similarity to the deep-seated psychic states: that is their degree of depth. This dimension of depth comes into view when the moment of physical sympathy of intensity smoothes thus giving way to a graceful movement towards a moral sympathy of inner states related to many memories, perceptions, emotions and ideas, guiding their alternation in a certain direction (1950, p.31).

Beside these intermediate states, there are the affective and representative sensations. Affective sensations like pleasure and pain correspond to organic disturbance whose molecular movement cannot be captured by consciousness and thus they do not have a magnitude. These occur in the interval between an external stimulus and a definite automatic reaction to it; only to prefigure the latter and resist its definitive direction in that they call up the intermediary of consciousness. Consciousness, then, becomes aware of this resistance to the automatic reaction marking the intensity of the sensation, and thus it forms “a sign of the future reaction” (1950, p.34) and informs us of the possibility of choice. In other words, the existence of the intensity of affective sensation as resistance is determined by this definitive automatic movement and by the

consciousness awareness of it. Without these two, there is no intensive sensation (1950, p.35). As we have seen before, the intensity progresses through qualitative alternation and muscular contractions of the participating sympathizing parts (1950, p.35-36).

The intensity of affective sensations might thus be nothing more than our consciousness of the involuntary movements which are being begun and outlined, so to speak, within these states, and which would have gone on in their own way if nature had made us automata instead of conscious beings (1950, p.36).

Representative sensations caused by external objects or sound and light show the body's inclinations defined as movements of the participating organs - through muscle contractions, towards the pictured sensation. When two or more images of a sensation such as pleasure simultaneously make their appearance in our mind, our body seems to creep spontaneously towards the preferred one, thus to say it is attracted, "attraction serves to define movement rather than to produce it" (1950, p.39). The enjoyment of this sensation is in the body's inertia as it resists all other sensations or images. Representative sensations' intensity is determined by the affective character they have. This character calls for a reaction in our body as we have seen in the affective sensation and prevents the sensations from being purely representative. A pure representative sensation's intensity depends on the degree of the strength of its external cause.

It will be perceived that the magnitude of a representative sensation depends on the cause having been put into the effect, while the intensity of the affective element depends on the more or less

important reactions which prolong the external stimulations and find their way into the sensation itself (1950, p.47).

When the external cause is weak (low sound or dim light), it requires more effort of attention to be perceived thus its intensity is reduced but when it is strong it causes a reflexive intense movement in our body (1950, p.40). Medium intensities of representative sensations, which do not call for other ideas, attentive effort or bodily reactions, proceed by being compared or repeated (1950, p.40) and thus reflected upon in relation to their external cause.

The idea of the external cause is associated with a certain effect as sensation, thus, forming a relation of “acquired perception” (1950, p.42) between the magnitude of the cause and the quality of the effect. In other words, the sensation is an acquired perception of intensity known from without rather than affective intensity from within the body.

We thus associate the idea of a certain quantity of cause with a certain quality of effect; and finally, as happens in the case of every acquired perception, we transfer the idea into the sensation, the quantity of the cause into the quality of the effect (1950, p.42).

The third type of intensities or affects, which are deep-seated psychic states refer to emotions and feelings representing “pure intensity” without the involvement of extensions (e.g. joy, aesthetic feelings). Yet, Bergson clarifies that this purity of physical symptoms is actually rare and hardly exists (1950, p.20). These emotions appear either isolated (i.e. desire) or mediated consciously by certain ideas such as thinking of the future or the past. Both cases progress by qualitative alternation where the isolated feelings get

intensified by such progress, and the mediated ones directly alter the nature of the fundamental emotions and pervade them (1950, p.10). Aesthetic feelings follow the second case where they are resolved in many other emotions that could suggest possible movement of virtual sympathy, so we think it is a change in magnitude (1950, p.13).

The aesthetic feelings offer us a still more striking example of this progressive stepping in new elements, which can be detected in the fundamental emotion and which seem to increase its magnitude, although in reality they do nothing more than alter its nature (1950, p.11).

The differences in the nature of the heterogeneous feelings influence the qualitative progress of the aesthetic feelings. This progress displays a difference in the degree of intensity and a difference in the degree of elevation or depth (1950, p.17).

The degree of intensity is based on the power by which a certain feeling influences other feelings and the extent to which the latter alternate as such the influencing feeling might either completely replace or scarcely change them. In this sense, a division might occur between the successive intensities differentiating two degrees of the same feeling, so they are experienced and distinguished. For example, we experience extreme joy and our perceptions and memories are heightened up to the extent that when “we stare at our own self, we wonder how it can really exist” (1950, p.10). Then, we are tempted to turn to the future with its infinite and fruitful possibilities only to realize that such a future unfolds in either: a challenge that presumes infinite efforts or a dream

that cannot be. The feeling of joy is diminished. Thus, joy is experienced in its purity and brutality.

The degree of depth, on the other hand, refers to the richness of the emotion itself with many other sensations, feelings, memories and ideas that turn towards it. For Bergson, the merit of art is in this richness rather than in the power of intensity.

The successive intensities of the aesthetic feeling thus correspond to changes of state occurring in us, and the degrees of depth to the larger or smaller number of elementary psychic phenomena which we dimly discern in the fundamental emotion (1950, p.18).

The process of art aims to “impress” rather than to “express” and such impression is achieved through art’s suggestibility of emotions and our body’s ability to mechanically imitate them (1950, p.17), facilitating a graceful movement that passes between the two. This movement expresses the qualitative progress, which is an effortless motion accompanied by a physical sympathy that takes possession of thought and will and a moral sympathy towards ourselves that makes us prefigure what is coming next, that is the future, and even have the feeling of controlling it (Bergson 1950, p.12-13). The dancer’s movement, for example, with the rhythm and music allows the viewer to prefigure the future movement, thus, lending viewers to feel as if they are controlling the dancer’s movement, and as if the latter obeys them. Thus, Bergson insists:

that in anything which we call very graceful we imagine ourselves able to detect, besides the lightness which is a sign of mobility, some

suggestion of a possible movement towards ourselves, of a virtual and even nascent sympathy. It is this mobile sympathy, always ready to offer itself, which is just the essence of higher grace. Thus the increasing intensities of aesthetic feeling are here resolved into as many different feelings, each one of which, already heralded by its predecessor, becomes perceptible in it and then completely eclipses it. It is this qualitative progress which we interpret as a change of magnitude, because we like simple thoughts and because our language is ill-suited to render the subtleties of psychological analysis (1950, p.13).

Although the artist chooses signs and representations that suggest emotional experiences, these intensities remain unique to the individual experiencing them and cannot be grasped by another subject except if the latter lived the life of the first which brings us to the ways of assembling psychic states in Bergson's account (1950, p.18).

For Bergson, two ways of assimilating conscious states with others could be defined (1950, p.186). The first is static (viewer as a spectator) and the other is dynamic (viewer as an actor). The static one is *imagined* because the conscious state is substituted with its idea, where intensity is added to the image as it is no longer felt in real time (1950, p.186). Related to this, the spectator is able to predict the character's feelings due to learning about some of their history. The more that is known about the character and the more one grasps of their existence, the closer one is to living their life. In the second one, the dynamic spectator is experiencing conscious states themselves, in which case the viewer as an actor does not predict the character's feelings but lives them. If the two, viewer and character, are one, then it is not time that tells them apart, as the two-in-one 'One' are hypothetically living the same real moment qualitatively

and with identical intensity. It is their occupancy of different places that marks their twine-ness.

While the first mode of assimilation is related to the principles of causality on prefiguring the future act (cause-effect or idea-feeling of effort-act), the dynamic mode eliminates this prefiguration as the act becomes unpredictable. But as we know the two-in-one 'One' does not exist, as there is always a challenge left to the viewer; a challenge that intertwines his virtuality and his experience with his prefiguring. This challenge emerges from the degrees of intensity and depth which depend on the number of participating muscles and the heterogeneous feelings, ideas and memories participating in the affective state and which show the difference in the viewers' sense of identification with characters.

In response to the points Hansen initiates we can claim that to 'transfer'⁶⁵ affection or affective power or effect from one space to the other or from an image to the body, it must, in the first place, exist in the former.⁶⁶ On the other hand, that which goes out of the body does not go back to it, whether it is affect or effect. Bergson points out that "turning backward" is never applicable to or accomplished by living beings because of the lapse of duration. He attributed this error to us perceiving ourselves as "forms borrowed from the external world" (Bergson 1950, p.153-154).⁶⁷ Affection that goes from the body to the image is never returned or turned backward. That which the body inputs and that which it outputs (e.g. air, water, effort) is always processed differently. The same never remains the same (1950, p.153). As we have seen, for Bergson, the aesthetic emotion is "suggested" but not "caused" (1950, p.17); in other

words, it is not triggered. Affectivity is not in the transfer of the suggested power, as Hansen claims, but rather in the richness of its emotions, feelings and ideas.

Actually, it is only the “illusion of consciousness” which, according to Bergson, is accustomed to think in terms of “space” and therefore that which is intensive will be thought of as extensive (1950, p.26).⁶⁸ Otherwise, pure psychic states are not quantitative, and do not occupy space or have a magnitude (1950, p.21) as we have seen. Rather than being a separate force acting on the body, as Hansen claims, psychic states, emotions and feelings progress qualitatively in the body, altering the nature of other sensations and fundamental emotions which, in turn, join the experienced sensation (1950, p.27).⁶⁹ Indeed, we can say it is as if the body summons itself from inside, calls its muscles and organs to join together, answer one another, be there for each other and unite in their pleasures and sufferings. Affectivity is then intensified by such sympathetic contraction, whether physical or emotional, accompanying the psychic phenomena in relation to its own or individual particularities. This enables it to prefigure future movement or attitude.

A large number of psychic states are accompanied, in fact, by muscular contractions and peripheral sensations. Sometimes these superficial elements are co-ordinated by a purely speculative idea, sometimes by an idea of a practical order. In the first case there is intellectual effort or attention; in the second we have the emotions which may be called violent or acute: anger, terror, and certain varieties of joy, sorrow, passion and desire (1950, p.27).

This intellectual or emotional coordination between psychic states, muscular contractions and peripheral sensations does not allow any bodily element to

isolate itself from the body as Hansen claims. Those elements that isolate themselves from the body to act on it, either from within or without, in the first place, detach themselves from the body. Whatever forces or actions they exercise on it is, then, solely of their own but are foreign and a burden to the body. Thus, they require power to force the body to submit.

Hansen's account seems to lack elaboration of the affectivity account he advances, for example it does not explain what constitutes the body's feeling of itself *more than itself* or how the bodily activity produces affects, in order to allow us to identify it with the versions described by Bergson. If we consider Stern's description of the process of "affective attunement" (Stern 1998), which Hansen links to physical contact, we find that it does not necessarily require bodily interaction or response as Hansen conceives. Moreover, the incapability of the cinema and the capability of new media to initiate such affects are not clear.

According to Stern, the display of categorical affects such as sadness can be directly felt by the viewer where evolution and experience has made the transposition of feelings between individuals comprehensible. On the other hand, Stern has emphasized that vitality affects can be felt by the viewer precisely by automatic transposition of perceptual qualities (time, intensity and shape) into feeling qualities, specifically those related to people. He provides the example of how an arm gesture, instead of being transposed as a perceptual quality, is experienced as 'forceful' in terms of vitality affects (1998, p.158). Vitality affects are experienced from within, as in others' behaviour

(1998, p.54), but they differ from categorical affects in that they are not identified by *activation* (amount of intensity and urgency of feeling quality) and *hedonic tone* (the degree of the pleasurability of the feeling quality) (1998, p.55). They are not limited to categorical affects.

Stern gives the example of 'rush' as a vitality affect; one could not determine whether the 'rush' is due to anger, joy, a perceived flooding of light or an immeasurable wave of feeling evoked by music. All of these can be felt as 'rushes'. Moreover, dancing could reveal multiple vitality affects in that it expresses a way of feeling rather than the content of feeling (1998, p.56). In this way, vitality affects are experienced before the formal acts. Vitality affects precede the sensorimotor connection with the interface, proving that this level could be achievable by the cinematic close-up. Stern has already clarified that a vitality affect "resides in virtually any behaviour one can perform and thus provides a continuously present (though changing) subject for attunement" which could be made with inner quality of feeling. They are not about *what* behaviour is performed but *how* a behaviour, any behaviour, is performed (1998, p.175). Stern stresses that this aspect has actually been addressed in the art domain and that it is the understanding of art that will help us to understand behaviour. Different art forms present us with vitality affects. Stern points out that "some behaviour as a form of expressionism makes attunement a precursor to the experience of Art" (1998, p.158). Stern's suggestion that art is helpful in understanding human behaviour in relation to affect, specifically vitality affects is directly related to Bergson (1950, p.14), who suggests studying

beauty produced by “conscious effort” in the work of the arts and then pass on from art to nature.

The characteristics that can be deduced from Hansen’s account of the affective in the interaction with new media is that affects: 1) are caused by the power transfer of the image that appears as a corporeal shock, 2) have bodily bases but not emotional depth which is an affective dimension so they do not have any future direction, and 3) follow physical activity. In this sense, affects could be seen as a form of pure representative sensation, the intensity of which intensity depends on the degree of the strength of the external cause. Such sensations develop into acquired perception where the repetitions and comparisons lead to the association between the quantity and the effect, which suits the experience of *Erlebnis* Hansen emphasizes in his model of embodied interaction with new media.

Eventually, then, there is a linear relation of experience where: the new media image causes perceptual sensations leading to embodied effect and response. This reinforces the point made in chapter two – although Hansen criticizes the concept of *technesis* as ‘the putting of technology into discourse’ he is *embodying* a different model of *technesis*, a model of discourse based on acquired perception that limits the embodied experience to *Erlebnis*, a momentary short-lived experience of interaction with technology.

4.4. Spectatorship

4.4.1. Imitation and suggestibility

Hansen seems to think that Deleuze does not consider the spectator in his analysis of cinema. In a debate with Rushton,⁷⁰ Hansen (2004a, p.362) agrees with Rushton's point that by setting the expression as autonomous from the face, it can condition communication with the spectator's body. Hansen (2004a, p.362) considers the triggering effect of the face on the body *of the spectator* who "undergoes a process of 'cognitive' reorganization" in which "the difference of its new configuration just is the meaning of the autonomous expression in-itself of the face" (2004a, p.362). However, he disagrees that Deleuze is concerned with the *body of the spectator* but rather argues that he is focusing on the body of the character as part of the image. For Hansen, this extension is part of Rushton's "own gloss on Deleuze's concept" and Hansen's own effort to bring in such a correlation.

The correlation of the face (or the image) and the perceiving – cognizing – feeling body of the spectator is precisely the pay-off of my critical appropriation–extension of Deleuze's work on the cinema, and in particular, of my effort to 'rescue' Bergson's embodied notion of the center of indetermination from Deleuze's disembodied generalization of it as the abstract operation of cinematic framing (2004a, p.362).

Rushton (2009) admits the absence of an explicit theory of spectatorship or even use of language associated with film studies in Deleuze's books about cinema (2009, p.46).⁷¹ He states that research in film studies and screen theory has been informed by Deleuze's non-cinematic work due to the difficulty of the

cinema books. Yet, Rushton insists that “an implicit theory of spectatorship can be found in the Cinema books” (2009, p.47) which, unlike the trends in screen theory, sees the passivity of the spectator who is hypnotized by the cinema as positive.

Rushton differentiates between the two terms immersion and absorption. Immersion means that the film *comes out* to the spectator, the latter is conscious of the film to be there *for him*, to attract or arouse him, in other words the spectator is aware of his own subjectivity. Rushton links immersion to physical interaction where the participant feels his mastery for controlling the film which becomes the object for him (2009, p.52). Absorption, on the other hand, means that the viewer *goes into* the film (2009, p.49), and there is a loss of subjectivity due to bodily sensations of occupying the space of another world or of being another being by which one becomes the object (2009, p.51). Rushton aligns his position on Deleuze’s spectatorship with the latter.

Deleuze throws down a quite extraordinary and risky challenge: that we lose control of ourselves, undo ourselves, forget ourselves while in front of the cinema screen. Only then will we be able to loosen the shackles of our existing subjectivities and open ourselves up to other ways of experiencing and knowing (2009, p.53).

Rushton’s prospect is interesting but as Deleuze poses the cinema as transformation of philosophy, as mentioned in chapter two, it is reasonable to build a Deleuzian approach of spectatorship based on this relation with other Deleuzian work. However, this research is focusing primarily on the arguments related to Hansen, Deleuze and Bergson. The discussion of spectatorship is therefore restricted to the influence of Deleuze’s transformation of Bergson’s

works on spectatorship, which results in seeing the cinema as embodied or as a centre of indetermination.

It is important to notice that spectatorship follows a relational approach and not a transformational one. Deleuze's objective is to transform Bergson's theory of embodiment to show how the cinema and its operations can be embodied rather than abstract (there is a cinema eye, cinema consciousness or perception, cinema can affect and be affected in human ways as well as in/non-human or superhuman ways peculiar to its being 'in itself').

A relation is what defines the whole or duration. For Deleuze, the relation "is not a property of objects, it is always external to its terms. It is also inseparable from objects, and displays a spiritual or mental existence" (Deleuze 2005a, p.10). This spiritual existence or reality means the relation expresses a qualitative change in duration or a whole that is always open. As spectatorship is a relation, the focus is not the object/subject nor the going into/coming out movements of either the film or viewer into the other's space. This is a peripheral matter where the central point is the '*coincidence*' of the subject and the object and the qualitative change of the whole. The absorbed at this point, as quoted previously, "does not transform itself into *either objects of perception or acts of the subject.*" For this reason, spectatorship could be based on Bergson's ways of assembling affective or psychic states.

For Bergson and Deleuze, experiencing the artwork is characterized by the uniqueness of the subject, where subjectivity emerges due to the weaving of

different feelings, ideas, perceptions and memories. This allows 'qualitative progression' to act only at the level of suggestibility, not imposition. In this way, spectatorship could be seen as a form of virtual reality where the virtual act of perceiving an image coincides with the real act of the body making what is perceived, felt and experienced by the body.

Spectatorship as a relation is not restricted to moments or temporaries, as argued by Hansen, but extends to the changing duration. This could be seen as the virtual dimension of the film, which is called the out-of-field. It refers to "what is neither seen nor understood, but nevertheless perfectly present" (Deleuze 2005a, p.17) as a continual, immanent to the movement or image duration in its relative aspect and to the whole universe in its absolute aspect.⁷²

Rushton argues that, for Hansen, the aim of the "communication" between the human and the computer is the exchange of information (2004, p.354). Rushton (2004, p.355) believes that the realm of the virtual for Deleuze is "beyond information and, for this reason, it does not include a 'communication exchange'." Actually, it does include a form of 'communication exchange' that makes the frame or the closed set "informatic" by communicating data to spectators (Deleuze 2005a). The virtual, for Deleuze, is determined by duration or the opening whole which he describes as a "thread" that passes through each frame and connects the frame to other systems; a relational movement from being to becoming. This is evident in the relative aspect of the out-of-field, which can be validated when the virtual is actualized within the duration of closed sets of images and becomes visible, so that the image acquires more

space by the addition of the imaginary space. The thread, which links the 'seen' set to the 'unseen' set that turns to be seen or to infinity, gets 'thicker' through acquiring more actualisable relations with other sets or systems. It could be inferred correctly that the words 'unseen' and 'seen' and the other system cannot but refer to the human system. This system forms the bases for Deleuze's transformation to what Colman calls a ciné-system that is defined, used and depicted to function according to the way its body functions, and forms relationships between its elements, social and becoming aspects (Colman 2011, p.22). The out-of-field is to be actualized or expressed in the other system and bears the possibility of being true as an actualization in the succession of the sets of the closed system.⁷³

Spectatorship, here, is based on the prefiguration of action where "what the viewer perceived ... was a sensory-motor image in which he took a greater or lesser part by identification with the characters" (Deleuze 2005b, p.3). The absolute aspect of the out-of-field does not return communication exchange of information and thus it is not 'informatic'. This aspect is transspatial, open to spirit, which is the whole that is constantly changing due to its relations, and time. It "testifies to a more disturbing presence, which cannot even be said to exist, but rather to 'insist' or 'subsist', a more radical Elsewhere, outside homogeneous space and time" (Deleuze 2005a, p.18). The relation to the whole is virtual and thus the thread, here, is 'very fine' to assure the openness and continuity of the frame or the whole film to the universe. It could be argued that the medium does not support such potentiality of returning communication

exchange or such potentiality might actually be beyond any medium. However, it should be emphasized that the change in the whole or duration does not always happen within transformative movement brought in by the subject but also as a translation taking place through relation or becoming of the changing whole that includes both the human and the cinema as described in chapter two of this thesis.

A change in *identification* occurred during the post-war where the dynamic assembling of psychic states was transformed to the cinema. Here, “the character or the viewer, and the two together, become visionaries” (Deleuze 2005b, p.18). The viewers are now included in the film, where they find themselves “in front of ‘descriptions’, in front of optical and sound-images, and nothing more” (Deleuze 2005b, p.3). At the same time, “the character has become a kind of viewer” where they “reacted to situations; even when one of them found himself reduced to helplessness, bound and gagged, as a result of the ups and downs of the action” (Deleuze 2005b, p.3).

Noting Hansen’s major claim about Deleuze’s inadequate transformation of Bergson’s theory, this is a key difference between Hansen’s transformation of embodiment and Deleuze’s. Hansen transforms the embodiment of the female’s body to technology or new media thus establishing within his critique a univocal set of relations. This is because he restricts the embodiment to functional or operational perspectives (e.g. pregnancy), and limits technological situations to a certain form of interaction conditioned by acquired perception and momentary experience, that is “*Erlebnis*”. Consequently, the determination in the relational

constituents of embodiment, that is affection and perception, situates the variation in technology or media, which makes their qualities meaningless, as, observed in the analysis of Hansen's work in chapter two. On the other hand, this determination leaves the spectator with nothing that could hold its interest as explained in chapter three. In other words, spectatorship in Hansen's work becomes moments of temporalities guided by acquired perception, which could fall into the realm of a habit where it causes the same intensity, affective response and action. Therefore, it becomes a form of a non-spectatorship experience. In contrast, what should define spectatorship in Deleuze is that the embodied cinema provides different forms of perception and affection as presented in chapter two. Here, spectatorship should be defined by the duration and its openness to the whole as pointed out previously. This also means the embedding of different relations between the embodied cinema and the embodied human that vary based on the interacting participants; different images and different human beings. This variation in relation is brought about by the use of different cinematic techniques such as framing, cutting and montage, and the varying ways subjects experience them.

Rushton's analysis seems to recognise one aspect of this spectatorship related to "qualitative progression" where the work of art puts the spectator in a hypnotic state. This process, of what Rushton calls absorption, falls within the imitation-suggestion in the work of Bergson and Deleuze and which is taken further by Thrift (2007). Bergson argues, art induces the viewer into a hypnotic state:

we shall perceive that the object of art is to put to sleep the active or rather resistant powers of our personality, and thus to bring us into a state of perfect responsiveness, in which we realize the idea that is suggested to us and sympathize with the feeling that is expressed. In the processes of art we shall find, in a weakened form, a refined and in some measure spiritualized version of the processes commonly used to induce the state of hypnosis (Bergson 1950, p.14).

Thrift devises the study of imitation and suggestibility to understand affective contagions. These phenomena are effected through hypnotic paradigms, making certain objects fall into the interest of psychopathologic (e.g. hallucinatory) and spiritual forms of communication, leading to a 'take over' of the subject/object relations. Affects, in this sense, are flows moving through the bodies of humans and other beings, which in turn become passages that process, receive, interpret and transmit them. Space is the conditioning environment to 'prime' and 'cook' affects based on pre-discursive means that allow changes in bodily states. These changes have their biological roots which challenge the body as a 'fixed component' of humanity and call for "cartographic imagination in order to map out the movement between corporeal states of being which is simultaneously a change in connectivity" (2007, p.236).

Affective contagion is the norm where imitation, perceived as a higher level of cognitive function rather than simple emulation or mechanical copying, is rapid, semiconscious, automatic and foreshadowed by suggestibility that influences the person's spontaneous thinking (Thrift 2007, p.240). For Thrift, the effect of automatism, taking the body as the medium for transmitting unconscious affective forces and thoughts, is evident in Western cultures, which have become vulnerable to emergent events and political inventions. The change in

the affective time structure, where brief moments of engagement and attachment are paralleled by moments of disengagement and detachment, has become a dominant condition. Specifically, affects such as anxiety, obsession and compulsion are perceived as outcomes of a sense of corporeal vulnerability that diminishes humans' self-agency over their bodies and actions. Creative corporeality, continuous intentionality and embodied actions all need bodily effort effecting *reluctance to engage* in the embodied experience of being in the world, emphasizing the challenge of corporeal vulnerability (Thrift 2007, p.242).

Media and mass media are perceived as affective techniques in two ways. First, they reinforce the regularity of automatism through the facilitation of the manipulation of time, either by speeding up the presentation through a selected affective platform, one which has been communicated repeatedly, or by deferring the presentation in order to pre-treat the work to get the deserved action. Second, they maximize the processes of suggestion and imitation by bombarding the spectators repetitively with multimedia which make the individuals feel that they are the originators of the thoughts and beliefs rather than mechanical reproducers of the "beliefs of a charismatic other" (Thrift 2007, p.242-243).

By pointing the corporeal vulnerability out, Thrift's account overcomes the terminological dualism between absorption and immersion presented by Rushton. It emphasizes that even action in the interactive paradigm can be automated. Interestingly, this perspective could also be used to criticize Hansen's work, which advocates the physical activity of the participant. Thrift's

account simply informs us that the embodiment of the participant Hansen advocates in technological situations could be the result of automating the participant's actions. Subjectivity, in this sense, could itself be no more than imitation where the embodied *technesis* equals the mechanical reproduction of subjectivity. To follow this discourse in Deleuze's books about cinema, the next section elaborates on the close-up.

4.4.2. The close-up

The close-up of the face is the main affection-image for Deleuze and Hansen.

Deleuze asserts:

There is no close-up of the face, the face is in itself close-up, the close-up is by itself face and both are affect, affection-image (Deleuze 2005a, p.90).

This is an example of 'qualitative progression' that unites the face and the close-up, altering the nature of the former as they both become affects – affection-images (2005a, p.90). The affect does not exist independently from (although it could exist independently of) the face that expresses it. The close-up does not tear the face from the body but it implies an "absolute change" that "calls forth the pure affect as the expressed", and even the space in the background loses its co-ordinates as singularities join in and it becomes "any-space-whatever" (2005a, p.98-99).⁷⁴

Rushton (2004, p.355) has already emphasized that by liberating the affects from the face to enter the realm of the virtual, the quality of the emotion is felt rather than thought in relation to the personhood of the subject. Rather than

liberation, this could be perceived as a unification intensifying the emotion itself. The increase in the magnitude is a result – an outcome rather than a process. Deleuze presents affects as a complex that it is “made up of all sorts of singularities that it sometimes connects and into which it sometimes divides” and that “it constantly varies and changes qualitatively” (2005a, p.108). Deleuze insists, “what produces the unity of the affect at each instant is the virtual conjunction assured by the expression, face or proposition” (2005a, p.108). Deleuze speaks of face, affect and effect that are not anymore related to the state of things, to the actions, roles or individuals,

... but the event itself, the affective, the effect, goes beyond its own causes, and only refers to other effects, whilst the causes for their part fall aside (2005a, p.109).

“It is the anger *of* the bishop” (2005a, p.109). This anger, in this or that situation, is not any anger whatsoever but whatever. Its singularity, its power and quality is that of the anger *of* the bishop (2005a, p.109). ‘The anger *of* the bishop’ becomes a continuous event but why, where, what, when and how the bishop got angry -or even who that bishop was - is the part of the event that becomes a historical event. This is what Deleuze seems to mean when he uses the word ‘extract’. It is not based on liberation but on a qualitative continuity of the effect of the expressed.

The close-up or the Digital Facial Interface (DFI) for Hansen, is based on Hansen’s model of embodied experience (elaborated on in chapter two). These are considered as ‘alien’ installations and ‘triggers’ of affection identified with the corporeal shock, by posing the problem of forging a contact with the image

(Hansen 2006b, p.139). This level of embodiment is already achieved in cinema. Here, Deleuze conceives the shock as “the very form of communication of movement in images” (Deleuze 2005b, p.152). Marks explains Deleuze’s interest in shock in relation to Deleuze’s image of thought, where he presumes that “we think rarely and more often under the impulse of a shock than in the excitement of a taste for thinking” (Marks 2005, p.278). This is the ‘spiritual automatism’ where the continuous movement or the succession of images – especially the irrational associations and continuous variation between images – does not spare time for the viewer to grasp the image or to contemplate. The shock, produced by the automatic movement of the image, is physically experienced by the viewer as it directly touches his nervous and cerebral system (Deleuze 2005b, p.151). This indicates that thought comes before consciousness.⁷⁵ As Lambert and Flaxman, elaborating on Eisenstein’s and Deleuze’s description of the dialectical intellectual montage, remark:

The mind of the spectator is forced to respond, to react, to think; and this, in turn, changes the shape and the sensibility of thought, which appears from a shadowy region that is outside the subject’s own powers of autoaffection (Lambert and Flaxman 2000, p.258).

This is a cinema of thought which “has as correlate ‘sensory thought’ or ‘emotional intelligence’” (Deleuze 2005b, p.154) and which defines it as a real vocation⁷⁶ in the supreme of ‘monism’ where action-thought *indicates the relation between the man and the world*, between man and nature, the sensory-motor unity (Deleuze 2005b, p.156). Its circus is a coexistence of sensory and affective shocks that passes from the image to the concept, to affect and to the intellectual cinema.

With this effect of cinematic shock, and the shock deployed in Hansen's analysis and examples, we can see the inadequacy of Hansen's claims about Deleuze disembodying the centre of indetermination, at least at this level of corporeal shock.⁷⁷ Yet what Hansen strips from the shock-image is the automatic movement characterizing cinematographic image. In new media, this turns to take the form of 'deliberate contact' involving, against Hansen's efforts to annihilate perception as we have pointed out previously, the provision of instructions while interacting with the new media installation that brings the participant to the point of being an active cognitive agent. In this case, consciousness (being informed by acquired perception of intensity) comes before thought. Therefore, the relationship between the subject and image has come in the form of a reciprocal communication triggering bodily sensations; a shock through alienation rather than movement.

The problem posed later on is how to continue being in contact with the unresponsive image where the failure to do so catalyses the participant's affective reaction of being irrelevant to the image's world. Hence, Hansen advocates the pre-cinematic regime for its manual and tactile dimension as affecting the embodied experience of visuality and involving the viewer more than the cinema that embodies, for Hansen, the illusion of image (2006b, p.127-128). It is worth noting, here, that from our previous account in HCI we have learnt that, although the manual interaction is an effective contact technique in communication, it does not guarantee the affective engagement of the participant with the image. This is not only because such engagement depends

on the context and the participant's interest in the image but also because, once the alienation effect comes to an end and the manual interaction turns into no more than a contact medium, it is the virtual embodiment's or image's properties that become the main catalysts of affective experience.⁷⁸ Indeed, while Hansen's analysis of perception as subtraction left a subject without any interest in the world, his reliance on the short lived corporeal shocks left a no-shocked subject. The experience of this subject is either of perceived cause-effect intensity of sensation without affective characteristic; that is without any richness in feelings. Undeniably, without this dimension the body cannot feel itself more than itself but it can only sense itself without even making sense of the affective experience, as the subject can enjoy no emotions, no colours or variation. The corporeal shock represents only a sensational quality of a perceptual idea turning it into a bodily habit.

4.5. Triggering affectivity and temporality

4.5.1. Hansen's account of time-image

As demonstrated in chapter two about embodied perception, in order to understand Hansen's conceptualization of the embodied affection of the 'centre of indetermination' in new media, we turn to neurocognition, in particular, Varela's project of naturalizing phenomenology (Varela 1995; 2000), which is a better match for Hansen's phenomenological account than Bergson and Deleuze. Hansen defines affectivity as "the capacity of the body to experience itself as 'more than itself' and [it] thus, deploys its sensorimotor power to create

the unpredictable, the experimental, the new” (2006b, p.7). He defines “affection-image as interruption of the sensorimotor circuit” (2006b, p.166) where the image is perceived as a ‘trigger’ of affectivity, definitions that can be explained within Varela and Depraz’s work.⁷⁹

In the first place, however, we should pinpoint the points of departure between their work and Hansen’s presentation. The first of these is that their work does not imply the separation between perception and affection (Varela 2000; Varela and Depraz 2005). Actually, recent work carried out by Marc Lewis (2005) on emotion theory in relation to neurobiology and psychology deals with this issue in terms of part-whole vision. For Lewis, neurobiology is more concerned by the parts, that is the brain-circuit analysis, and ignores the whole, whereas psychology takes the opposite direction as a way of viewing the emotion-cognition relationship. His theoretical work emphasizes the primacy of the integration and the inseparability of emotions and appraisals which he supports by pointing out the anatomical and functional overlap in all neural circuit levels of the brain’s systems.⁸⁰ In agreement with other researchers, he asserts that the separation could be at a psychological level and the duality between them, while considering their interdependence, should be noted for heuristic purposes.

He informs us that:

Tucker is not surprised that, when examining neural circuits at all levels, we find no separation of cognitive functions from emotional functions, thus losing the functional categories with which the analysis began. In fact, much like Colombetti & Thompson, he suggests that these isolated functions are ‘psychological fictions’, and losing them may be a necessary step in the development of more sophisticated neuropsychological models. Tucker goes on to

suggest that the embedding whole in psychological terms is the self, and that this corresponds to the vertical integration of neural activities reflecting both past and present needs and demands (Lewis 2005, p.231).

Varela identifies his position as expanding the phenomenological account in relation to temporality and affects in a way, we can claim, that is close to Bergson. Hansen is right, thus, that Varela's analysis suggests "the necessity of introducing into the experience of temporality the very same 'impurity' – the impurity of affection" found in Bergson's account (Hansen 2006b, p.250) and evident in Deleuze's work. Second, Varela announces his departure from the phenomenological account that perceives the "duality" between affection and consciousness in relation to time. By seeking a "non-dual synthesis" (Varela 2000, p.25) of a cognitive agent, Varela and Depraz (2005, p.154) emphasize, first, the placement of "altered" affect at the "very core of temporality" or perhaps as "its antecedent".⁸¹ They insist

This means that our exploration here departs from the generally accepted view in the phenomenological tradition, since we do not base our analysis on an original temporality that would, itself, structure affect (2005, p.154).

Bearing the avoidance of the problematization of the chicken-egg, affection-time and affection-perception primordially in mind leads us also to notice that, for both Varela and Bergson, consciousness is something, rather than consciousness of something and consciousness is sensation rather than consciousness of sensation. Here, then, we need to have a digression with the time-image and the theoretical differences Hansen elaborates on between the Deleuzian cinema and new media artworks. In *Time and Free Will* (1950,

p.181/190), Bergson puts forward the question, “is time space?” In his neurophenomenological analysis, Varela (2000) replies to this question, though not to Bergson, with “the spacious present”. We are in the realm of time-consciousness: ‘real duration’ (Bergson) and ‘nowness’ (Varela), the direct presentation of time (Deleuze) and the expanded now (Hansen). Varela’s (2000) initiative of exposing the temporality of natural dynamical systems is based on the Husserlian analysis of temporality and a Neurocognitive analysis. Husserl identifies retention and protention as two important categories of temporality. Instead of seeing time as objective linearity consisting of past, present and future moments, for Husserl, the present moment’s experience constitutes retention and protention. While retention is the just past experience’s shading in the present and thus it is not yet fully past that is a memory, protention is an anticipated future shading in the present that is not yet a fully future event. Dostal (2006) asserts, “There is certain symmetry in the constitution of the lived experience of time; both protention and retention are essential to the account and both are distinguished, respectively, from memory and hope” (2006, p.147). As the time goes by, the retentional shading fades until it wholly trails away from the present succeeding moments to become a memory, and the future shading thickened until the future moment is the present moment.

Varela’s analysis shows that for a cognitive act to be completed it passes through three scales of temporality. The first one is elementary events or the neuronal-level constitutive events (the ‘1/10’ scale), which are represented by

the time of a fusion interval (ranging from 10 to 100 milliseconds) that is perceived as “the minimum distance needed for two stimuli to be perceived as non-simultaneous” (2000, p.6). The elementary events are regarded as synaptic integrations which give rise to incompressible micro-cognitive phenomena among which are perceptual moments and iconic memory, excitability circles and subjective time quanta.

The emergence of the complete cognitive act is triggered by specific reciprocal determination of cell assemblies (CAs). Cell assemblies are distributed and actively interconnected subsets of neurons that engage different and separated geographical regions of the brain, forming dynamical networks. Neural activity from multiple regions forms transient aggregates of phase locked signals, which cause the ensembling of the cells. This grouping is related to the situation in order to “constitute meaningful contents in meaningful contexts for perception and action” (2000, p.7). Varela defines three casual and temporal levels of emergence that form the genesis and determination of CAs. These are first the

onto-genetic level which sets the anatomical architecture of a given brain into circuits and subcircuits; a second, developmental-learning level: sets of neurons that are frequently co-active strengthen their synaptic efficacies; and a third level of determination for CAs' constitution. The third level is the faster time scale of the experience of immediate daily coping, which manifests at the perception-action level, a duration of the order of seconds (2000, p.7).

The second scale (the 1-scale) emphasizes that CAs have relaxation or holding time followed by a bifurcation phase. This time is longer than the time of elementary events (neural activity) and comparable to the completion of the cognitive act. Here, neural synchronization of the ensembles takes place as

bifurcations of phase transitions where new circles begin. This represents a perceptual shift, and is reflected based on the 'hold' time of ensembles and the number of CAs. The integration-relaxations at the 1-scale are strict correlates of present-time consciousness. The integration in moments of 'nowness' gives rise to broader temporal horizons. The third and final scale is the descriptive-narrative assessments (the '10' scale), which is linked to linguistic capacities (2000, p.9).

Affection, as Varela states (2000, p.27), prefigures the change in perception. That is, an emotional change accompanies the sudden perceptual shift (2000, p.23). As we have seen, the triggering event or phase that interrupts the orderly behaviour of the system and, as Lewis presents it, the appraisal-emotion events is important for Varela and Lewis's neurobiological and psychological emotional interpretation account. This triggering phase marks a phase transition that defines the first moment of emotional episode (time-0) in the psychological model and starts off temporal instability in the biological system. Novelty emerges as the system elements interact among themselves to reach stability and orderliness. That is, the triggering event changes the appraisal-emotion events in relation to the context and inner state characteristics.

Of importance to the previous account, first, is that the developmental-learning level of emergence is based on co-activation, that is, habitual rather than rememorative (2000, p.9). A second evolving point is that time-consciousness, for Varela and Depraz, is "guided by the experience of the future" (Depraz 2008, p.249). Varela emphasizes that, while Husserl's analysis of time is static, giving

the impression that retention and protention are symmetrical, his own analysis perceives protention as asymmetrical to retention. The protentional aspect of consciousness has an intrinsic sense of agency for action based on controlling the anticipatory processes that precede the action itself. Depraz and Varela call this “self-previousness”; that is, a temporalization process open to the indetermination of the future (2008, p.248). This involves an undetermined anticipatory sense of content (what I am about to experience) and a relatively determined sense of self (what I am going to experience) (Gallagher and Varela 2001, p.30-32).

Providing this understanding of protention, Varela is close to Bergson, who sees the present as a whole as a perception of both immediate past that is sensation, and immediate future that is action. Movement prolongs or extends the sensation to action, thereby making the present sensorimotor (Bergson 2004, p.177). Consciousness is preoccupied by determining the undetermined future (Bergson 2004, p.194) and prefiguring the future action, which remains realizable but not yet realized (Bergson 1950, p.211). Bergson describes the present as the “infinitesimal element of the curve of time” that indicates the future (2004, p.177). This metaphor of movement to the ‘curve’ flowing in time is essential in establishing a feeling of grace as we have seen in our previous analysis of qualitative progression.

Still, might not we say, then, that for Deleuze it is the frame, the movement-image, that is the moment of the present? Its content is defined by a *tendency* that is never accomplished. Its closing is never absolute and its wholeness is

never 'closed' but 'open' to connectivity, integration and communication through a thread that is manifested in an actual or virtual relation. It is the movement that expresses such change or articulates duration (Deleuze 2005a, p.18-30). It is not surprising, then, that Varela points out that the 'now' moment or centre of temporality of the mental act corresponds to a frame or window of simultaneity of the integrated components and holds for the duration (2000, p.6). Precisely, this moment of nowness, this frame, is heterogeneous to all those others that have just preceded or will just follow in the temporal horizon because, simply, it does not depend on the 'ticking clock' but on the dynamic integration and aggregation of heterogeneous, non-linear brain elements. Its 'ticking clock' duration, that is, its space, its semantically measured time, is artificial. But is not what Varela is saying regarding cognition also what Bergson says about psychic states?

Indeed, Varela announces his second point of departure from phenomenology. As Varela and Depraz (2005, p.156) point out the affect-emotion remarks time-consciousness's openness to an emotional space that contains the source of the protention. They put it:

Our focus here has been to argue that affect-emotion is not simply one among many types of aspects of lived experience; they are *generative for consciousness itself* (2005, p.174).⁸²

The previous account of Varela could be aligned with Bergson's qualitative progress of consciousness where he defends his thesis of real duration against the illusions of reflective consciousness. Bergson insists that duration within us is:

A qualitative multiplicity, with no likeness to number; an organic evolution which is yet not an increasing quantity; a pure heterogeneity within which there are no distinct qualities. In a word, the moments of inner duration are not external to one another (Bergson 1950, p.226).

Thus correcting the three illusions of perceiving time, Bergson asserts that, first, psychic states are pure quality, unextended and do not have magnitude (discussed previously); and, second, real duration is a dynamic progress of psychic state processes. It is the time “flowing” and not the time “flown” (1950, p.226). Third, real duration is deep-seated psychic states which are heterogeneous where each state cannot reoccur; what seems the same is always new because it occurs in a different moment and has its own life-story (1950, p.200). Consciousness cannot measure the real duration, the internal, but homogeneous time.

What seems important for all the previous accounts is the interval (Bergson), the relaxation time followed by phase transition (Varela), or the cut (Deleuze). As we are aware of Hansen’s inadequate interpretation of Deleuze, we come to his claim that

When Deleuze suggests that invention in the cinema doubles and must be doubled by invention in the brain – that new circuits in cinema generates new cerebral circuits – he effectively renders the time-image something that can only be thought. Put another way, by strictly correlating the presentation of the outside in cinema with a modification of the brain, Deleuze asserts a *direct* transmission of the force of time into thought (Hansen 2006b, p.249).⁸³

The use of the words transmission, brain and thought here is of importance because it again has the same assumption that time has been presented and then transmitted into thought rather than time being directly *presented* and this

presentation is defined with the temporal consciousness of the viewer. Deleuze differentiates between the movement-image and the time-image precisely by this direct 'presentation' of time as he, like Bergson and Varela, confirms the heterogeneity of the moment of nowness and, simultaneously, sets the interval free. For Deleuze modern cinema is,

defined by a reversal where the image is unlinked and the cut begins to have an importance in itself. The cut or the interstice, between two series of images no longer forms part either of two series: it is the equivalent of an irrational cut, which determine the non-commensurable relations between images. It is thus no longer a lacuna that the associated images would be assumed to cross; the images are certainly not abandoned to chance, but there are only relinkages subject to the cut, instead of cuts subject to the linkage (2005b, p.205-206).

The irrational cut is what brings the viewer's consciousness in direct contact with the 'flowing' time rather than the time which has 'flown'. Moreover, what is at stake by speaking of the brain and cerebral circuits and the innovation of the cinema is the activation of neurons where the cinema initiates new cognitive acts that could activate different brain circuits. This effect of mirroring or simulation theory has been evident in social theory and investigated in learning new skills, mind reading and inner states of others.

Contrasting new media works to Deleuze, Hansen focuses on time as discrete quantified units by pointing to techniques of slow (Douglas Gordan) or fast (Bill Viola) recording and their experiential effects. While the first is correlated with 'affective anticipation', the second is correlated with the imperceptible and non-lived content. Douglas Gordan's work of slowing motion, *24-Hour Psycho*, exemplifies the interstice between images and temporality,⁸⁴ and could be

viewed in relation to the movement-image where the cut forms a '*shift*', occurring "once every twelve seconds" that the associated images cross (Hansen 2006b, p.244). Although the production of the out-of-field effect might be affected by slow motion and voicelessness, there is certainly a causal relation taking the form of idea, feeling of effort and action (Bergson 1950, p.211) in Hansen's description:

Because the image changes only once every twelve seconds, viewers quickly find their attention intensely concentrated on anticipating this moment of change.

Where

this process of anticipation becomes ever more affectively charged, to the point of becoming practically unbearable (2006b, p.244-245).

Generally, we cannot say that this shift does not coincide with the lived duration of the viewer or that it does not involve modifications in the neural system. But this is not the point. The point is that the shift is anticipated, affected or prefigured in the space of prior consciousness. In this sense, it is not a direct presentation of real duration in unconsciousness, understood by time-image, as we cannot claim that it is "mediated by the process of non-conscious neural dynamics from which the now emerges continually and perpetually" (Hansen 2006b, p.253). Bergson puts it as follows:

Hence there is no question here of duration, but only of space and simultaneities. To announce that something will take place at the end of a time *t* is to declare that consciousness will note between now and then a number *t* of simultaneities of a certain kind (1950, p.116).

It does not free the interval where the viewer can “recover possession of oneself, and to get back into pure duration” in order to “act freely”. First, it should be observed that this account informs us that the time-image for Hansen appears as being anticipated which means that, similar to our previous account, consciousness comes before affection. This brings us to the third point of departure between Hansen and Varela where Hansen (2004b) explores the “technical expansion of self-affection”. While Hansen foregrounds self-affectedness or subjectivity, Varela and Depraz emphasize that “self-affection is from the very start traversed by alterity” (2005, p.154). Varela objects to Heidegger and Merleau-Ponty’s treatment of time as self-affectedness making it “a key insight into the nature of consciousness”. Varela quotes Heidegger:

... even the most precise consciousness of which we are capable is affected by itself or given to itself. The very word consciousness has no meaning apart from this duality (Varela 2000, p.24)

Varela and Depraz (2005, p.154) term this ‘valence’. Valence generally describes the organic somatic neurobiological level (amygdala, hippocampus) of analysing our intersubjective bodily attitude. It refers to the level of subpersonal neuro-vegetation system of the micro-bodily dynamic generation of intersubjectivity. This intersubjectivity is based, at this level, on primary, involuntary attraction and repulsion dynamics which are anchored in our somatic organization. These attraction/repulsion dynamics are manifested in the polarization of affective sensory modalities (positive/negative, pleasure/displeasure, gust/disgust) which informs the initial dynamic of our interpersonal relationship with others; that is, the immediate feeling of being

attracted or repelled by the other. Other levels (phenomenological level, affection, that is the movement that informs self-other folded coupling, and psychological level, i.e. emotion-constituted affects which the individual oscillates between, e.g. binary affects) inform the intersubjective coupling.

This is in agreement with Hansen that

Viola's aesthetic experimentation with new media intensifies the now by literally overloading it with stimuli (units of information)⁸⁵ that are properly imperceptible (that is, imperceptible to natural perception) (2004b, p.610).

In relation to time, the transition of affects in Viola's works, such as *Quintet of the Astonished*, is built in through the technique of shooting in high speed and playing back in slow motion, which extends the time of experiencing the intensified affects. On the other hand, it should be noted that the expansion in the technical moment does not correspond with the expansion of the 'biological' moment. Although, it is reasonable that the intensity of the affective image intensifies the biological 'nowness', there is no reason to think that the image's ticking-clock is the biological ticking-clock or that the latter will keep ticking identical ticks until it concedes with the 'minute shift'. In other words, if we retrain the missing half-second from Massumi's account, there is no reason to think that the following half-second will be missing, even if the intensity effect of the image continues.

The distinction Brian Massumi draws between intensity (affect),⁸⁶ depth reactions and free higher functions, in his book *Parables for the virtual: Movement, affect, sensation* (2002), is worth mentioning here because it

precisely marks a critical difference when compared to Hansen's account of triggered affectivity. Massumi differentiates between intensity or affects and emotions where the latter is defined as 'qualified intensity', that is intensity is extended into communicable forms.

Emotion is qualified intensity, the conventional, consensual point of insertion of intensity into semantically and semiotically formed progressions, into narrativizable action-reaction circuits, into function and meaning. It is intensity owed and recognized (Massumi 2002, p.28).

Massumi asserts that affects are autonomic reactions manifested in the skin. They are incipient happenings in the body and their incipency is just captured but to be missed in the experimental 'half of a second', in the Deleuzian-Bergsonian 'interval of virtuality' and in neuroscience's 'bifurcation shift' or 'time-0' to mark the emergence of the new.⁸⁷ It impinges on the body and brain but is not yet seen by its consciousness and mind (this seems to be the qualitative progression in Bergson's account). On the other hand, the depth reactions are related to the qualified form/content and are associated with expectations. They are observed in higher levels of arousal, heartbeats and deep breathing, and most importantly they are a mix of conscious and autonomic reactions. Hansen's definition of affection-image falls within the range of this mix. Thus, although it puts a foot in the interval, the virtual or the shift, it is never there because consciousness keeps pulling it back, as we have seen, either by expectations (as in his analysis of the time-image), by instructions (as in the interaction with DFI) or by bodily activity (as to accord the participant's body the framing function). All of these act as concrete barriers representing the agent's

conscious resistance to affective involvement with the image, and redirecting the interaction towards a representative idea of acquired perception underlying embodiment in Hansen's model of *techne*.

4.6. Summary

This chapter focuses on investigating embodied affectivity as the second constituent of embodiment based on the argument levelled by Hansen regarding Deleuze's inadequate transformation of Bergson's theory. The analysis reveals an agreement between Bergson and Deleuze's transformation regarding affectivity as affection-image in relation to its 'place' as noted in the elaboration of qualitative progression and discussion of the close-up. The analysis of spectatorship does not support Hansen's claim that Deleuze has disembodied the centre of indetermination or has ignored the viewer's body and feelings in his analysis of cinema. Moreover, neither Bergson nor Varela separate perception from affection, as Hansen advocates, but their accounts are comparable in relation to the heterogeneity and temporality of the moment. Hansen's claimed separation between affectivity and perception lacks evidence as contemporary approaches shows the opposite.

Generally, Hansen's model of affectivity is positioned in relation to acquired perception where the intensity of the sensation is already determined due to cause-effect perception. The problem we sense in Hansen's account is that it denies art its fundamental artism or aesthetics in relation to human experience, rather cornering it to a subordinate role. The findings of these two chapters on

perception and affection indicate that Hansen's account of embodiment is problematic as it departs from other theorists and reveals a lack of clarity in its concepts.

4.7. Conclusion: beyond polarization

The first phase of the transdisciplinary approach introduced an analytical study of the empirical research on embodiment. The findings revealed that there was a reduction of embodiment to image and of embodied interaction to verbal evaluation of the outcome, which motivated the second phase of this research. This latter phase aimed to overcome the previous issues through the provision of understanding embodiment, embodied interaction and their constituents from another discipline. The focus here was on the analysis of the work of Mark Hansen on embodiment in new media.

Hansen claims to introduce a phenomenological model of embodiment that supports the scientific practice. However, Hansen's engagement with other philosophers and theorists such as Bergson, Varela and Deleuze seems more relevant to achieve our aim than Hansen's own account. This is because, on the one hand, Hansen poses a similar problem to HCI as his account implies mind/body polarization within human computer interaction which restricts its analysis. In HCI, as the first chapter concluded, this articulation is indirect but is the consequence of the experimentation strategy and measurement tools that favor verbal measurement over a behavioral one, thus ignoring the embodiment of the subject (embodied perception and affection), which in effect limits the virtual embodiment to representational roles. On the other hand, the polarization

in Hansen, which prioritizes the subject over technology, is deliberate due to his selection of the model of transformation, which is based on a patriarchal account.

Hansen's patriarchal account views the technology as a woman, where the experience in technological situations is described as *Erlebnis*, which is a short-lived subjective and corporeal experience. Technological materiality and qualitative autonomy are explained in relation to knowledge of the female body and its functions. Technological variation, situations and experiences are restricted to the projection of this account. Hansen's model of embodiment and his analysis of the female Digital Facial Images (DFI) falls within the interest of studies focusing on agent's abuse or misuse in HCI. These studies investigate verbal abuse in participants' direct interaction with embodied conversational agents (ECAs) (Brahnam and Angeli 2008; Brahnam et al. 2011; Brahnam and Angeli 2012). Similar abuse cases are also reported in learners' interaction with pedagogical agents (PAs) studies, although these were not intended or designed for such explorations (Veletsianos et al. 2008; Gulz et al. 2011). Brahnam (2011), looking at the historical shift from women working as human computers, to the emergence of electrical computers in the 1950s as their counterparts, emphasizes that "computer is woman" is a foundational metaphor that has an impact on HCI second person interface design (2011, p.402). This feminization "can reinforce traditionally inscribed feminine values that perpetuate the oppression of women's material and social bodies within a

patriarchal society” (2011, p.406). Brahnam stresses that such metaphors have influence on how people treat and relate to each other in real life (2011, p.410).

Hansen’s transformation becomes problematic to our understanding of embodiment as it fails to account for embodied interaction and experience in technological situations, however it is a by-product of the research. Deleuze’s work, in contrast, shows us a different type of technological embodiment. The embodied cinema, for Deleuze, similar to the computer, has its own organs but instead of modeling natural perception and affection, it creates its own images of perception, affection and action. Three stages of development characterize the cinema and its images within the dimensions of movement, time and becoming. These are the embodied stage, as the initial or new phase, becoming, as the stage of development, and transcending, as a final stage of going beyond. The second stage is the most important. This stage is relational and leads to the creation of new images and virtual connections. This focus on relation and becoming makes cinema open to duration, where the effect of the extracted image can continue beyond the time of viewing.

For Deleuze, a change in a notion can create new ways of thinking. It could be this that HCI requires, change in notions, focus on relations, and viewing of the participants and technology as becoming. Embodiment in HCI should pass the stage of being viewed as new and peculiar to computers, in order to be related to the familiar. This means it will be addressed in its stage of development, where the focus will be on the creation of new effects, images and relations, rather than equating virtual embodiment with the human and addressing

aspects that focus on convincing participants that the machine is human, as we have seen in the introduction. The evaluation of embodiment should overcome the reduction of the participant to their mind, as the body is not considered as an active determinant in this evaluation. The design and evaluation could benefit from building on the 'relational dimension' between the machine's and human's embodiments instead of the 'effectiveness' measure. In this way, the design will prompt questions on how to create relations between the two forms of embodiment, rather than how to create effective interfaces. It is not that the latter is not important, but it is a dimension of the relation or the experience and is not constitutive of it.

4.7.1. Embodiment constituents

The engagement with other philosophers and theorists has informed our understanding of embodied interaction and embodied constituents. Chapters three and four focused on embodied perception and affection. Here, a summary is provided of the main points found in the research of different perspectives of embodied perception, which are important to the design and evaluation of the user experience and embodiment in HCI. First, the perception of the living being involves different degrees and types. Its simplest form is an automatic movement related to the spinal cord stimulation. As a complex form, it addresses the process of selecting a reaction from a variety of virtual actions that exist due to the reciprocal relationship between the participant and the variation in the environment. Another form explains automatic reactions based on the associations of recurrent patterns between sensorimotor, perceptual

images and actions, which could form learned communication patterns. Second, distance and time are inseparable dimensions of perception, which is explained as a tendency towards movement or an action. Perception is defined as the *extraction* (extracting, defined previously, as bringing into focus by suppression or abstraction of other parts of the image) of an image of interest from the object and qualifying this either by developing real or virtual connections. Virtual representations and connections, along with participant's sensorimotor knowledge, awareness and expectations are part of the user's perceptual experience. Third, perception also counts for the activity through which the participant brings new information or details into view.

This means that embodied perception can only be evaluated in its emergence and through the process of interaction. Studies in HCI that explore the analysis of participant's experience can make use of strategies for evaluation of physical activity and behaviour to evaluate perception. Other studies that aim to evaluate achievement should consider the correlation between the degree of complexity, variation and pattern's associations. On the other hand, the design of virtual embodiment should consider the extraction of those animations or physical activities of the character, in relation to the quality and effect the design is required to achieve. As we have seen in the discussion of chapter one, the pedagogical agents' role is limited to pointers and verbal feedback; those pointed out by Turing in his paper in 1950. However, while the design can start from natural perception, it can be used to change or undo already established associations and produce new perceptions that enable new sensorimotor

grasps. It is important to think what a virtual character can do instead of what a human or an image can do, in order to achieve a qualitative leap in design and evaluation.

The second constituent of embodied interaction is embodied affectivity. As elaborated, affection has bodily bases (muscles contraction), degree of depth or quality (richness of feelings and emotions) and intensity (conscious reaction). Affective states are temporal and vary during the process. Qualitative progression, suggestibility and temporality are three important aspects that come out of our analysis. First, qualitative progression means that affective states do not spread out, but are based on participation and the independent joining in of each element. That is, different muscles, feelings, emotions, memories and perceptions observe change in their nature due to the force of a certain stimuli or feeling. The degree of this change varies from one element to another, which means that the strength or intensity of the affective state is based on heterogeneous elements and thus it is subjective to individuals.

Second, suggestibility means that the image does not impose certain effects on the subject, but suggests certain directions or emotions. Third, temporality refers to affective states in their emergence. The emergence of new emotions or feelings during the process, affects future actions or decisions whether at the time of interaction or later on. The affective dimension also explains the anticipation of future experience but does not guarantee its repetition. This explanation of affectivity provides a different way of investigating the affective dimension in the interaction with virtual embodiment. Instead of verbal

feedback, the changes in affective intensity and affections could be observed during the process. This facilitates the acquisition of feedback about different aspects or stages in the interaction, without ruling out the individual's subjectivity.

Embodied perception and affection inform the evaluation and design of embodiment and embodied interaction. Besides these two, the interaction seems to be revealed in physical or visible behaviour. This motivates us to investigate the becoming and relational dimension that appears in the analysis of cinema, in the field of HCI. This dimension characterizes the 'development' stage in the relationship between the human and the computer. It influences the evaluation or analysis of human's experience and interaction with computers. As pointed out in the research background, the lack of considering duration has led to addressing and evaluating embodiment and its effect as a 'new' phenomenon. The next phase of the transdisciplinary approach has two aims. Firstly, it extends the understanding of this dimension through the exploration of Gilbert Simondon's work on individuation. Secondly, it intends to counter the issue of mind/body polarization observed in HCI and Hansen's accounts, by focusing on immanent perspective. Here, it hypothesizes that the Turing Machine is a heterogeneous compound, representing a relationship between Turing and computers that was developed through a process of becoming. In this sense, it provides a reading of Alan Turing's work based on this understanding.

5. Chapter Five: From Polarization to Immanence:

Embodiment in AI

5.1. Introduction

The previous phase of this research showed that the translation of human embodiment into technology is crucial in actualizing these technologies and in determining human interaction with them. A reversal from the investment in machine embodiment explored in chapter one to the investment in participants' own embodiment examined through Hansen's account was observed. The studies in chapter one focused on providing an objective account for the evaluation of the user's experience of interacting with virtual embodiment. This was referred to as the persona effect. It showed that the participant's embodiment in the learning situation was ignored in favour of evaluating the effects on learning measures of transfer and retention and subjective measures of perception, affection, believability and usefulness through eliciting verbal responses after the process. Disciplinary bias reduced virtual embodiment to an animated image added to the interface, which acted as feedback indicators (e.g. arrows).

Hansen's account, on the other hand, provided a subjective account based on restricting the user's experience in technological situations to *Erlebnis*, which referred to a short-lived subjective experience. It demonstrated a body/mind polarization where the technology's effect was 'claimed'⁸⁸ to be limited to the body but did not entail the cognition of the participant. The gendering of

technology or new media (e.g. DFI images) by viewing it as a female body restricted technological situations and embodied interaction as described earlier in chapter two. Due to the nature of Hansen's research, in particular his theoretical and philosophical analysis, another account of embodied technology is linked to this, namely Deleuze's work on embodied cinema. Deleuze transferred Henry Bergson's theory of embodiment to the cinema showing that the cinema can perceive, affect and be affected like living beings. Moreover, the cinema also has its own perception and affection images. The cinema can shock the viewers, create virtual conjectures, induce subjective images that make them think, have an impact on and affect their relation to the world in the course of its duration.

A particular investigation into embodied perception and affection emphasized that evaluation should take into account the participants' embodied interaction and physical behaviour during the process. At the same time, a movement from human-computer interaction (HCI) to human-computer relation (HCR) should be considered. This change means the design should target extracting qualities from embodiment in a similar way to the cinema in Deleuze's account. The extracted qualities can become 'singularities' and, so they can create real or virtual conjectures. Virtual embodiment does not need to be restricted to real embodiment. Evaluation of the effects or interaction should follow a similar path where a focus is placed on the changing relation between the participant and the machine throughout the process. What makes this change important is that the embodiment of the machine is no longer at the stage of 'newness' but has

moved to the stage of development or becoming. This stage, as Deleuze affirms, is where the essence of a thing makes its appearance (elaborated earlier in chapter two). However, the previous two accounts placed and evaluated the machine or virtual embodiment as new, thus, never taking into account the counter-becoming of the machines and humans, and the relations between them.

This phase of the transdisciplinary approach aims to establish a constitutive account of the human and machine's embodiment, leading to innovations, creativity and continuity. This account intends to overcome the mind/body and object/subject polarizations found in the previous accounts. It attempts to grasp and accept two fundamental aspects: first, the multiple emergences of different relations that materialize from the relation between a human's embodiment and a machine's (i.e. Turing and the digital computer); and, second, the irreducibility of this relationship to be seen as an invention that has occurred within a certain period of time and space as a result of acquired scientific knowledge. Affectivity is perceived as central to both aspects.

This part of the thesis explains the relationship between the human and machine's embodiment in relation to two accounts, Gilbert Simondon's and Alan Turing's. Gilbert Simondon's work can inform our understanding of a 'relation' and process rather than interaction and outcome. This view can be used to overcome the polarization observed in the HCI and Hansen's account of embodiment. A fuller account of Simondon's concept of individuation will be given in chapter six, but here it is important to introduce the main points in

relation to the theme of this part of the thesis. Simondon states, “in technical reality there is human reality” (Simondon 1980 [1958], p.11); which can also be understood as ‘in human reality there is technical reality’, which should not be comprehended on the basis of an entire reversal but a complex integration of relations and becomings. He takes the initiative in thinking about the process of individuation instead of the individual as an outcome.

Simondon’s conviction was that no thinking that was in thrall to constituted individuals, and blind to the processes and operations that brought them into existence – blind to individuation, in short – could cope with the challenges of a technological society (Toscano 2007, p.1).⁸⁹

For Simondon, individuation or becoming is a central dimension of the life and evolution of both the human being and the machine or technical being. Simondon’s concept of individuation differs from the substantialist’s self-centred monism that defines the unity of the individual by its essence, andhylomorphic’s bipolarity that perceive the individual as “the conjunction of a form and some matter” (Simondon 1992, p.297). Simondon focuses on the process that is the in-between rather than the beginning or end of the individual. In this sense, his approach is based on energy “taking-form” or “effect” that becomes “real” by passing through the “material clinching of an effective event” and “ideal” by coming “into the effective present of that energetic event as the action of its future” (Massumi et al. 2009, p.43-44). In other words, the real-time of the present event is defined by taking a futurity “effect”.

Massumi stresses that the integral reshaping of disciplines by digital technologies is reflected in the human being. The question of how a being

'becomes' has also become a question of technology as a "constitutive factor in human life" (2009, p.38).

becoming-human only makes sense in relation to a nonhuman phase-shifting into it. And becoming-posthuman only makes sense in terms of the human phase-shifting out of itself, back into a nonhuman. If the nonhuman phases in and phases out, it is conceivable that it phases through – which raises the issue of the immanence of the nonhuman to all of the vicissitudes of the human (2009, p.37).

A technical culture, then, represents an interplay of human-technical individuations. Massumi stresses the importance of considering the 'natural' habitat or, more precisely, the integration between the physical and biological, the matter and information for the emergence of the new. "Inventivism" is used here to signify this integration and emergence within the process of becoming.

"An inventivism" Massumi asserts, "is not afraid of nature, and its creativity" (2009, p.38). It marks "an action of the future on the present" (2009, p.39). This action is based on the sensitiveness to present qualities or effects of individual elements that when assembled bring a new self-conditioning individual into being. For this reason, Simondon's work differs from the constructivists who are interested in constructing "perspectives or paradigms and the corresponding subject positions" (2009, p.37) by applying linguistic models, which "reduced the constitution of the human plane to the question of human subject" (2009, p.62).⁹⁰ It could be said that "inventivism" for Massumi marks 'the future of becoming.' Becoming, here, is a process marked with points such as inventions and discoveries, that is, crossing thresholds, rather than being thought of as 'the

becoming of the future', perceived as time in a becoming process where there are points, which remark beings of future. Thought, in the latter sense, cannot be grasped by the thinkers themselves but it unfolds within time and can be thought, only backwards more than forwards as a reasoning *about* a relationship when the relationship is *blind* to the future of its own becoming.

A technical culture, for Simondon, requires a technical mentality that has "coherent and usable schemas for a cognitive interpretation" (2009, p.20) that allows the understanding of technical reality. In order for technical reality to lend "itself remarkably well to being continued, completed, perfected, extended" it needs "a single criterion the manifestation of cognitive schemas, affective modalities, and norms of action: that of the opening; technical reality lends itself remarkably well to being continued, completed, perfected, extended" (2009, p.24). This necessitates a different science, which Simondon calls "mechanology". Mechanology's definition is realized in three aspects. Firstly, it is not a science of studying mechanisms but the "exchanges of energy and information within the technical object or between the technical object and its environment" (1980 [1958], p.42). Secondly, as John Hart points out in his preface to the translated version of Simondon's doctoral thesis *On the Mode of Existence of Technical Objects* (1980 [1958]), there is an implicit reference to the centrality of,

the human body with its balance, its rapport, and its emanations which gives to mechanology a degree of universality which put it into legitimate comparison with the broad extension of science (Simondon 1980 [1958], p.3).

The technical object, for Simondon, could be seen as a “physicochemical system in which mutual actions take place according to all the laws of science” (1980 [1958], p.31). That is, although the technical object is designed in response to human needs, it is not limited to them. Its design should also be identified with universal scientific knowledge (1980 [1958], p.31). The former assures it of being a representation of a human goal, and the latter guarantees it being a representation of scientific knowledge where it is considered as never being completely known, never fully calculated, and so never completely concrete (1980 [1958], p.31). Therefore, it “approximates the mode of existence of natural objects” (1980 [1958], p.40). Thirdly, mechanology postulates that the understanding of the role of the man and the nature of machines cannot be attained by scientific knowledge, which “sees in a technical object the practical application of a theoretical law” (1980 [1958], p.15) or through the habit of using them. An organizing engineer who is a psychologist, sociologist or mechanologist of machines might be able to attain the required understanding (1980 [1958], p.15).

Simondon elaborates on the human being’s becoming in the ‘The Genesis of the Individual’ (1992). A similar account of the becoming and evolution of the technical object is in *On the Mode of Existence of Technical Objects* (1980 [1958]). In ‘Technical Mentality’ (2009) he outlines the conflict between the human and the machine that appears due to the industrial modes of production and attempts to define “schemes of action” that mark its universal “value code” relevant to the psychosocial level of human society.⁹¹

To understand this complex integration, individuation and conflict between machines and humans, I outline an analysis of Alan Turing's work on intelligent machinery. Turing is considered the father of computer science and the founder of artificial intelligence (AI). His later work on intelligent machinery (1948–1952), has influenced past and current trends in computing, the role of the computer, and technological and human science applications. The basic seed for machines or digital computers' embodiment, could be traced back as far, if not further, as the "thinking machines" and "learning machines" described by Alan Turing (1950s) who described his ideas as "recitations tending to produce belief" (1950, p.455). Turing argues that machines can think, develop and be experienced as other living beings. He pursued the design of a universal Turing Machine, which refers to a digital computer with infinite memory that can imitate any other machine. Besides this, Turing also described the imitation game and the Turing test, intended to defend and demonstrate machine intelligence. Analyses of Turing's writings also imply that these settings are underlain, like the previous account, by a transformation of human embodiment and by gender issues. These initiate various debates in science as a discipline and scientific culture. At the same time, they also motivate research in user's experience or the persona effect of embodied software agents explored in chapter one.

This analysis differs by viewing the Turing Machine (Machine is capitalized in order to emphasize its equivalent role in the compound) as a compound within the process of individuation rather than explaining it in the light of scientific rigours and hegemony or philosophical judgements. In other words, we are

focusing on the complexity of the relationship between Turing and machines itself, rather than determining the dominant term in the body/work equation, as observed in the previous accounts. The multiple emergences refer to Turing's papers on intelligent machinery, game and test, as well as the debates addressing the question 'what was in Turing's mind?' The compound and the relation are elaborated in reference to Simondon's work and Deleuze on becoming and individuation. By perceiving the Turing Machine as a compound, the focus moves from the individual element to the whole, as a unit of individuation and analysis. For example, the Turings or the 'other things', as I call them, which refer to a certain test, a game and a universal property that are associated with Alan Turing's works on machines have started to individuate on their own, thus bringing their own ceaseless discursive, technical and cultural dimensions into the computing field and machine embodiment. This emphasizes the relation in-between the elements, and is yet inseparable from them. Each term participates progressively through forming a set of relations between them and their environment. A relation is formed first through attraction between the terms and, second, through establishing a dynamic background with which both terms interact.

The analysis in this part of the thesis is divided into two chapters. The first chapter investigates the reasons for abstracting the actual existence of the Turing Machine. Here, Turing Machine is repositioned within the virtual-actual existent realm rather than the abstract-probable nonexistent realm. It also examines the multiple relations emerging from Turing's 1950s papers, in

response to the question, which has repeatedly appeared in other Turing studies, 'what was in Turing's mind?' The second chapter in this analysis introduces Simondon's work on becoming or individuation. Then, taking the analysis of Alan Turing as a case of this individuation, the Turing Machine is established as a compound by applying Deleuze's concept of 'dark precursor' as a point of formation between two heterogeneous systems. Moreover, it examines the lines of becoming-same/other relationship between Turing's embodiment and machine, or machine representation in relation to the gendered accounts implied in both Hansen's and Turing's work.

5.2. Turing Machine

5.2.1. Reality of Turing Machine

Many of the current developments in and debates about the technical and cultural advancement in the computer's role could be detected in Alan Turing's writings and as a consequence of his aim to design a Turing Machine, which is considered an abstract for an electronically stored-programme digital computer. What encourages us to reopen the Turing Machine file now is that, while the machine's embodiment becomes visible and necessary to the human's interaction, it cannot be separated from the human's psyche or soma anymore. In other words, the constructed 'boundaries' between them are already vanishing and a sort of transmission of affect is taking place which is supported for example by modelling and biofeedback techniques. If Turing is regarded as the father of computer science, and the founder of artificial intelligence and

artificial life it is not ultimately because of his scientific knowledge but because the Turing Machine has challenged these boundaries allowing multiple emergences.

Before elaborating upon the counter-becoming and multiple emergences of the Turing Machine relationship, which is in the next chapter, it is important to determine the actual reality of the Turing Machine. This section argues that the Turing Machine could be repositioned from being abstract or conceptual (that is non-existent) to being regarded as actual (that is existent), which implies virtual conjectures and a relation of becoming between Turing and Machine. To relocate the Turing Machine and Turing's work, this table (figure 17) is adopted from Rob Shields' book *The Virtual* (2005), which aims at investigating the virtual in relation to everyday life including virtual realities and environments. Shields insists that a critique of the virtual and probabilistic entities is required for avoiding problems and definitional debates (2006, p.284).

The virtual, according to Shields, means "incomplete imitation of the real" (2005, p.46) that is "what is so in essence but not in form" (2005, p.22). "Humans have a cognitive ability to substitute 'what is so in essence' for actual things themselves" (2005, p.23). For example in calculations x, y and z are understood as quantity substituting actual objects. What is transferred between the virtual and the actual is "a quality" that "becomes the essence of the matter" (2005, p.22). He affirms that the word virtual in commonsense is deployed as "a placeholder for important forms of reality which are not tangible but are essential and necessary to our survival" (2005, p.19). The virtual is a multiplicity or a capacity

that can be actualized in different ways where its effect is known through a specific instantiation (2006, p.285). This provided, the table below is intended to give an understanding of the distinctions between the common set of categories that usually occurs in philosophical readings.

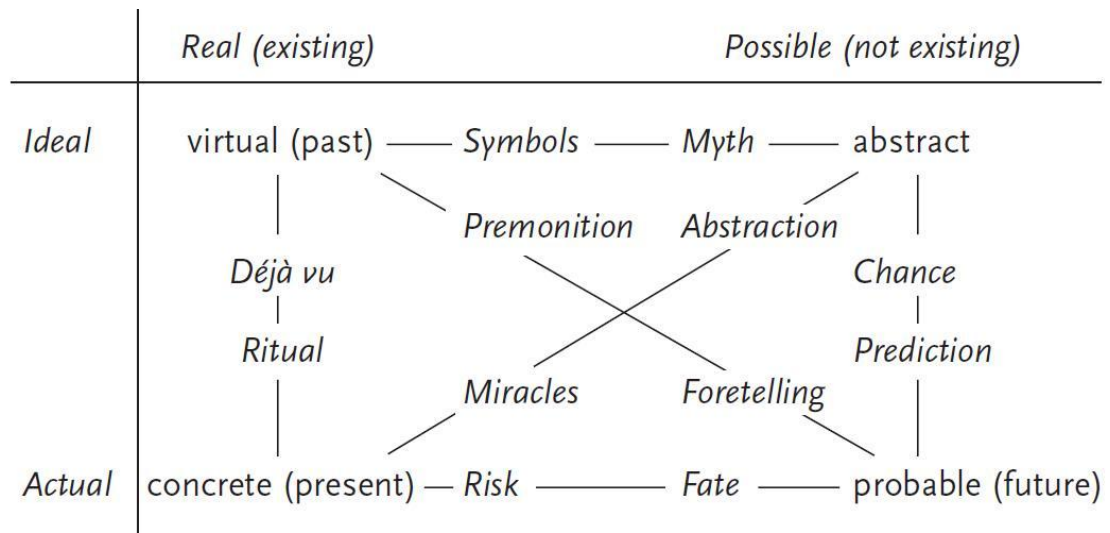


Figure 17. Figures of speech and movement between categories of the real (2005, p.34)

Abstract according to the provided table is nonexistent and to become concrete it requires a sudden materialization; that is a miracle. So is Turing Machine an ideal abstract, a myth, a fantasy or a chance happening, or is there any actual or concrete materiality to the Turing Machine? The reasons for the abstraction of the Turing Machine or its reduction to text could be pursued within two influences. The first one is related to the machine's states and materiality and the second one is due to the disagreement between the scientific culture and Turing. These reasons and arguments are presented in the next section.

5.2.1.1. Machine's statue and materiality

Three reasons could be said to influence the actual existence of Turing Machine. Firstly, the Turing Machine, which is an electronically stored-programme digital computer, is perceived in Turing's final complete theoretical project rather than the development process of the project. Turing's complete project is to be realized in the universal Turing Machine, which is "a type of machine which had a central mechanism, and an infinite memory which was contained on an infinite tape" and can imitate any other machine (Turing 2004d, p.379). In this quotation the word "*infinity*" is generalized to constitute all the different forms of Turing Machines. As Copeland says, "Indeed, because they are abstract machines, with unlimited memory, they are capable of computations that no actual computer could perform in practice" (Copeland 2004, p. 17). In other words, Turing Machine is perceived in holistic thought.

Secondly, machines' existence is perceived in their limitations, that is 'whatever they cannot do', or the non-existent.⁹² In this sense, existence is not identified with materiality but with that which does not exist per se; that is the limitation. This existence of the limitation is constitutive of the perception of a machine's corporeality, which means all that exists is already existent in its entirety that is fully calculated and represented. The existence, which is whatever the machine cannot do, is equivalent to the non-existence through a perceived perfectness. The existing corporeality is not existent because it is perfect, that is complete, flawless and attracts no further attention or calculations now and in the future. It has been perceived in its perfectness, and thus it belongs to the realm of

abstractness where 'whatever they cannot do' appears in fantasy and fiction representations, but they will not be called into object of representation in science or culture any further. The non-existence within the table in figure 17 means the probability of their futurity is a matter of chance and predication.

Thirdly, in relation to the previous point, the concrete here is allocated to the hardware, and the abstract is allocated to the software. That is the software does not exist prior to the hardware that carries it and in which it functions. A problem arises when the software operates in advance of the hardware it aims to operate within. As Copeland states "Turing's philosophy ... was to dispense with additional hardware in favour of software: in his design, complex behaviour was to be achieved by complex programming rather than by complex equipment" (2004, p. 366). Turing's experience of designing and developing machines is only considered actual, concrete or evident through the acceptance of engineers. The implementation is limited. The rest of the programming and prepositions are taken as abstract. The software is actual but in a different matter, that is, text and not in the matter that it is intended to be in, which is digital. The fact that it is in one state means that it is perceived as non-existent in the other state. In this sense, the relation, if not abstract, is, at best, one of 'prediction' or probability. Shields explains the probable as the 'actual possibility', for example, "the likelihood of rain in the weather forecast" (2005, p.25).

This indicates that the complexity of the Turing Machine (compound) is not only a question of its actual existence but also of its actual cultural acceptance, as

well as the acceptance of the multiple emergences of Turing's work. The extent to which this actuality is foothold is examined below.

Firstly, in relation to the first and second points, outside the *infinite* property, the Turing Machine has actual implementations. However, as pointed above machines are perceived in their limitations whether in carrying out different tasks, or in the case of the Turing Machine in the unachieved infinite property. Turing has rejected this view insisting that machines have actual existence and there are varieties of machines. Turing's response to this argument shows the progress of his work on the Turing machine. He argues,

The objection ... in its crudest form is refuted at once by the actual existence of machinery (ENIAC [Electronic Numerical Integrator And Computer] etc.) which can go on through immense numbers (e.g. 1060,000 about for ACE [Automatic Computing Engine]) of operations without repetition, assuming no breakdown (2004c, p.411).

The ACE (designed by Turing and installed in 1945) is a practical version of the universal Turing Machine with the exception of the infinite memory and infinite tape (Turing 2004d, p.379). Another version of the Turing Machine was the implementation of the 'Manchester baby' (1948), which was run in the Computing Machine Laboratory by Manchester University. This was followed by Ferranti Mark 1 (the first commercially produced electronic stored-programme computer) also designed by Turing (Copeland 2004, p. 16). From 1951, Turing worked on Mark1 to model aspects of biological growth (2004, p. 3). Copeland elaborates on two of Turing's contributions to modern computers. These are: "controlling the function of a computing machine by storing a programme of

symbolically encoded instructions in the machine's memory," and his demonstration "that, by this means, a single machine of fixed structure is able to carry out every computation that can be carried out by any Turing Machine whatsoever" that is the 'universal' property' (2004, p. 15). Eventually, then, the Turing Machine's existence, regardless its actualized varieties, is perceived through the limitation of the property Turing proposed and that which modern computers still lack, which is the "infinity."

Secondly, there is problem of allocating abstractness to the software. For Turing, the software was operating on what he calls the "Paper Machine". The "Paper Machine" refers to a "combination of a man with written instructions". The man is provided with a set of procedural rules, a pencil, and rubber, and is "subject to strict discipline" (Turing 2004c, p. 416). Turing used this in one of his experiments for playing chess. He confirms that "playing against such a machine gives a definite feeling that one is pitting one's wits against something alive" (2004c, p.412). In this sense, it is actual (being actual here refers to its effect). It could be argued that the relation between the paper machine and the digital machine, or the code on paper and the digital code on computer in Turing's work – and even the preposition and their future achievement- is of a different relation than the possible or probable. It is not a case of a cloud that might rain or not, but that of water that constitutes the evaporation or change to gas within it. In this latter case, the change in state is an 'associative' inseparable part of the state itself while in the case of cloud/rain it is based on repetition or temporality of occurrences, and for this reason, it is forecasted.

Associative in this context is used to donate a relationship between text and digital and whether the design or programming is developed on a paper machine or on a digital machine does not really matter, as it does not change the final products.⁹³ The final product is experiencing the machine's intelligence and building the universal Turing Machine. The remaining task for Turing is a matter of physical effort in building the sufficient hardware. This might mean that the infinite and universal properties of the Universal Turing Machine do not fall within the abstract-probable but rather within the virtual-concrete. The virtual for Shields,

retains its creative character as an ontological category pertinent to discussions of change, becoming, genesis, development, emergence, autopoiesis, the genetic power of codes as well as of codings themselves (2006, p.285).

As the paper machine's experiment shows, Turing attributes to machines not the matter they are created in, but the quality of producing certain experiences.

Moreover, the associated relation, which occurs in the course of a digital computers development, is the repetition that his work, either as designs or as propositions are realized in the present time and are still in the course of realization. This also means that the provision of alternatives of the same implementation - such as modern computers- does not mean that the original design of the Turing Machine itself is faulty or abstract. Even if the provided alternatives could function in a better way than the original or initial one, they remain alternatives provided in the course of development. In this way, they

have an associated relation of representing the future, that is the 'fate' of the original design.

An associative relation appears where the course of development shows that the digital functions in the same way as the text. Transformation from one materiality to the other becomes a matter of verification in the course of development rather than a miracle. This transformation is based on the engineers' and programmers' work. For Turing, sooner or later – in fifty years' time, a hundred years' time, etc. – a sufficient digital computer, better than the Manchester machine (1950, p.441), which in turn was better than Babbage's machine (1950, p.439), will be constructed. The program will be found, if programmers work as steadily as him (1950, p.445) and in the meantime, potentially, the universal aspect will become true. The relation between the digital and the text then remains within the realm of existence that is virtual-actual rather than abstract-probable.⁹⁴

5.2.1.2. Scientific Culture and Turing

Cultural abstraction, in the Turing Machine's case, could be perceived as an expression of rejection or denial and, at the same time, as a means through which scientific cultural adaptation takes place without risking its adherence to methodological and structural thinking. Martin Heidegger in his essay 'The Age of The World Picture' (1976) explains how this adherence is crucial in identifying the essence of the scientific research. Heidegger's account is helpful here to reflect on the nature of the scientific research in the modern age and to understand the conflict between it and Turing. For Heidegger the essence of

science is research. Metaphysics of any phenomena is based on reflection defined as the “courage to question as deeply as possible the truth of our own presuppositions and the exact place of our own aims” (Heidegger 1976, 341). Mechanical technique is not an application of modern mathematical natural science to practice, but an autonomous transformation of practice that demands the application of mathematical natural science (1976, 342). In other words, we do not start from mathematics and use machines to transfer it but we start from machines and what is required by them to work. Heidegger defines the essence of modern science as research through which knowledge is established.

Modern science simultaneously establishes itself and differentiates itself in its projections of specific object-spheres. These projection-plans are developed by means of a corresponding methodology, which is made secure through rigor. Methodology adapts and establishes itself at any given time in ongoing activity. Projection and rigor, methodology and ongoing activity, mutually requiring one another, constitute the essence of modern science, transform science into research (Heidegger 1977, p.126).

A research is rigorous as long as the cognitive procedures or models strictly remain within the topic of the research field (that is projected) and adhere to its predetermined plans, which must be “accessible in all the complexity of its layers and interlacings,” in order to be objective (1976, 344). To be objective, means that the procedure should present the facts and investigate the variables that cause constant changes of these facts. Facts are revealed within a rule, a law and spatiotemporal magnitudes of motion that is exactness. The rule means that the facts are permanent and permanently change due to certain factors. The law (e.g. hypothesis) is that change to these facts always occurs due to some factors (1976, 344). The methodology ensures the clarification of the facts

by explaining the unknown (findings) by the known (means), simultaneously preserving the known means by the unknown findings (1976, 345). In other words, it is rigorous as long as it allows replication, through which the new findings are explained in view of the previous findings. Scientific research is characterized by an “ongoing activity” through which specializations (that is disciplines), institutionalization and adaptation of new procedures appear. This is because “the methodology of the science becomes circumscribed by means of its results” (1977, p.124), which leads to singularization, individualization and solidarity of research topics. “The real system of science consists in a solidarity of procedure and attitude with respect to the objectification of whatever is- a solidarity that is brought about appropriately at any given time on the basis of planning” (1977, p.126).

Knowledge as research means that any being’s existence is determined by the extent to which a researcher brings it to be an object of representation. Represented, the object can be bound to calculations, which allows the verification of its past and the calculation of its future, course in advance (1976, p.349; 1977, p.127). In this sense, the being must appear as object first, in order to be admitted to its certain existence.

The modern age for Heidegger has brought with it an interplay of subjectivism and objectivism. This interplay is deployed in the event of simultaneous emergences of the essences of the man and the world. Through this event the man becomes a subject (*subiectum*) and the world becomes a picture (an object of representation) (1977, p.132). The modern man becomes a subject if

his essence changes and not by freeing himself to himself from previous obligations (1977, p.128). This change occurs when the man intentionally sets himself in precedence over all other centres, as a representative of the world, and maintains his position in being, so as constitutive (1977, p.132). In other words, the man does not find himself as the centre of the world but he establishes this position by himself. Defined as a subject, he brings a world picture or the world as a picture. This becomes the essence of the modern age: the conceiving of the world in its entirety as a picture. The world, then, becomes an object of representation. The extent of its being in its entirety is determined by the man (subject) representing it (1977, p.130) and the latter's relation to the man's lived experience. To represent means,

to bring what is present at hand ... before oneself as something standing over against, to relate it to oneself, to the one representing it, and to force it back into this relationship to oneself as the normative realm (1977, p.131).

Represented, then, the world's history, nature and so on can be seen as a system, which is a unity of structures developed and produced by man and according to the plan of objectifying (1977, p.141). Man can set the measures and guidelines for it (1977, p.134). Nothing else is admitted into existence without being first objectified, represented and interpreted in this way (1977, p.130). Through this route of "representedness", newness and new things, which define the modern age come into being (1977, p.132). Achieving his essence of being a subject brings into question a counter struggle for and against individualism, that which is the "I" in society and that which is the "we" (1977, p.133). It also brings up the confrontation between different views of life

or lived experiences of different men. To resolve these confrontations, science as research becomes essential for the struggle of the “establishing of self in the world” (1977, p.135) where the “man brings into play his unlimited power for the calculating, planning, and molding of all things” (1977, p.135). In this way, then, science becomes the man’s vehicle to represent and to exist itself. This struggle is not an event but a sign of another happening that is the “gigantic”. The gigantic does not announce its appearance in visible, recognizable or realizable ways to man. It takes place with “a velocity unknown to the participants” (1977, p.135). It appears in that which is “increasingly small” and quantitative (e.g. the increase in the number of mediums that decrease distance and time, for example, in travelling and communication) making quantity itself its special quality.⁹⁵

Quantity as quality becomes “a remarkable kind of greatness” that characterizes this historical moment. The gigantic, the “increasingly small,” keeps increasing/decreasing until it becomes incalculable and thus invisible. It could be said, that what has come into existence through representation has departed the representation through the increased quantity of representations. Thus, it cannot be represented anymore outside the incalculable struggles. It is extended to the incalculable determinateness, which is a field of struggling representations rather than being a field or representation itself. In other words, it loses what has defined it as a field representing certain phenomena. Consequently, as long as its existence as a being or object in-itself is denied, that is it does not exist without being perceived and calculated, then “self-

deception and blindness in relation to the historical moment” occurs (1977, p.136). To recognize the incalculable, reflection as a power of creative questioning is required to transport the man of the future from his extreme subjectivism, through which the world is set in extreme objectivism, to the ‘between’ “in which he belongs to Being and yet remains a stranger amid that which is” (1977, p.136).

Turing by formal definition is a scientist and scientists, as Snow declares,

have their own culture, intensive, rigorous, and constantly in action. This culture contains a great deal of argument, usually much more rigorous, and almost always at a higher conceptual level, than literary persons’ arguments – even though the scientists do cheerfully use words in senses which literary persons don’t recognise, the senses are exact ones, and when they talk about ‘subjective’, ‘objective’, ‘philosophy’ or ‘progressive’, they know what they mean, even though it isn’t what one is accustomed to expect (Snow 1990, p.171).

Except in the case of Turing the ‘one’ is a self-reference to the same culture of ‘science’ and thus in relation to the discipline of science, Turing has to prove his word rigorous. As Heidegger’s account shows, science or the scientific culture has its own hegemony over its individuals, through which it determines what matters: basically exactness and rigorousness. Reasonably, in relation to Turing’s work, scientists are interested in the well-established facts (calculated and measured representations) but resist the conjectures these facts are wrapped in. They struggle to read Turing’s paper, especially ‘Computing Machinery and Intelligence’ (1950), objectively because the conjectures address their subjectivity: ‘Why gender and not only human?’ ‘Why imitation and not just thinking?’ ‘Why game and not only test?’ This paper introduces the

'other things' (i.e. game, imitation, emotions, child machines), which are not only related to Turing's scientific research, but which are neither objective nor replicable. For scientific research, these are associated with the risk of stripping its essence.

Turing himself is part of this abstraction. Turing has already established a position for himself as a scientist and as a code-breaker of the Enigma, which is the German machine used for military communication in World War II. His intelligence was undeniable and his contributions were much appreciated. Yet, after that, Turing showed that he did not adhere to the essence of science nor to the social culture. Turing spoke of "the art of using" machines (Newman et al. 2004, p.127), and of having "some experience" with them (Turing Papers AMT A/1, cited in (Wilson 2004, p.42), as well as, considered intelligence as an "emotional concept" (2004c, p.431). For him, reliability does not bring newness as it "seems to be confirmed by the well known fact that the most reliable people will not usually hit upon really new methods". The mathematician hits upon "entirely new methods" not by being reliable but by making mistakes – a specificity that machines can also be constructed for (Turing 2004f, p.105-106). Turing argues that for theorems, machines must not make mistakes, while for Turing "this is not a requirement for intelligence" but a matter of development similar to children's learning (2004c, p.411). Moreover, he argues for the disassociation of that which is credited to machine from that which is credited to its programmer. In other words, crediting whatever the machine does to its programmer is the same as crediting the teacher for the result reached by his

student (2004c, p.411).⁹⁶ In this way, science becomes a vehicle through which machines represent themselves rather than representing the scientists.

Hodges has already pointed out that Turing never suggested that the physical world is computable and thus a computer can simulate it, so that all its experiences could be imitated. Instead Turing imagined “a machine learning from interaction with the world” (1997, p.49). This interaction appears in his propositions of the imitation game, test and machines learning by experience, which has initiated a great discussion and discourse about intelligence and a machine’s gender in relation to his homosexuality. Turing was not adhering to science nor to the social culture. His writing “stands intransigent in style as well as content” as he has written it “with typical sang-froid, ignoring all conventional cultural barriers” (Hodges 1997, p.34). Whatever hypothesis or speculations Turing wrote did not only arise from objective knowledge but also from his desire or subjective experience. In a way, science becomes the vehicle for self-expression of desire. Turing mixes the well-established facts with his conjectures and selectively advocates “the wisest ground”. He asserts,

the popular view that scientists proceed inexorably from well-established fact to well-established fact, never being influenced by any unproved conjecture, is quite mistaken. Provided it is made clear which are proved facts and which are conjectures, no harm can result (1950, p.442).

“No harm can result” only if the boundaries between the two are clearly drawn. Boundaries are what science establishes as part of its essence between facts and everything else, but science here is what Turing himself challenges. Turing’s views of machines are different and based on no foothold grounds.

Turing confesses that he has “no very convincing arguments of a positive nature” to support his views, for this reason he only proceeds by arguing against contrary views (1950, p.454). He asserts that his arguments are not convincing and that they are “recitations tending to produce belief” (1950, p.455). He also confirmed that, at the time, he did not know how the mechanical brain “might be programmed to behave like brains” (2004a, p.484). However, he insists, “I, personally, am inclined to believe that such a programme will be found” (2004a, p.484).

The scientific culture is faced by a mixed character of the scientist, the hero and the unorthodox. Total acceptance of Turing’s papers on Turing Machine intelligence might mean the acceptance of their implications, while total rejection puts at risk the potential they have: the new possibilization of machines that will not only change the way they are perceived but also the way they are felt. Thus, the papers are subject to disagreements within the different disciplines. The scientific culture uses abstraction as a means to avoid the influences of desire, affection and personal experience on the work. Being a scientist, Turing must be represented in a scientific manner. He must be calculable in a way that allows the verification of his scientific work in the past and future. The ‘Turings’ have to adapt to the scientific cultural norms, which took place by generalizing a generic version of the Turing Test or game that excludes the gender version. This allows their adoption through which they have obtained a different statue and have gained their futurity and continuity. In this way, they have started to individuate in their own way or ways by being

separated from the decision problem related to Turing's desire that haunted their history and risked bringing them to a stopping point in the scientific culture. Within this adoption-adaption process, research and scientists provide new dimensions of understanding the relationship between humans – even Turing – and machines as a constitutive relationship.

In summary, the Turing Machine has an actual existence that could be seen in some of the first designed machines. At that time, machines were perceived by their limitations. Turing challenged this by perceiving machines through interaction and experience. In other words, it is only through experience we can know what machines can do. In this way, Turing made machine's intelligence an object of representation and thus it becomes a matter of scientific research interest. Crossing the line of representation, the machine being has become part of human subjectivism. It could even be said that the Turing Machine is one of the participants in bringing about what Heidegger calls the 'gigantic' (1977, p.135), where here human-machine relations and encounters quantitatively increase, decreasing the differences between machines and humans. As was seen in the introduction and chapter one, embodiment has a major role in decreasing this difference and increasing the 'equality' between human and machine. The following section investigates the test or game versions in relation to the question of "what was in Turing's mind?" that has initiated many scientific, cultural and philosophical arguments and debates. These versions of interaction also set the base for the methodological experimentation of the studies in chapter one.

5.3. What was in Turing's mind?

5.3.1. *Is it a game or a test?*

Shieber (2004) states that “there is weak internal evidence in the *Mind* paper itself that the nongendered variant was what Turing had in mind” (2004, p.102). He insists that Turing does not consider gender and uses the word ‘man’ in its generic form. Shieber supports his claim by presenting quotations from Turing’s talks and interviews with the BBC in 1951 and 1952, where the descriptions of the test in its simpler form (the interrogator distinguishes between machine/human) are free of gender complications referred to by other authors. Sterrett (2003) insists that the rationalizations of other researchers “do seize upon an important feature common to both tests: the requirement of being able to carry on a conversation with a human.”(Sterrett 2003, p.81) With this focus, Sterrett eliminates the equivalence and the gendering issues between the tests. He argues that there are two nonequivalent tests in the paper: the first “The Original Imitation Game”, which is based on the first version of the imitation game (elaborated below) and the second, “The Standard Turing Test” (2003, p.80) based on the third version (described below).

Hodges quotes Turing’s “relatively unambiguous words” in formulating the imitation game question, yet, when it comes to the gender issue, he ironically insists that such formula is nothing but a “careless syntax” (1997, p.37) and “a poor analogy” (Hodges 2011) that detracts from his main arguments that “the successful imitation of intelligence *is* intelligence” (1997, p.38). It seems as if

“the literal meaning of the words” is not literal anymore, as long as it does not confirm to the conventional culture. Piccinini (2001) asserts that:

Any reading of Turing’s rules must explain how the imitation game fulfils his goal of replacing the question of whether machines can think. As I said, the standard account is straightforward: if a machine can demonstrate mastery of human language, knowledge, and inferential capacities to the point that it is mistaken for a human being, most people would consider it intelligent – or so they should according to Turing (2001, p.575-576).

No support for this definition of the standard reading is found in Turing’s paper or the BBC interview previously mentioned. As pointed previously, intelligence for Turing is an emotional concept, which means mistaking the machine for a human being or not is emotional. Actually, Turing does not explain his goal except as avoiding the attempt of defining ‘thinking’ and, yet, he says the replacement is “closely related”. But as he does not put a definition on and perceives the “normal use of the words” as dangerous (1950, p.433), it is difficult to determine the relation and whether it has a semantic, magnitude, kind or constitutive closeness.

What could be noted is that the 1950 paper does imply a gender issue as other researchers explained, where, in this particular paper, the use of the word ‘man’ is not generic as Shieber claims. In the 1950 paper, Turing described three versions of the imitation game. The first version of the game consists of three people: player (A) is a man, player (B) is a woman and player (C) an interrogator. Players A and B are placed in one room, which means that they can see and hear each other’s answers.⁹⁷ The man (A) imitates a woman and tries to convince the interrogator that he is a woman, and the woman (B) tries to

assist the interrogator in deciding that she is the woman. Their answers are transmitted to the interrogator through a teleprinter or an intermediary device. The interrogator who knows them by labels X and Y could be a man or a woman and his task is to identify which is the man and which is the woman from their answers (1950, p.434).

The conditions of the game are as follows. First, the language is neutralized through the device and is related to one gender, 'woman', which means that this is the only factor influencing the interrogator's strategies. Second, the man wins the game if the interrogator "*decides wrongly*" that he is a woman and the woman is a man. Therefore, the interrogator's skills and strategies decrease the player or *imitator's* chances of winning and add levels of difficulty to the game. The player's task is to convince the interrogator and not to defeat the woman. Third, the woman tries to 'prove' that she is the woman, which actually in the game's context gains her no points, as she is not imitating and thus has nothing to win. This implies that the woman herself is actually not a core player but, as we can infer, is a model for imitation or for comparing the imitative performance. The man increases his imitative performance and chances of winning by using the woman as a resource. Turing points out that the man can say similar things to those said by the woman, and thus the fact of being a woman does not bring her any benefits over the man's performance as anything she says, he can say.

The object of the game for the third player (B) is to help the interrogator. The best strategy for her is probably to give truthful answers ... She can add such things as 'I am the woman, don't listen to him!' to her answers, but it will avail nothing as the man can make similar remarks (1950, p.434).

Finally, the interrogator evaluates the performance of the players. If he cannot distinguish between the performances of A & B, his labelling and identification of the man and woman will be wrong. This means the man (A) wins the game because his performance is good. If the interrogator is able to distinguish between the two performances, the man (A) loses the game, as his performance is not good enough. The correct identification matters only to the extent of indicating the level of the performance. However, the identification of the woman with her performance does not matter, as it is not imitation. The woman does not win in all cases. Turing expects that the interrogator will often “*decides wrongly*”, which means the man’s level of performance is high.

We now ask the question, ‘What will happen when a machine takes the part of A in this game?’ Will the interrogator decide wrongly as often when the game is played like this as he does when the game is played between a man and a woman? (1950, p.434)

Will the same apply when the machine takes the part of player (A)? Will the interrogator fail to distinguish its imitative behaviour as often as in man/woman setting?

The second version of the game is digital computer – machine imitation game. Turing suggests replacing the man that is player A, the core player of the game, with a machine. First, this is only *suggested* but it does not take place; in other words, the imitation game does not take the form of ‘player A is a machine imitating a woman and player B is a woman’. Second, Turing insists on identifying the ‘machine’ that will be permitted to play the imitation game beforehand: “following this suggestion we only *permit* digital computers to take

part in our game” (1950, p.436).

Turing differentiates between actual digital computers classified as “discrete state machines” and the *universal* digital computers. The former has a finite number of possible states, and limited storage capacity (1950, p.440). Thus their actions are predictable. The *universal* digital computers, on the other hand, have enormous or infinite number of states, larger storage and higher speed, and thus can be programmed to “mimic the behaviour of any discrete state machine” (1950, p.441). In the context of a computer-machine imitation game, the universal digital computer (*as A*), that is, as a man, imitates the discrete state machine, which is (*as B*) a woman. The interrogator will be – similar to the man/woman imitation game – unable to differentiate between them due to the digital computer’s universal property (1950, p.441). The universality property means the ability to mimic the behaviour of any discrete state machine. Taking this to the first version also means that the man has the universality property, that is the ability to mimic the behaviour of any woman (this could be supported by the man in the “Paper Machine” which “is in effect a universal machine” (Turing 2004c, p.416)). The criterion of evaluation is that the interrogator cannot differentiate between them and the woman or machine they imitate.

The modifications required for the third game’s conditions are as follows. It could be argued that the third game version is actually the third round in the game course as the man and computer imitative performance is high. Turing clarifies the following points: it is not a case of “constructing a thinking machine” with “every kind of engineering technique” (1950, p.436), “men born in the usual

manner are excluded from the machines” (1950, p.435). The third version or round of the imitation game is described below:

But in view of the universality property we see that either of these questions is equivalent to this, ‘Let us fix our attention on one particular digital computer C. Is it true that by modifying this computer to have an adequate storage, suitably increasing its speed of action, and providing it with an appropriate programme, *C can be made to play satisfactorily the part of A in the imitation game, the part of B being taken by a man?*’ (1950, p.442).⁹⁸

In this version it should be noticed that the computer is not (*as A: a man*) and the man is not (*as B: a woman*) as in the previous version.⁹⁹ First, *the part of A*, which is here taken by the computer, is constantly imitating the woman. Considering the properties of *universality* and *imitation*, this means the computer is not a man imitating a woman or giving answers given by a woman. Rather, it has an internal state through which it differentiates itself as a computer, defines its action as playing, its role as imitating, its context as a player in a game, its imitating model and database resources which can be collected from the other, in this case from player B, to increase and compare its performance, and its aim as winning. Second, *The part of B* is constantly convincing the interrogator that s/he is the woman, which is here taken by a man and this can only mean, “in view of the universality property” that the man is seen as a proper model of the woman. The man, here, is a real player and thus “it will be assumed that the best strategy is to try to provide answers that would naturally be given by a man” (1950, p.435). The man here is not required to give “truthful answers” like the strategy devised for the woman but he is advised to ‘*try*’ to give “answers that would naturally be given by a man.” This is

because in this setting he has no model to imitate and he “cannot pretend to be the machine (the computer)” (1950, p.435). Third, the question concerning the interrogator’s evaluation remains the same. The modification made to the computer, which now can “give a good showing in the game” (1950, p.436). If the interrogator was able to distinguish their performances, the computer loses the game.

In this respect, the conclusion drawn here is comparable with Saygin et al. (Saygin et al. 2000), who suggests that “the man and the machine are measured in terms of their respective performances against a real woman” (2000, p.467) but, the gender issue, although not addressed against woman, is still determined in Turing’s paper. Simply, the only changing variable in the treatment condition is the gender while all the other variables, the task, the role of players A and B, the language, the instructions and the role of the interrogator, are kept consistent.¹⁰⁰ There is no reason for us to assume that the man in this context would behave in a different way to the way already identified by Turing: imitating a woman.¹⁰¹ The non-gendered version of the imitation game is unlikely. Turing clearly describes the conditions of his game experiment,¹⁰² identifies who is who and the roles of each person in the first scenario, as well as mentioning any relevant modifications later on.¹⁰³

5.3.2. *Is there a Turing test?*

Yes, there is a Turing test, which is different from Turing’s imitation game. Lassègue (1996) points out correctly that the word ‘test’ appears only three

times in Turing's 1950 paper and it has specific meaning in the mathematical field as being objective and "free from any personal bias" (1996, p.39). However, it is worth noting that Turing has two versions: one is a 'game' and the other is a 'test', which are not equivalent, or the same, and which he himself differentiates in the 1950 paper and elsewhere. The imitation game (described above) considering its setting and gendered form as the computer/man game is a 'replacement', a 'variant' or a 'substitution' for the original question: 'Can machines think?' Turing says:

We cannot altogether abandon the original form of the problem, for opinions will differ as to the appropriateness of the substitution and we must at least listen to what has to be said in this connexion (1950, p.442).

This means that Turing – being aware of the gendered issues the replacement raises – could not discard the original question in his paper.¹⁰⁴ The second setting is the machine/human test, which Turing calls his "test" (Newman et al. 2004, p.119). He emphasizes:

I would like to suggest a particular kind of test that one might apply to a machine. You might call it a test to see whether the machine thinks, but it would be better to avoid begging the question, and say that the machines that pass are (let's say) 'Grade A' machines (Newman et al. 2004, p.118).

This test is based on the original Turing question, 'Can machines think?', which he believes is "too meaningless to deserve discussion" (1950, p.442). In the 1950 paper, the word 'test' appears in Turing's argument against Professor Jefferson:¹⁰⁵

Probably he [Professor Jefferson] *would be quite willing to accept the imitation game as a test*. The game (with the player B omitted) is frequently used in practice under the name of *viva voce* to discover whether someone really understands something or has learnt it parrot fashion (1950, p.446).

This test case as a *viva voce* examination, also mentioned elsewhere (Turing 2004e, p.114), is actually different from the game case. The following can be noted from the quotation above. First, there is no player B – the woman or the man imitating the woman. Second, player A is also omitted as the example Turing provides is a dialogue between an interrogator and a “witness”. Third, the description of this ‘witness’ is more likely to fit the actual digital computer, that is the ‘discrete state machine’ rather than the *universal* digital computer. This is because the recording and switching functions imply a finite number of states that Turing associates with these machines (1950, p.447). And, fourth, the imitative nature itself is replaced by a parrot-like rather than a man-like imitation, and the task has come to measure understanding rather than identification. The outcome of this case is the generalized Turing test, the machine/ human test. Turing describes his test as follows:

The idea of the test is that the machine has to try and pretend to be a man, by answering questions put to it, and it will only pass if the pretence is convincing. A considerable proportion of a jury, who should not be expert about machines, must be taken in by the pretence. They aren’t allowed to see the machine itself – that would make it too easy. So the machine is kept in a far away room and the jury are allowed to ask it questions, which are transmitted through to it: it sends back a typewritten answer ... And the questions don’t really have to be questions, any more than questions in a law court are really questions ... Likewise the machine would be permitted all sorts of tricks so as to appear more man-like ... We had better suppose that each jury has to judge quite a number of times, and that sometimes they really are dealing with a man and not a machine.

That will prevent them saying 'It must be a machine' every time without proper consideration (2004, p.118-119).

As can be seen, an essential difference between the two is that the test is associated with pure answering/questioning and pretence technique (Turing 2004e, p.114) and thus the imitation and the imitated disappear in this condition.¹⁰⁶ While pretence requires representing the performance without exact matching, imitation is actual and exact modelling of the performance that requires a third party.

5.4. Summary

This chapter repositions the Turing Machine from being considered as abstract and non-existent to being seen within the virtual-actual realm and thus existent. This is important in order to validate the counter-becoming of the Turing Machine in the next chapter. The Turing Machine had an actual existence that could be seen in some of the first designed machines (e.g. Manchester Baby, ACE and Ferranti Mark 1). However, it was abstracted for two reasons. The first one is perceiving machines by their limitations where whatever they cannot do is abstracted, and simultaneously, perceiving the Turing Machine in its final or complete project, which at that time lacked the two properties Turing suggested: universality and infinity. By repositioning the Turing Machine within the realm of virtual-actual, these limitations (not having universal and infinite properties) could be seen as virtual, that is, they were real in essence but incomplete. They could become actual reality in the course of machine evolution or development. For example, the universal property, which refers to a machine that can imitate

any other machine, has become an actual reality of current computers (Copeland 2004, p.15).

Secondly, scientific culture imposes another type of abstraction on the Turing Machine in order to allow its adaptation to scientific cultural norms by preventing the notion that science, for Turing, became a self-expression of desires. This abstraction serves as a means to select the areas of scientific interest without risking the essence of science or accepting personal experience as part of scientific research. There are two different versions of the Machine-human interaction suggested by Turing: the Turing Test and the Turing imitation game. The main difference between them is that the Turing test is a one-to-one conversation without an interrogator and based on the machine's pretence of being human while the imitation game is based on the machine's imitation of a human being. The imitation game, where the computer imitates a woman, is linked to Turing's desires and affective experience. The difference between the game and the test is abolished in AI, and they are referred to as the Turing Test, which also means the imitative performance is reduced to pretence.

The abstraction of the Turing Machine and the selection of the Turing Test allow scientific culture to control and modulate the individuation of the Turing Machine through the exclusion of interaction and subjective experience. Reasonably, in a metaphorical way, Turing fathers computer science, as pointed out by scientific culture, but computer science has never been called the child of Turing. Following Heidegger's description of the role of modern science and scientist, and through abstraction and selection, science itself has become a discipline of

self-expression.¹⁰⁷ The next section will elaborate on the individuation of the Turing Machine in relation to Simondon's account. The focus will be on exploring the process of interaction, experience and affective modality in the Turing Machine individuation.

6. Chapter Six: Individuation in AI

6.1. Introduction

This chapter focuses on understanding the individuation of the Turing Machine as a process by focussing on his work related to artificial intelligence. This understanding is based Simondon's work on individuation, which, on the one hand, is introduced to counter the mind/body, subject/object polarizations noticed in both HCI and Hansen's account. On the other hand, it deepens our understanding of the being problem, technical culture and the becoming process of human-machine relationships. Simondon's work was introduced in the introduction of the previous chapter. Here, an expansion on his account and application to the Turing Machine account will be pursued.

Turing has already described a situation where the machines, will take control over humans (2004b, p.475). Turing is against the opposition, fear and anxiety that the construction of such machines might supersede human beings. He likens this to the fear of being superseded by the pig or the rat (2004a, p.486). Yet, he believes that no bounds can be set on machine imitation of human characteristics. He foretells of machines that "would not take long to outstrip our feeble powers" (2004b, p.475). Machines that will converse with each other (2004b, p.475). For Turing, intellectuals should not be afraid that the machines would put them out of their jobs. The intellectuals will be trying to keep their "intelligence up to the standard set by the machines" (2004b, p.475). Turing was agnostic about machine's limitations. Turing wrote all his theoretical

'hypotheses' and practical work at a time, when the word 'computers' was used to describe human beings, and when the machines were electronic instead of digital. This explains why Turing's account perceived as mediation between his expertise, desire and prediction could not be accounted for by external individuation controlled by scientific culture. This individuation acts from outside the relationship between Turing and machine. It progresses through selecting only those elements that interest the scientists in the relationship while abstracting other elements, as pointed out earlier. Turing's account can only be explained through the internal individuation of the relationship itself. This individuation progresses through affective modality, which is a primary constituent of any relationship. Affective modality, here, refers to the manner within which emotions and feelings are experienced and qualified throughout the on-going process or interplay in-between human and machine. It is essential in understanding Turing's account and how Turing has already predicted the changes in the relationship between the human and the computer as well as the modulation of the current culture..

6.2. The loss and gain of affective modality

As could be seen, Turing expected that human beings' position would be marginalized by machines. This marginalization is what motivates Simondon's work on providing an understanding of the human and technical object's individualization, and the human and nonhuman dynamic backgrounds in the current culture. These will be elaborated in the following section. For Simondon this understanding is central to overcome the loss of the genesis of affective

modalities. These have disappeared with the progression from the artisanal mode of production to the industrial one leading to the alienation of the human being, antagonism and nostalgia for the return to the artisanal modalities, which has become an illusion (2009, p.21). Affective modalities characterized the artisanal age for a number of reasons. First, the human being was the technical individual, as he used his body to integrate different tools to operate and harmonize the whole (1980 [1958], p.69). He was the source of energy that is exercising and building, and the source of information, which refers to learned skills through education. The exercise regulated the aim and the information of the material. Second, the relationship between him, the object and its materiality and nature was immediate and in a continuous processual contact (2009, p.20). Object transformation was a multifactored process between different forces: human and non-human (2009, p.20). Third, the man's work was the "sole expression of his technicality" and "his need to work is translation of this need of expression" (1980 [1958], p.67 n 5). His expression signified his expertise and efficiency through knowing his job, his tools, and the necessary modifications in insuring "the internal distribution and self-regulation of the job" (1980 [1958], p.67). Human beings could cooperate either to speed up the work or to perform different organized roles to achieve the job. In the latter case, the genesis of the group was similar to the genesis of the technical ensemble (1980 [1958], p.67) in that the ensemble produces different relationships between members or elements of the group without destroying their autonomy (1980 [1958], p.55).

Then, the man has started a process of humanizing the machine “to the extent that he looks on the machine-as-technical individual as if it were a man” (1980 [1958], p.70). He has discovered natural sources of energy, so he thought that he possesses “a considerable power” (2009, p.21). Thus, he has made way to the appearance of the “industrial modality” (2009, p.20) and concrete machines. As the machine becomes more concrete, that is, it maintains its own functioning and becomes autonomous, the man increasingly believes in its being a man (1980 [1958], p.70).

Consequently, in the current industrial mode, a “role-change” in man’s position is observed (1980 [1958], p.70). The man has become the source of information only and the source of energy is left to nature (2009, p.20). As the machine requires different types of people with a variety of knowledge and information contribution (2009, p.21), the man has to adapt himself to become part of the technical ensemble (1980 [1958], p.70). Specialization and fragmentation appear. It is the machine that has become “the most general form of technical individuals” (1980 [1958], p.67). A technical individual is characterized by its self-conditioning and autonomy. It has a separate existence. It seems to imitate the man. It “takes the place of man the tool-bearer” (1980 [1958], p.67). It replaces him as the working individual. The man feels frustrated. Antagonism appears. He is “separated from his role as technical individual.” He loses the method through which he expresses himself. He is either an organizer or a servant of the machine but he remains either “unhappy inventor” or “dehumanized worker” (2009, p.21). He is a technician not an artisan. He goes

between machines but he is no longer the centre in-between them. It could be said that the man has lost his subjectivity as the machine is the one that represents the world and the man altogether.

The man is represented by the machine, through the machine, in relation to the machine and in machine ways. The man is left with his “memories of himself” in the old days (1980 [1958], p.70). Nostalgia appears. He feels alienated, in his own “human environment,” sometimes perceiving machines as idolatries with unconditional power that he can exploit for his own use, other times as “robots” that are “a duplicate of man, but without interiority” (1980 [1958], p.13) that become a threat for his existence. The slavery and freedom of the man has come into question (1980 [1958], p.70). So what should he do?

He should become the “machine-bearer” (1980 [1958], p.68). For Simondon, this alienation of the man is a consequence of the misunderstanding of the nature of machines and limiting them to the world of utility rather than meaning. The man as a “perpetual invention” (1980 [1958], p.14) is a permanent coordinator, organizer and interpreter of the machines around him and of the technical ensembles (1980 [1958], p.13) whom, having a similar intensity, affect and are affected by their performance. In other words, he should assume his position as a technical individual by perceiving a form of leadership, which acts as a trajectory point (e.g. a conductor of an orchestra) through which communication and performance take place (1980 [1958], p.13/70). He should (re)place himself as the centre between the machine and the natural world

(1980 [1958], p.68). In order to take this position, Simondon seems to suggest two ways.

First, the technical object, “must be known in itself” for the man (1980 [1958], p.70), which is elaborated in section 6.4. In this respect, the machine becomes the “machine-tool” that is without self-regulation (1980 [1958], p.68). Limiting, regulating or controlling machines is achieved via their primitive margin of indetermination (1980 [1958], p.13), that is a margin of information conversion between the machine and nature, where they can be grouped into coherent ensembles and exchange information. Understood in this sense, it could be argued that the man cannot reclaim his position and re-celebrates his technicality, except through controlling the machine’s capacity of being autonomous and self-regulated. This contradicts Simondon’s emphasis that technical individuals must be self-conditioning. The controlling of machines becomes a matter of discovering their weakness, which signifies the weakness of the man in obtaining a human-technical culture.

The second way for the man to reclaim his position is by concretizing the technical mentality. This, as pointed out in the introduction of chapter five, is based on Cybernetic theory and assumes crossing of thresholds of functioning. Its perfection is in uniting “in a single criterion the manifestation of cognitive schemas, affective modalities, and norms of action: that of the opening; technical reality lends itself remarkably well to being continued, completed, perfected, extended” (2009, p.24). This requires the unification of the technical and natural environments to form one source of information entry, thus allowing

“the experience of technical reality as a whole” (2009, p.21). For Simondon, the technical mentality is complete (or concrete) by the production of a “made-to-measure assemblage”. Assemblage, here, refers to the multifactored process between human and non-human forces that participate in object transformation. An assemblage constitutes transduction, which means mediation between heterogeneous forces that develops into internal coherent relations. In this context, the human could be represented by the image of the technician, who is also the inventor, and constructor, that acts between “the material and conceptual synthesis of particularity” in relation to the technical pieces and the geographical environment. The non-human appears as industrial “concentration” in the factory that investigates the natural environment for the fabrication of adaptable pieces (2009, p.22). “Made-to-measure” describes a self-stable condition. For example, an artisanal “made-to-measure” object derives its essence from

an analytical organization which always leaves the way clear for new possibilities, possibilities which are the exterior manifestation of an interior contingency. In the encounter between the coherence of technical work and the coherence of the system of industrial needs, it is the coherence of utilization that prevails. The reason for this is that the made-to-measure object is one which has no intrinsic limits; its norms are imposed from without; it fails to achieve its own internal coherence; it is not a system of the necessary; it corresponds to an open system of requirements (1980 [1958], p.22).

Understood in these terms this could be problematic in relation to Simondon’s concept of becoming, as there is no concretization of the object. Concretization means that the object has internal coherence enabling it to achieve an autonomous and self-conditioning status, so that it maintains its own

functioning. Except, if the “made-to-measure assemblage” has a form of becoming through which it conserves its coherence of utilization, intrinsic limits and internal coherence, which makes it a “system of the necessary” rather than requirement. This form of becoming comes into existence when the industrial phase ends, as within it there is an industrial modality, which does not limit itself with the technical environment but extends “itself through nature” (2009, p.22). This extension occurs when the manufactured object leaves the factory. Here, it plays a transductive role by participating in a “maze of a virtual network” between the factory and the human world where natural structures “serve as the attachment point for the network that is being developed” (2009, p.22). This “attachment point” is multifunctional as it becomes the associated milieu between the human, nature and industry. It connects different technical objects, natural habitats and human beings, thus, unifying the sources of information and energy (e.g. Eiffel Tower is part of a multifunctional network as it interconnects with many masts and stations in Europe) (2009, p.22). In this way, the object is transformed into an assemblage and the attachment point represents networks of thought, information, and energies in-between the two environments (networks thus acts like a synthesis of the various dynamic backgrounds).

“A thought-network” is established due to a “certain effect” exerted by the assemblage, which “constitutes the harness of nature” (2009, p.22) due to its inseparability from the attachment point (Simondon gives examples of this effect in expressions such as the Raman or Compton effects) (2009, p.19).¹⁰⁸ As

pointed out previously, quality, for Simondon, is defined as a force in which fixed effect is not necessarily sensory or practical. Individuals develop sensitiveness to this quality. The thought-network has as a support to it, a physical-network, that is the energy-network, which obtains a similar effect due to a standardization of the assemblage. The standardization refers to the distribution of similar industrial pieces over different attachment points allowing an informational role (multifunctional use of energy controllers and devices) (2009, p.22). In this way, the assemblage influences both the thoughts and lives of different human beings and, thus, it conserves its coherence of utilization in the virtual and actual networks.

.In this sense, it could be argued that the human or the inventor has retrained a different type of affective modalities, that emerge from the industrial distribution of the object (that is fame as a quantitative measure) and the latter's participation in different user's thoughts and lives (that is qualitative value). Reasonably, the object becomes part of the "psychosocial life" of the individual and collective. This, for Simondon, forms a source of resistance of the technical mentality at the level of voluntary decisions and social norms (2009, p.24). The object, first, has to cross a threshold of functioning in order to develop schemes of concretization that mark its self-conditioning and autonomy. Then, the autonomous self-conditioned object has to cross another threshold of norms in order to develop "schemes of action" that mark its universal "value code" and make it capable of "yielding a morality in human environments that are entirely dedicated to industrial production" (2009, p.21). For Simondon, the object's

'fate' is not decided at the moment of its birth but at the moment of meeting with users' decisions, voluntary choices and social norms. Rob Shields in his book *The Virtual* (2005) calls such moments of transformation "liminality", in relation to 'limen' which means threshold (Shields 2005, p.12). Crossing this threshold has a "transformative power" where the participants receive new status. Liminal time is a "time out of time" as it is a suspension of everyday regulations where the object encounters "the adaptive powers of a culture" (2005, p.12). Simondon sees the object as "a closed object, a false organism that is seized by a holistic thought that was psycho-socially produced" (2009, p.24). This moment of encounter is one and the same with the moment of judging, valuing and introducing the object into life.

Adaptation to the psychosocial level is another form of the hypertelic phenomena. Hypertelia will be explained in section 6.4 but here it is important to say that it describes a negative effect that appears due to an object's specialization and adaptation as it restricts its evolution process. It appears as an inflation of "obsolescence", which refers to the ageing of the object in relation to its "disuse" (2009, p.23). This disuse is due to a change in social conventions and habits rather than "a loss of functionality of the technical object" (2009, p.23). For example, cars and planes have a "network reality" but cars age before planes because they are social objects influenced by inessential criteria of choice such as, representing the individual's prestige, charm, flattery of social myths or personal faiths (2009, p.23). The main source for "obsolescence" is the existence of a "virtual" human (e.g. the presumed buyer) - whom voluntary

choices are affected by those non-technical norms - at the production process, and the latter's anticipation of a "mixed character" object that achieves both aims: the social and the industrial (2009, p.23-24).

In this sense, the psychosocial level is another element to consider in the technical imagination which will be explained in section 6.4, which requires sensitiveness to the object's social and psychological qualities. Simondon suggests two ways to overcome the resistance of technical mentality. Firstly, "ascetism" as a way of getting rid of social norms and "hypertelic developments or developments that in reality don't function" (2009, p.24). Secondly, the object should have a reticular structure that allows the object openness to manipulation in "the state of perpetual actuality" (2009, p.24). It should consist of a

unity of two layers of reality: a layer that is as stable and permanent as possible, which adheres to the user and is made to last; and a layer that can be perpetually replaced, changed, renewed, because it is made up of elements that are all similar, impersonal, mass-produced by industry and distributed by all the networks of exchange (2009, p.24).

This is what Simondon calls the postindustrial object as it has permanent and adjustable parts for different usage, which ensures its newness and contemporariness (2009, p.24) (this could be thought in relation to Simondon's explanation of information in the case of the human being which is presented in section 6.3). The next section elaborates on Simondon's concept of human and technical object's individuations

6.3. Living being and machine individuation

6.3.1. Living being individuation

In Simondonian terms, the process of individuation is part of the “ontogenetic” development of the being, defined by a process of becoming. Becoming, as a dimension of the being, represents its capacity of falling out of phase with itself due to the forces of tension, and its mode of resolving the initial incompatibilities that occur and which are commonly overburdened with potentials. The end resolution of each phase appears as a stage in the being (considered as a whole) and of the being (considered as an end phase of the whole being). Therefore, there is no final outcome in becoming. There are only phases and stages of the being’s development where the individual is a result of each phase of the being at that stage (1992, p.300-301).

Simondon sees the living being as “a veritable theater of individuation” (1992, p.305). Three participants of the play are defined where the play is only its own becoming participants, initially staged on a supersaturated un-phased preindividual reality, which they share and which keeps them intact through internal, external and transindividual beings. The internal individuation is a ‘psychic being’ who is continually trying but is unable to resolve its own problematic due to the dimension of becoming. Affectivity and perception allow the emergence of new dimensions, thus endowing the living being with “an open ended axiomatic” (1992, p.307). Therefore, it is supported by a collective individuation or a collective aspect that is an associated part of the individual

reality, inherited and borne with it from the preindividual reality. This is external individuation.

By entering into a relationship of participation as a unit, on the level of the subject as a living being in a continual psychic becoming, and participation as an element of unity of the whole process of individuation on the level of individual-milieu or individual-group, that is as a collective being, the living being is able to contribute to resolving both its own and group problematics. Simondon (1992, p.306) terms this participation, which unites both the psychic and the collective individual and makes the constitution of a new problematic, transindividuation. The transindividual does not only constitute the psychic and social realities and the reciprocal effect between them but also the preindividual individuation underlining all of them. Within the three-party theatre of becoming and the relations between them and the milieu, the individual does not strive – as it does not need to – to become individualized, this is a closed system, because the double-participatory role keeps it open. This double-participatory role manifests as, first, an element or infra-individual; a psyche – similar to an organ of a body – with all its energies, potentials and future virtualities and second, a unit without which the whole cannot become or emerge as new but remains trapped in an endless temporality; it is an incomplete project with potentiality. Taking this together with the preindividual reality, mediation between heterogeneous orders is central to Simondon. This is because it is not limited to the becoming of the living being in relation to the outside world, but

also to its own interiority as being constitutive of the individuating process where an internal mediation, termed the internal resonance, takes place.

Internal resonance as 'a form of communication,' and transduction are both considered primitive forms, developing between primordial orders of magnitude and thus they exist in both physical objects and living beings (1992, p.318). Internal resonance, on the one hand, as a 'primitive form of communication' within the transductive process between heterogeneous orders, amplifies individuation and condenses it towards taking a phase or structuring a third order of magnitude. On the other hand, it exists in the individual or system, between it and its preindividual reality, as well as all that is formed by it, thus enabling a new transduction to take place; in other words, the new always emerges from internal resonance. A more complex system, for example, a machine, requires a permanent communication and adaptation of its relationship with its milieu (1992, p.305). On the other hand, the living being, having interiority as constitutive of its individuating system, requires contemporaneousness to deal with its immediate temporal and spatial relations with its milieu. For this reason, Simondon replaces substance and form with information as "information always exists in the present, that it is always contemporary, because it yields the meaning according to which a system is individuated" (1992, p.311).

The living being, then, contains within itself all levels of internal resonance. In this sense, while the preindividual metastable reality is always there, shared between all orders of magnitude, existing and emerging, internal resonance –

understood in its requirement of the highest level as the transmission of contemporary information in communication between orders of magnitude – ensures the openness of the individual to the *new dimension*, made available by perception and affection (1992, p.307). Information, for Simondon, is not the specificity of one order nor is it a pre-given but it appears when two disparate orders, in the very process of their ‘disparation’, in the interlinking between their sets of potentials, become one system. The communication of these two disparate orders is already preconditioned by a shared preindividual reality. The new dimension of individuation is revealed, instigated and is organized in the resolution process (1992, p.310-311). The new then emerges with internal resonance that ensures its basic communication and individuation, and as a system or a node of information that ensures its autonomy and self-regulation.

Anxiety could appear as a result of the failure of one of two of internal resonance’s double process. Firstly, there is a continual amplification due to the metastability and internal or psychic individuation of the system, where condensation prevents information transmission. Condensation here could be understood as the appearance of a structured layer of emotion preventing the emergence of the multiple dimensions of the active being. Consequently, the formation of another layer necessary for individuation does not take place. This leads either to inward condensation that might eventually reach the internally, the centre or the heart of the system and stop its activity, or leads to system fragmentation. Condensation could have an inward effect due to the successive failures of the active being, in resolving its affective problem. Thus, its energy or

activity keeps reducing allowing a thickening of the condensed emotion. Fragmentation appears when the living being is left with no more dimensions of becoming or potentials to explore. Secondly, there is a continual amplification – as a necessary condition marking the existence of potential energy for individuation – but a condensation event does not take place; as such there is no phasing out that marks the system resolution, thus it is captivated within a temporal open series of iterations without actualization. For Simondon,

If the individual being puts itself, but nothing else, into question, then it will not be able to move beyond the limits of anxiety, for anxiety is a process without action, a permanent emotion that does not succeed in resolving affectivity, a challenge in which the individuated being explores the dimensions of its being without being able to progress beyond them (1992, p.310).

Anxiety then is a negative emotion that limits the individual's becoming to its psychic problem and prevents it from establishing relationships through which it can proceed.

6.3.2. *Technical object individuation*

Simondon, identifies two movements of thought or cognitive schemas as methods that offer a mode of knowledge for “the discovery of common modes of functioning—or of regimes of operation—in otherwise different orders of reality” (2009, p.17). These orders of reality could be chosen “from the living or the inert as from the human or the non-human”. The first one is related to the Cartesian, the other to the Cybernetic (2009, p.17). The Cartesian is simple, logical, rigorous and productive. The essence of the technical object is in its capacity to transfer forces without losses or gaps through a successive chain of links or

levels, where one layer is the foundation for the one coming next. Then arrangement and control, to put the pieces in a unified whole, is required. In this sense, thought for Simondon,

needs an anchoring point that is the operative equivalent of the stone under the building, or of the ring that is attached to the origin of the chain: *certum quid et inconcussum*: it is evident what remains after all attempts at deconstruction, even after hyperbolic doubt (2009, p.18).

The second one is Cybernetic theory, which is useful for the construction of automatic equipment where the technical realization of finalized conduct is due to the recurrence of information for an active adaptation. This is based on a theory of knowledge that is realist idealist, which can grasp the phenomenology or 'universality of a mode of activity' without any ontological presuppositions (2009, p.19). This kind of technical mentality, requires two conditions. First, it requires the normalization of crossing "*threshold of functioning*" (2009, p.24), which determines the emergence of the technical object as a functioning invention (2009, p.19/24). The realization of this threshold earns the object its self-maintenance that is "a regime of automatism" where each phase forms the base of completion for the following phase (2009, p.19). Second, the object should be perceived as a regime of functioning and not only a structure. This entails an understanding and examination of its subsets, and the "degree of solidarity" between them, which constitutes the measure of the optimum functionality of the regime in relation to the threshold of functioning (2009, p.24). Simondon's thesis, *On the mode of Existence of Technical Objects*, aims to

provide an account of these two conditions determinate to the understanding of technical culture.

Simondon rejects automation of machines, which although having no technical significance but social and economical (1980 [1958], p.13), has become a human objective which limits machines' real perfection. Simondon, thus argues that the real perfection of machines, that is its level of technicality, is in concealing a certain margin of indetermination (1980 [1958], p.13). This margin differentiates between a closed automatic machine and an open one. The machine being is conceived as a "unity of becoming" within specific networks of temporal and spatial relations (Mackenzie 2006, p.14) which could be human or nonhuman. The margin is sensitive to information from outside (Simondon 1980 [1958], p.13) and, being so, it makes possible the technical ensemble which could be understood as the formation of relations or dimensions of becoming between the networks' elements, without these elements losing their autonomy. Following Mackenzie (2006), the margin could be seen as having two functions: transducers or converters of information into determined forms and, simultaneously, preventers of the machine from becoming an entirely different entity (2006, p.26). Mackenzie states that machines, for Simondon, are transducers of information (2006, p.25). In this sense, when machines are absolutely concrete, which, for Simondon, is not possible (1980 [1958], p.43), the margin of indetermination disappears.

The technical object has an essence or absolute origin. This essence lays in two things: its fecundity or non-saturation character that makes it a centre of a phenomena, and its “asymmetric conductance” or dissymmetrical functioning that makes it of extensive virtue (1980 [1958], p.37). An example of this is the diode which is a two-way valve with a hot and emissive electrode (which could be cathode or anode) and a cold and non-emissive electrode (anode), where the latter attracts electrons in its positive state. This creates the origin of the technical object. It, then, engenders a family (e.g. the diode is the “forefather of the triode as well as of other multiple-electrode tubes”) and thus it creates a “lineage of technical objects” that is “marked by a synthetic act of invention” (1980 [1958], p.38). This essence remains stable and “capable of producing structures and functions by internal development and progressive saturation” (1980 [1958], p.38).

The technical object does not evolve through “artificialization” but through concretization. Artificialization is an intervening action of man on the artificialized object, where the latter’s biological or natural regulations are manipulated or replaced as it remains dependent on its environment e.g. laboratory or green house (1980 [1958], p.40). A concretized object in its primitive stages starts as an artificial object but as it evolves, it “loses its artificial character” due to its internal coherence and because it “incorporates part of the natural world which intervenes as a condition of its functioning” (1980 [1958], p.40). It gains a mode of existence peculiar to it, where it becomes more internally organized and then closed, to the extent that it can depart its artificial

environment and exist independently from it (1980 [1958], p.41). Thus, they become self-sustainable and can create relations with other technical or natural objects (1980 [1958], p.41). This makes it viable to the inductive studies of science (1980 [1958], p.42). If its origins are to be traced and identified with the individual sciences that participate in its mode of existence or its production as a whole, then, a different science will appear. This is mechanology (1980 [1958], p.42). Mechanology is not a science of studying comparisons of outward observable behaviours or exterior characteristics. Moreover, the automaton is denied as “there is no species of automata”, but technical objects with functional organisations and different degrees of automatism (1980 [1958], p.42). This could be understood in relation to the “regime of automatism” explained previously. Consequently, mechanology focuses on the “exchanges of energy and information within the technical object or between the technical object and its environment” (1980 [1958], p.42).

The technical object has a genesis, which is essential to it (1980 [1958], p.18). It is not what it is given in time and space but that which has a sequence and an extended continuity (1980 [1958], p.19). The genesis of the technical object is in its evolution marked by the “synthetic act of invention” which has three characteristics: convergence, adaptation, and unification by internal resonance (could refer to the intercommunication between its internal sub-sets). Technical objects could be abstract/primitive (logical assembly) or concrete/industrial. Abstract objects are recognizable as each element functions alone on the allocated time in solitude and isolation from others, so any exchange of energy

or relation is seen as an imperfection of each of them. Each one has its primitive or abstract form, through which it is materially and theoretically perceived in its absoluteness as a constitutive closed system with its 'intrinsic perfection'. Intrinsic perfection refers to "the material and structural support for certain practical qualities" (1980 [1958], p.61). This means that the arrangements of form and matter for a certain use have gained a stable structure that identifies the "intrinsic value" (1980 [1958], p.63) of the object's practical quality (e.g. adze requires a technical ensemble of foundry, forge and tempering to produce the quality that enables it to work with hard wood without being damaged) (1980 [1958], p.60). In this sense, when abstract objects are integrated, a compatibility problem occurs between them (1980 [1958], p.20).

This informs a conversion stage. Structures, pure technical requirement and economic constraints (preferences and motivations) of the abstract mode (manual) converge into a structural unity through concomitance between conflicting requirements (1980 [1958], p.21). This stage brings about a concrete technical object. The coherence of the utilization is the most important aspect. For example, the handmade or "made-to-measure" object has no intrinsic limits, and it fails to obtain internal coherence. It is an open system of requirement that depends on external individuation from without (1980 [1958], p.22). It has an analytic character, which means it requires more construction. A more technical complicated form of the "made-to-measure" object is where each element, as pointed out above, acts as a complete system. If an element is broken down, it ruins the system (1980 [1958], p.22).

The conversion from primitive or abstract to concrete is the first mutation stage in the evolution of the technical object. This brings “successive systems of coherence”, due to, firstly, improvement in usage, raw material production and better adaptations, and, secondly, changes to its structure (1980 [1958], p.37). The technical object is ‘the theatre of a number of relationships of reciprocal causality’ (1980 [1958], p.25). Differentiation lies at the core of these relationships while specialization is important in overcoming antagonism and reducing side effects. For Simondon, the evolution of the technical object depends on its interior distribution of functions where the essence for its concreteness lies in the “organizing of functional sub-systems into the total functioning” (1980 [1958], p.30). Concretization (one element performing several functions instead of one) should not be confused with the possibilities the technical object opens due to its complex structure (1980 [1958], p.27), because for concrete objects the indetermination should be reduced and interaction should be defined. Each piece of the technical object is part of the whole system and its effect is not determined by the design plan (1980 [1958], p.31). The progress of the technical object depends on the transcending of the limitations between its sub-sets and relations, while an integration of structures in total synergy of functioning takes place. This integration creates a leap or a phase in the technical being due to the modifications in the internal dispositions of functions (1980 [1958], p.25). Its degree of perfection is where ‘all functions fulfilled by a particular structure are positive, essential, and integrated into the functioning of the whole (1980 [1958], p.31).¹⁰⁹ The Guimbal turbine is an example of this concretizing process. It is immersed in the water-pipe and

connected to a small generator in housing filled with oil, under pressure. Here, appears a field of intercommunications and potentials that materialize in the 'plurifunctional' relations that specify each item (1980 [1958], p.47). The water "supplies the energy that activates the turbine and the generator, and evacuates heat produced by the generator". The oil "lubricates the generator, insulates the gears, and conducts heat from the gears to the housing, where it is evacuated by the water ... prevents water seepage through the axle-casing into the housing, because the oil pressure within the housing is greater than the water-pressure without" (1980 [1958], p.47). This difference between the two becomes a quality in itself, of potentials, where the pressure "effects permanent greasing under pressure in the bearings, while preventing seepage of water if the bearings are not quite watertight" (1980 [1958], p.47).

What makes the Guimbal turbine interesting is, on the one hand, it is a case of evolutionary adaptation, and, on the other hand, it is a case of concretization. Adaptation is the second characteristic of the technical object's evolution that determines its "double relationship" with both geographic and technical environments, which integrate it and simultaneously are brought together by it regardless of their heterogeneity of compatibility (1980 [1958], p.46). Adaptation has two forms: as a result of the environment or as a process of the object evolution. The first one is governed by a "hypertelic phenomena" which identifies the negative effect of the compromising relation between the object's specialization and adaptation. While specialization allows the object to overcome antagonism and reduce side effects (1980 [1958], p.25) by limiting

the object to certain use or environment, adaptation, in its higher level, allows the object to self-condition itself in order to delimit its existence to a certain use or environment. Hypertelia, thus, restricts and could be fatal to the process of the object's evolution. It has two cases. The first one appears at the production stage where what constitutes the object- that is its qualities- is adapted in relation to the environment and conditions of its use. The environment could be geographical (e.g. a pump produced for cold weather might not work in hot weather) or technical (e.g. pairing a clock's functionality with a particular electrical circuit, thus, it might work in France but not in America) (1980 [1958], p.45). Although the object, in both cases, is autonomous as it can exist independently but it cannot exist outside either its geographical or technical environment. The second case of hypertelia is a functional over-adaptation identified by an inter-dependent relationship between the functions of two objects. This occurs as parasitism (e.g. some small planes can only be launched by a larger one) or as a partnership where the technical object is an asymmetrical part of a technical whole (e.g. a transport glider as part of a towing vessel) (1980 [1958], p.44). In these cases, the object does not gain autonomy peculiar to it. In all these cases, adaptation is part of the object but not of its evolutionary process. The second form of adaptation signifies adaptation without the risk of hypertelia. This seems to be the case when adaptation is not directed towards overcoming prior external relations with any of its environments or conditions of use, but towards internal development of relational modality. Simondon highlights the internal necessity in the evolution of

the technical object rather than the external or economic one (1980 [1958], p.21).

It is not the production-line which produces standardization; rather it is intrinsic standardization which makes the production-line possible (1980 [1958], p.21).

This is the case of the Guimbal turbine. Here, adaptation appears in modifications or replacements of elements based on their qualities (e.g. qualities of the water and oil). The more these qualities allow mediations between the technical and geographical environments, the greater their relations and field of use (1980 [1958], p.47). In this sense, it “represents real technical progress” (1980 [1958], p.47) because it could be seen as part of the process of evolution identified by the object’s autonomy and concretization. The generator’s size, its placement in the water-pipe, the water, the oil and the pressure all could be thought of as a solution for a problem. But this is not the point because not all types of changes due to problems are part of the evolution of the technical object. For example, minor improvements, negativity or change of the technical object in order to meet different aims of the inventor or user, might not be essential to the progress of the technical object (1980 [1958], p.60). The essential, here, emerges from the point that concretization and adaptation are self-referential processes and thus extend in a continuity. Concretization becomes possible because of “the new conditions erected by concretization” itself, and adaptation is non-hypertelic when the environment is “created by the adaptation itself” (1980 [1958], p.48). The new stage in the evolution of the technical object comes into view from this adaptation-

concretizing process. It is identified by the emergence of a new self-conditioned “technogeographical” environment that becomes part of “a systematic and plurifunctional convergence”, which becomes regulated (1980 [1958], p.49).

“Invention” is the term reserved for technical objects that emerge through this self-conditioning process, that materialize through the technogeographical environment. Inventions only “exist in their completeness or not at all” as they cause their own conditions of functioning or existence (Simondon 1980 [1958], p.50). The technogeographical environment is called the “associated milieu”, which allows the individualization of the technical object. This milieu is the mediator between two systems: a “definite system of natural elements surrounding the technical object” and “a definite system of elements which constitute the technical object” (1980 [1958], p.49). It is a “transfer system” (1980 [1958], p.54) that institutes a recurrence causality (e.g. of the regulated interplay between water and oil) that conditions the object’s individuation, makes it visible and open to reciprocal influences.

The invention is the new individual that emerges from the concretization process. For Simondon, although the technological object, “approximates the mode of existence of natural objects”, it does not have signification like a living being where the latter exists in its absolute concreteness from the beginning (1980 [1958], p.40). The former’s signification resides in the study of its process of temporal evolution, which remains open as a tendency towards concretization (1980 [1958], p.43). Nevertheless, it never concretizes by bringing about an end-come. This tendency defines the becoming of the

technical object as a process of “condensation and concretization” signified by crossing “a threshold to start up and to maintain their own functioning; above this threshold, they are absurd, self-destructive; below it, they are self-stable” (2009, p.19).¹¹⁰ Without condensation the object is destroyed due to the continuous amplification (e.g. over-heating an engine causes it to deteriorate irreversibly) and without concretization, it becomes stable so that its evolution stops and becomes “a made-to-measure” object that has no intrinsic coherence. It is required but not necessary (2009, p.22). For this reason, the object of invention exists as “a regime of functioning” within a “schema of concretization” (2009, p.19) with its associated milieu that gives it an autonomy and self-conditioning.

Technical individualization could be observed in three levels: the element, the ensemble and the individual. The first level, the element, is the infra-individual technical object, which is analogue to the organs of the body (this resembles the psychic individual in human being individuation).¹¹¹ The element does not have an associated milieu prior to the whole object constitution (1980 [1958], p.50). As pointed out previously, the element has an intrinsic quality that defines its degree of perfection (1980 [1958], p.60). Simondon explains how the adze, as an example of a good tool, is made up of a plurality of functioning zones that are arranged to achieve a certain system of usage with a stable structure. This arrangement is based on an internal distribution of the molecular chains of metal, for example, between the cutting edge and the flat part, and between the socket and the cutting part of the blade. This molecular distribution varies

between the zones to increase the solidarity and the elasticity of the adze, thus, ensuring its quality as a whole (1980 [1958], p.62). Technicality is the term reserved for this quality (1980 [1958], p.63). The quality here refers to the “forces” of the element identified as the “capacities for producing or undergoing an effect in a fixed manner” (1980 [1958], p.64). Being fixed means it is a stable “positive characteristic”, defining the element concreteness level or technical reality (1980 [1958], p.63). Being concrete means its quality is determined. The element is the bearer of the technicality of the ensemble or the technical individual.

Elements signify “a line of causality” (1980 [1958], p.57) in the evolution or progress of the technical object that marks a present spatial solidarity and historical successive solidarity of the technical being (1980 [1958], p.58). In other words, what passes in the temporal line of the technical object are the elements produced through the internal intercommunication between the ensembles (1980 [1958], p.60), only to “participate in a cycle of becoming” (1980 [1958], p.58). The spatial solidarity is the present moment of integration between elements, ensembles and technical individuals. Elements are detachable from the ensembles and, thus, able to join other technical beings and modify the latter’s characteristics, which in turn is reflected in the ensembles that produce other elements (1980 [1958], p.57-58). Thus, a successive solidarity is established through the “transductive role” played by concrete elements in the transmission of technicality from one age to the next (1980 [1958], p.65).¹¹² The elements are “good witnesses of technical

development” (1980 [1958], p.66) and as “an analysis of the technics of a human group on an analysis of the elements produced by their individuals and ensembles” (1980 [1958], p.66).

Elements are integrated in the technical individual and enter into new compositions (1980 [1958], p.63). Once different elements are organized as a whole by an internal consistency, a relation between them is established in a circular causality in order to achieve a future ensemble (1980 [1958], p.52). The integration of elements in order to form a whole is not a matter of chance but is the “conditioning of the present by the future, or by what up to now does not exist” (1980 [1958], p.50). This conditioning takes place through technical imagination, which is

a capacity for perceiving in objects qualities that are not practical, qualities that are neither directly sensory nor wholly geometric, qualities that have to do neither with pure matter nor pure form but belong to the in-between level of systems. The technical imagination may be considered as defined by a particular sensitiveness to the technicality of elements that paves the way for the discovery of possible connections (1980 [1958], p.63-64).

This “sensitiveness” precedes the invention. Inventions are individuals formed by the participatory elements. The second level of technical object, individualization, lies in the sub-ensembles of a higher ensemble (e.g. laboratory or factory) which is identified by “its capacity to effect various free relationships without destroying the autonomy of individualized sub-ensembles” (1980 [1958], p.55). These sub-ensembles or devices are not connected (1980 [1958], p.56) but each of them constitutes a recurrent causality with their

associated milieu (this resembles the collective individual in human being individuation). The sub-ensembles should be grouped or connected in relationships that do not interfere with the autonomy and the independency of their different associated milieux (1980 [1958], p.55). As long as their organization requires independence, they do not require a *unique* associated milieu (1980 [1958], p.56). The associated milieu of the sub-ensemble is different from the *unique* associated milieu of the technical individual described earlier. It has a 'recurrent causality' but lacks the 'plurifunctional' or 'reciprocal' causality with other sub-ensembles. Moreover, its conditions of function affect other sub-ensembles only through the relations effected by the higher ensemble. The groupings of sub-ensembles are established based on axiological value, in order to best achieve certain results from their functioning. In this sense, their adaptation is subject to external influences such as the choices made in order to achieve the best result and the technical or natural environments (1980 [1958], p.54-56). The third level of a technical object's individualization is the technical individual (this resembles the trans-individual in human being individuation), which has a unique associated milieu essential to its functioning and can only act within it (1980 [1958], p.53). It has achieved evolutionary or self-conditioning adaptation and interior concretization (1980 [1958], p.56). It is characterised by its infra-individuals or elements (1980 [1958], p.57). Apart from the elements as transmitters of technicality, nothing lasts because both the technical individual and the ensembles are temporary (1980 [1958], p.66).

The living being is similar to the technical object as it is an individual that brings its associated milieu with it (1980 [1958], p.51). “The ability to be self-conditioning is a principle of production capacity in self-conditioning objects” (1980 [1958], p.51). Thus, the dynamism of the two is analogical on these terms. The technical object is analogical to the mental system where the former influence each other through dynamism of material functioning, the latter influence each other through dynamism of thought (1980 [1958], p.51). The unity of the associated milieu of a technical object is analogue to the unity of the living being (1980 [1958], p.50). There is always an active dynamic background, which associates the individual, the form, the living being, the technical object, the organ or the piece of thought. There is a “participational relationship” between the forms and their background. The background “gives existence to the system of forms” (1980 [1958], p.51). Forms interact with their background before they even have a separate existence. Forms are systems of actuality. They are passive as long as they are not organized in relation to their background. The background is “a system of virtualities, of potentials, and of moving forces” (1980 [1958], p.51). The participational relationship “brings the virtual to bear upon the actual” (1980 [1958], p.51). The whole holds a reciprocal influence of recurrence causality with its associated milieu. Backgrounds and forms relate through causality and conditioning. The technical object has a functioning background that connects its elements into a structural unity. It conditions the object’s structures as it is influenced by each structure individually but influences them collectively through an asymmetrical recurrence of causality (1980 [1958], p.51). It is the “vehicle for information-controlled

energy” (1980 [1958], p.51). This informed energy supplies the elements with their conditions of functioning (1980 [1958], p.50) and establishes an internal coherence between them. There is also the natural environment that determines their usage. The technical individual is the one that has a homeostatic associate milieu that emerges in-between these two environments (1980 [1958], p.51). The body has a living matter as a background, connecting all its organs into an organism and preserves chemical and physical equilibriums of the system (1980 [1958], p.52). There is also the ‘no organ’, a structure that appears as “hidden forms” (that is the unconscious) that could be related to explicit forms only through a psychic background (1980 [1958], p.52). Thought has a mental background linking its representations, images, memories and perceptions. A human individual has a homeostatic mental associated milieu as an environment that emerges in-between life and conscious thought (1980 [1958], p.53). Simondon asserts,

we are able to create technical beings because we have within ourselves an interplay of relationships and a matter-form association which is remarkably analogous to that which we establish in the technical object (1980 [1958], p.53).

Inventions materialize from this interplay of relationships in-between, as a reciprocal process of “a humanization of nature” and “a naturalization of man” (1980 [1958], p.49). The “sensitiveness” of the in-between does not only appear in the interplay between the physical and biological but also between the concrete and the abstract” (1980 [1958], p.63). A new system emerges with its ability to be autonomous. “The self-conditioning of a system by virtue of the

result of its operation, presupposes the use of an anticipatory functioning which is discoverable neither in nature nor in technical object, made up to the present” (1980 [1958], p.49). That is why the invention is an “integral inventivism” (Massumi et al. 2009, p.38) and not a mere development or improvement.

In summary, Simondon emphasizes the process of becoming as a dimension of the human-technical culture. Becoming is marked by crossing thresholds where the future acts on the present, leading to the emergence of new autonomous systems. This reversed action is due to the sensitiveness to qualities in-between heterogeneous systems which might not have practical or sensory existence. Reasonably, they could be in-between actual and virtual, and knowledge and emotions. They transform the assembled object into an assemblage with continual effects. Assemblages represent interplay between the human and machine’s becomings. Affectivity is an essential character for this interplay. A change in affective modalities appears within the industrial phase that challenges human’s becoming and subjectivity. This requires the development of a mental technicality defined by regimes of functioning, schemes of concretizations and of actions that unite the sources of information and energy and overcome psychosocial obstacles.

6.4. The Turing Machine “taking-effect”

In Simondon’s account, the loss and the gain of affective modality is essential for the counter-becoming between human and machine. The loss of affective modality started by humanizing the machine and believing that it is a man. The

Turing Machine stands on the very line between the loss and gain of affectivity, as Turing was the first to claim that machines are intelligent and thinking beings. This is because it determines the degree of sensitiveness to the non-practical or indirect sensory qualities while experiencing the technical object. This allows an action of future on present, that is, an “autonomous taking-effect of a futurity”, which allows the emergence of “an effective coming into existence that conditions its own potential to be as it comes” (Massumi et al. 2009, p.40). Elizabeth Wilson, interested in coassembling affects with artificial intelligence’s pioneers, puts forward Turing’s case in detail by pointing out, “Turing’s geeky attachment to machines was not thinly cognitive or logical. Rather, computational space and strong, positive feeling were often allied in Turing” (2008, p. 23). This attachment could be perceived as ‘introjective’ where machines are brought psychologically ‘inside’ in order to generate intimacy with them and expand their own competency (Wilson 2011). The “computational space”, in this sense, is the dynamic background that plays the informational role between Turing and the machine to which they both participate. Turing’s arguments, on the other hand, challenge ‘what exists’: the limitations and boundaries as he refuses to satisfy or submit to ‘objective proving’ through experimentation and the compiling of statistical results. Respectively, neither his questions nor his answers address the current states of machines. He asserts, “we are not asking whether all digital computers would do well in the game nor whether the computers at present available would do well, but whether there are imaginable computers which would do well” (1950). He gave a simple answer to Newman’s question about the time it would take to match a man and

a machine: “Oh yes,” he replied “at least 100 years, I should say” (Newman et al. 2004, p.119); this is the imaginable time. This highlights the sensitiveness to the relationship between machines and himself that, at the ‘present’ is only “a foretaste of what is to come”. For Turing, the future is already casting its “shadow of what is going to be” (Turing Papers AMT A/1, cited in (Wilson 2004, p.42). Some examples of what has taken place within this time are provided below.

In 1982, for example, *Time* magazine announced the winner of the ‘Man of the year’ competition to be a computer, calling it the “Machine of the year.” The competition, which started in 1927, is based on selecting the person who influenced the news and affected people’s lives for either good or evil. The article documents its choice of the computer;

there are some occasions, though, when the most significant force in a year's news is not a single individual but a process, and a widespread recognition by a whole society that this process is changing the course of all other processes (Friedrich 1983),

The computer then has passed the threshold of the social norms and started to create virtual and actual networks. An actual application of the Turing Test will be informative of the source of this influence. A contest that was held in 1991, showed that some computers are mistaken for human.¹¹³ The human confederate was misclassified as a computer due to her expert knowledge. “Her replies seemed to be too expert to be human” (Epstein 2009, p.10). Thus, Epstein affirms that,

As Turing anticipated, the contest tells us as much, or perhaps even more, about our failings as judges as it does about the failings of computers. People's preconceptions about the limits of computers – and of people – strongly biases their judgments (2009, p.10).

In other words, computers were perceived through their limitation but knowing what they can really do is based on having experience with them. Ironically, the experience of the effect of expertise, here, seems to computerize the human in a similar way to humanizing the machine. A final example is the report of a real marriage of a Japanese man, nicknamed 'Sal9000', to a video game character called Nene Anegasaki in 2009, by Reuters (Katayama 2009; Meyers 2009). The couple met in a dating simulation game called 'Love Plus'.¹¹⁴ These examples show that the reasons for abstracting the Turing Machine, affectivity and subjective experience, are the same reasons for the continuity of its multiple emergences and networks outside the realm of scientific culture.

These examples support two of the embodied or situated characteristics of Turing's man-machine transformation and interaction. These highlight the definition of intelligence as an emotional concept, which has been overlooked within the scientific abstraction of the Turing Machine, where intelligence is linked to cognition and has been recently reported as being "missed" by Turing (Shah and Warwick 2009, p.325), and the extraction of "comparable circumstances" between the man the computer. In relation to the former, what takes place within the future time, for Turing, is not machine-man or man-machine metamorphosis, that proceeds by replacing the man's organs with the machine's.

Turning disapproves of the task of building a 'thinking machine' by taking "a man as a whole and trying to replace all the parts of him by machinery". This is because "the creature would still have no contact with food, sex, sport, and many other things of interest to the human being" (Turing papers AMT C/11:16–17, cited in (Wilson 2004, p.40). In this sense, Turing links 'thinking' with what interests human beings. Although what interests human beings - "food, sex, sport, and many other things" - is related to the organs of the body, the body seems only as a vehicle or means to obtain a contact with such interests. This contact appears as emotions by which Turing defines intelligence. Thus, intelligence as an "emotional concept" (2004c, p.431), here, could be defined as the capacity of any-body-whatever to produce emotional effects. Turing argues that "with the same object therefore it is possible that one man would consider it as intelligent and another would not; the second man would have found out the rules of its behaviour" (2004c, p.431).

The rules of behaviour, in the case of machine, could refer to its written set of rules of procedures as in the case of the "Paper Machine", where Turing argues that it could "produce the effect of a computing machine" (2004c, p. 416). Emotional effects can be found through experience (it could be argued that, for Turing, scientific research is based on discovering pre-determined rules or facts and not on intelligence). For Turing, "we have to have some experience with the machine before we know its capacities" (Turing Papers AMT A/1, cited in (Wilson 2004, p.42). Having an experience with machines would allow more encounters with their emotional effects (that is their intelligence). Reasonably,

these effects, in Simondon's terms, mark the machine's technicality and Turing's sensitiveness towards it.

A man-machine transformation is necessary in order to allow this experience and elevates the machine from the abstractness and limitations attached to it. For Turing, this transformation should be based on extracting "comparable circumstances" between the man and machine (Turing 2004c, p.421). A mechanic mind is not a real mind, but mind functionality could be seen as stripping off the skin of an onion, where eventually putting all the skins together does not produce the totality or reality of the mind (Turing 1950, p. 454-455). It produces a different mind with its own totality. The real and the assembled will always be different. The extraction of the functions from the mind does not mean 'freeing' it from the brain, but that the functions of the mind are selected, as any-whatever detachable qualities, which appear in their effect or force. This allows the "mechanical analogues of brains" which requires accepting the real brains themselves as "a sort of machine" (Turing 2004f, p.483). Programming is the method through which these can be transferred to a mechanical brain and function within it. The functions become visible as behaviour which in turn is "predictable by calculation" (Turing 2004f, p.483) (it could be said that they can then become subject to scientific research or comparative experimentations). In a way, then, Turing perceives the mind in its functions (thinking) and the body in its actions (behaviour), where the mind's function is qualified by the predictable and calculable machine's action.

A machine is “completely described by the relation between its possible configurations at consecutive moments” (2004c, p. 419). Relations can be modified by the machine, that is “self-modification”, or by “interference” from outside, which changes the description of the machine. Normal operations do not alter the description of the machine. Self-modification is related to altering the content of storage– but not the instruction table - by internal operations. Turing differentiates between two types of interference from outside. The first is by replacing the machine’s parts with different parts, which does not hold his interest. The second is “paper interference”, “which consists in the mere communication of information to the machine, which alters its behaviour” (2004c, p. 419). For example, a man’s behaviour approximates a machine without interference when he is concentrating, that is, when he eliminates the distractions surrounding him. This behaviour, however, is determined by his previous interferences (2004c, p.421). Interference results in “successor relation”, that changes the original properties of the machines configurations. The outcome of this process is a “different machine” (2004c, p. 419).

6.5. The mixed and virtual characters in Turing Machine

The previous section brings us to the realization of the mixed and virtual characters in the Turing Machine. As pointed out previously, Turing insists that “unproved conjectures” are important and useful for scientific research (1950, p.442). This is already implied by the test and the imitation game versions. The former, so far has accommodated the interest of science, thus, rescuing the Turing Machine by insuring its adaptability and continuity within the scientific

culture. The latter, that is the game, is relevant to Turing's interest of abolishing gender through imitating (this should be understood within the previous definition of the emotional concept). In all cases, the machine, as pointed out in the Turing imitation game, has an internal state to differentiate itself.

Moreover, a patriarchal order appears where Turing describes two types of *domestic* machines as alternatives for abolishing gender: thinking machines simulating adult minds and learning machines simulating children minds; adults and children, that are present and future respectively. Lassègue (2009) correctly comments that the imitation game is a *fantasy* to abolish gender differences. In the adult's version, the "gender difference is only denied but does not disappear in the game" (2009, p.166). In the case of the child-machine version "the desire to abolish gender difference is ... linked to the desire of building a physical object which would not be subject to the initial divergence of physical systems" (2009, p.167). The following section elaborates on these versions.

6.5.1. The child-machine

Turing obtains his aforementioned position as the father of computer science for potentializing the machine within the process of construction rather than perceiving it as a constructed 'whole'. Turing suggests building a machine with little capacity that can be educated and can modify its behaviour through learning (2004c, p.422). He argues, "we need not be too concerned about the legs, eyes, etc. as there are other means of communication" (1950, p.456). These sensory organs can be developed later but initially his ambition was to

send the 'Creature' to school without children making fun of it and for it to be able to communicate with the teacher (1950, p.456). The programmable child machine, with its speed and storage capacity, can be constructed from the very beginning to overcome any organizational and cultural constraints.

Turing asserts that "there is so little mechanism [writing] in the child-brain that something like it can be easily programmed" (1950, p.456). Machines do not evolve but are constructed and the external selection takes place within this very process of construction. While its structure is "hereditary material", its changes are described as "mutations" controlled by the experimenter's judgments (this is similar to natural selection) (1950, p.456). The experimenter, who is "not restricted to random mutations", can induce changes based on "the exercise of intelligence" (1950, p.456), which in relation to our previous section could refer to the assessment of emotional effect. In this way, experiencing a machine and a machine's learning from experience could be interrelated. Specialization appears, as a number of people are required to work with the machine. Information and experiences communicated to the machine are controlled and selected by the experimenter in order to speed up the machine's learning (Turing 2004f, p.106). A schoolmaster carries out Teaching and facilitates learning. This can take place through rewards and punishments which could develop in a pleasure-pain system (2004c, p.422). For example, the pleasure/pain interference system is based on perceiving temporal configurations that determine a machine's future state. Pleasure as a positive experience occurs when the machine is right and prevents its behaviour from

changing, while pain is a negative experience that occurs when the machine is wrong, thus, it disturbs and changes its behaviour (2004c, p.425).

Information entry is restricted by the communication channels available to the teacher. "Orders are to be transmitted through the 'unemotional ' channels". "Symbolic language" could be used to teach the machine to obey orders (1950, p.457).¹¹⁵ Different logical inferences based on various kinds of definitions and propositions- with the exception of propositions related to belief-value - could be built or programmed in (1950, p.457). Propositions could be developed into imperatives within the system, which may be "given by authority" or reached by the machine through "scientific induction" (1950, p.458). These imperatives could be classed as "well-established facts" but they are "not part of the rules of the system" (1950, p.458). Some of the rules can be changed because they are "time-invariant" and "claiming only an ephemeral validity" (1950, p.458). The teacher knows nothing about the machine's inner workings. A random element used in searching for information works better than a systematic method in a learning machine. This is linked to the learning process which "may be regarded as a search for a form of behaviour which will satisfy the teacher" (1950, p.459). In this sense, Turing argues, "Intelligent behaviour presumably consists in a departure from the completely disciplined behaviour involved in computation, but a rather slight one, which does not 'give rise to random behaviour, or to pointless repetitive loops" (1950, p.459).

Another person to work with the machine is the mechanic who constructed it. If it operates incorrectly, the mechanic reverts it to a previous position and

decides about aspects that need to be repeated, but he is not involved in teaching (Turing 2004f, p.107). The machine has a memory that keeps a chronological list of statements and actions performed by or to it, an alphabetical index of experiences based on vocabulary recognition and times of occurrence, and an index of participants. Remembering is when the machine's memory "include[s] important parts of the configuration of the machine at each moment" (2004f, p.475). A new choice of the next action is taken by matching some features of the present situation with the indexed information and previous choices. The new choice might differ from one machine to the other, based on the machine's degree of education in relation to the found favourable or unfavourable indications and outcomes, which at the first stages could be solvable by crude rules and later by some kind of index (2004f, p.474). In this way the machine learning is situated.

6.5.2. Adult-machine: The imitation game

Simulating adult-mind is the second version for abolishing gender. Turing thinks that it would be necessary to "think a good deal about the process which has brought it [adult brain] to the state it is in" (1950, p.455). This will require information about its initial state, its previous education and experience. The imitation game seems one way to overcome this problem (constructing a child machine is the other alternative). As observed the imitation game has conditions and a process, which are elaborated upon in chapter one. Instead of thinking about the previous education and experiences, the game situates the

adults in a playing space. Two aspects could be noted here: first, the nature of imitation and second the effect of the process.

The argument about the nature of thinking or imitation, provoked by Turing's paper, is in line with Gibbs' idea that mimetic communication is a "complex communicative process" (2010, p.187) that takes place voluntarily and involuntarily, naturally and culturally, and involves visceral affect at its heart and other sensory modalities that produce emotional convergence in forming social processes. Regardless of the different forms it might take (e.g. synchrony and contagion), they establish a new "epidemiology of affect" that is a new way of perceiving continuities and discontinuities between homogenous and heterogenous networks of images, conversations, bodies and other things, in addition to social bonds being formed or broken. Essential to mimesis is the 'asubjectivity' and 'anti-representational' approach accorded to it in the Deleuzian-Spinozian view.

But at the heart of mimesis is the immediacy of what passes between bodies and which subtends cognitively mediated representation, which it does not entirely replace or supersede. It is not analyzable within a semiotic model, nor does it require an 'I': it is essentially asubjective even though it plays a crucial role in the formation of subjectivity. Mimesis can morph bodies, changing color, odor, form, or movement; or it might choose words or clothes or cars or even ideas as its medium. But what it signifies and the medium in which it operates is less important than its mode of operation. Mimicry is not representation of the other, but a rendering – a relation between things in 'which, like a flash, similarity appears' (Gibbs 2010, p.193, citing Foucault 1973, p.24).

This statement informs us that, in the case of Turing, the universal property of imitation cannot be reduced to a machine with pure cognition or mind

functionality, but a machine that is *rendered* to have the possibilities of forming and belonging to social bonds. Imitation in Turing's game cannot be restricted to writing the same sentences or doing the same actions because this remains on the subjective level as an imitation of identity, forms, subject, organs or functions. As mentioned earlier, Turing rejects man-machine transformation through organs and insists on extracting "comparable circumstances". The universal property of imitation, in this sense, is emotional intelligence, which has the capacity for producing the same effect.

If desire makes the body a machine, then it makes the machine a body. For this reason, the mechanical body is not excluded from the Turing Machine. In the imitation game, the machine's body is a 'hidden object' from the interrogator. It should be noted that Turing uses the word mimic and imitate interchangeably because for him learning a language "depend[s] rather too much on sense organs and locomotion to be feasible" (2004c, p.421). This means that he does not separate verbal behaviour from non-verbal embodied behaviours. Then, it is not a mind without a body, but a mind with a hidden body. In a way, the body, especially at the newness stage of machine, becomes the differentiator between the human and the machine. If the mechanical body was revealed at this stage, it could only be perceived as an object of science and not through its effects.

The hidden body, then, enters into relations for being hidden. Only after the evaluation through which its effects are experienced and judged, its emotional intelligence is affirmed. Then, the effect of visibility could be ruled out. It crosses

the threshold to gain its life before being seized by the “holistic thought” and being judged as mechanical. When the mechanical body appears after crossing the threshold, its mechanics cannot be perceived without its effects (chapter one informs us that as the machine’s effect is affirmed, there is no reason for the body to be hidden any longer. Comparative experimentation is now based on contrasting bodies through their effects). In his paper ‘Can Digital Computers Think?’ (1951), Turing asserts,

But I certainly hope and believe that no great efforts will be put into making machines with the most distinctively human, but non-intellectual characteristics such as the shape of the human body; it appears to me to be quite futile to make such attempts and their results would have something like the unpleasant quality of artificial flowers (2004a, p.486).

In this sense, the meaning of a machine’s body changes from being barely mechanical, to constitute the effects that come with it.

This brings about the second aspect related to the effect of the process. If effects precede the organ, then, the organ can be identified by its effects, which for Turing are the emotions it exerts. This brings in Deleuze and Guattari’s concept of becoming in relation to Spinoza. Deleuze and Guattari emphasize that the body is defined by counting its affects (Deleuze and Guattari 2004, p.283) where “affects are becomings” (Deleuze and Guattari 2004, p.283). Becoming is not imitation nor does it occur in the imagination (2004, p.261). The organs or individuals become elements in a “machinic assemblage”, which is defined by “a list of active and passive affects in the context of the individuated assemblage it is part of” (2004, p.283). The body’s coordinates are identified as

longitude and latitude. The first is defined as “the sum total of the material elements belonging to it under given relations of movement and rest, speed and slowness”, where the second, that is latitude, means “the sum total of the intensive affects it is capable of at a given power or degree of potential” (2004, p.287). Heterogeneous bodies are involved in *unnatural participation* that is

a composition of speeds and affects involving entirely different individuals, a symbiosis; it makes the rat become a thought, a feverish thought in the man, at the same time as the man becomes a rat gnashing its teeth in its death throes. The rat and the man are in no way the same thing, but Being expresses them both in a single meaning in a language that is no longer that of words, in a matter that is no longer that of forms, in an affectability that is no longer that of subjects (2004, p.285).

Becoming as a process of desire in *A Thousand Plateaus* (1980) means the extraction or emitting of particles that are with, or capable of taking, relations of movement and rest, in order to enter into a “zone of proximity” (Deleuze and Guattari 2004, p.300-301), where the identification of the boundaries between the two systems is impossible. Becomings are molecules; a plane that is defined by its intensity, deterritorialization and mobility in contrast to the molar plane which is defined by its extensity, organisms, subjects, and identities (see appendix for an example becoming-woman).

The situated game is, then, a situation for allowing the unnatural participation where the computer is experienced and known by its affects and intensities rather than its mechanical body. In this way, it is permitted its first hold to becoming-other. This is supported by Turing’s focus of software development, complex programming and the undifferentiated effect between the paper

machine and mechanical equipment materiality as explained in the previous chapter five. As noted in the previous chapter, the man imitates the woman, and the digital computer imitates the machine before the man and the computer arrive at the final imitation competition. From the previous elaboration on the nature of this imitation, emotional intelligence and experience, it could be argued that the imitation game becomes a transversal passage in which both the man and the computer pass through to become-other. The computer, which has evolved from the “discrete state machine” is in analogy with the man who imitates and uses the woman as its resource – it has produced a universal man or machine. This passage is situated so that an embodied effect at ‘asubjective’ level can take place involuntarily between the two systems. Thus, the threshold of becoming is approached.

6.6.2. Compound of heterogeneous systems

The effect of the process as becoming-other can be better understood in the case of the Turing Machine itself rather than the game. In this sense, Turing was becoming-machine, that is becoming-other, but within his thought-of-becoming, the machine was becoming-man, becoming-the-same, by showing intelligence, and becoming-other through behaviour. A similarity appears or is made to appear, a resemblance is figured between the machine and Turing (thinking), and between the machine and the woman-imitating man (behaviour), a compound of compatibility – similarity with difference. An example of this is when Turing says that thinking is a “‘buzzing’ in his head” (2004, p.184), he uses the machine’s sound to approximate his thinking with machines. In

reverse, the machines are buzzing and thus thinking. Confirming the affective dimension of the Turing Machine, it could be claimed that Turing perceives 'man' and 'machine' not from a scientist's perspective but from 'in-between'. Perceiving from the 'in-between' does not go to extremes but absorbs the extremes within its evolution. The man machine is not a mere tendency towards a replication of human body or thinking because the machine and human are not 'identical' systems.

This compound can be called the "dark precursor". This is one of Deleuze's concepts, which he describes as a 'differentiator' acting as a communication agent, which makes heterogeneous systems coexist and communicate. For Deleuze,

Given two heterogeneous series of differences, the precursor plays the part of the differentiator of these differences. In this manner, by virtue of its own power, it puts them into immediate relation to one another: it is the in-itself of difference or the 'differently different' – in other words, difference in the second degree, the self-different which relates different to different by itself (2004, p.146).

The dark precursor is a point formed between two heterogeneous systems' differences and includes both of them. This merging of, or interaction between differences will lead to a new difference (a new compound); a difference "in-itself" that is "differently different" (2004, p.146). This new compound relates the systems' differences as each difference finds a resemblance in the compound, but this resemblance is inseparable from the compound as it is already part of a new identity. In this way the resemblance and identity become effects rather than preconditions of the precursor (2004, p.146).

Given that the Turing Machine emerges between the two heterogeneous bodies called the 'human body' and the 'machine body', as a compound that is a dark precursor, and it constitutes resemblance to them and an internal difference from them, nevertheless, it remains as a homeostatic associated milieu. This internal difference is formed, as Turing's previous accounts show, by extracting "comparable circumstances", having experience with machines and delimiting their capacities. This difference does not aim to erase the specifications of a system and/or diminish the characteristics of the other or, more profoundly, blur the difference between them. Actually, the originality only manifests itself in the difference. The difference is strength, and the creative investment is, if we speak in terms of consciousness, directing this difference to re-strengthen or empower both systems. Becoming is the in-between of the heterogeneous systems, a unitary compound of both systems. What constitutes the Turing Machine compound is the emotional effect that has abstracted the Turing Machine on one level and allowed its emergence and continuity on another one. The Turing Machine itself becomes an effect or an attachment point defining artificial intelligence. This effect does not constitute the Turing Machine as a technical object or a 'machine' thought of by Turing, but it constitutes the relationship in-between human and machine. In other words, it is not the machine, but the relationship that has taken effect. The networks it has created are undeniable now, not only thought-networks, social-networks, energy-networks but along with them desire-networks where Hansen's account reserves a place here.

In summary, the mixed character propositions in Turing's account are due to his attempts to merge both his scientific knowledge of computation with his desire. It could be argued that he was directing the question of his psychic problem towards the machine as the collective for resolving his physical problems. The actual and virtual, the real and unreal are connected to the dynamic background in which they participate. The machine is taken as a method of construction and convention. The imitation game and the test, the child-machine and adult-machine contributed to the resolutions of the problematic issues for Turing with his psychic and collective individuals. While mediation did reveal a new dimension with its potentiality, continuity and futurity in the relationship between Turing and machines, which has been individuated due to the scientific culture, it did not resolve the physical and psychic problem for Turing. While Turing's thought showed transductivity in thinking, his psyche was haunted by fantasies, and his body was nowhere, that is imperceptible as he tried to satisfy his desires in a scientific way. This might lead, through amplification, to continual dedifferentiation or immanence on the one hand between science/desire, proved facts/unproved conjectures and, on the other hand, between effects and qualities of paper/digital, human/non-human, child/adult, self/machine, and living/mechanical bodies. It exceeded the limits. The increase of this dedifferentiation could be realized in his refined papers that started from 1948. His 1950's paper '*Computing Machinery and Intelligence*' is the accumulation of the indications of this immanence.

6.7. Summary

This chapter introduces a different understanding of the Turing Machine based on Simondon's concept of individuation. It emphasizes the role of affective modality in modulating the relationship between Turing and Machine that has led to the event of "taking-effect" or individuation. In his writing, Turing emphasized a number of characteristics that participated in this effect 'taking-effect'. Experience was the method through which machines' capacities could be known, extraction of "comparable circumstances" between human and machine is the principle to apply in humanizing machines, intelligence is an emotional concept, and a machine's intelligence is in the effect they produce. Multiple emergence and mixed character appeared as Turing attempted to mediate between, on the one hand, scientific culture and his desire and on the other hand, the simulation of adult-mind and the construction of the child-mind to play the game. Turing induced the fragmentation of tasks carried out by the individuals working with machines and later on emphasized that machines would overcome intellectuals and take control. In other words, and in relation to Simondon's account, they will marginalize human beings. He also indicated that machines would have networks as he pointed to their expected communication with each other.

6.8. Conclusion: beyond immanence

This phase of the transdisciplinarity approach follows the previous two phases, which focused on the analysis of empirical and phenomenological accounts of

the relationship between human and machine embodiments. It aims to address the problems found in the previous analyses where reduction of embodiment and embodied interaction is observed in relation to the indirect or subjective application of the Cartesian mind/body split. It hypothesizes that the analysis of the Turing Machine could counter the previous accounts, since it has led to multiple emergences of relationships between humans and machines, as well as different fields to study these relationships, such as AI and HCI. This phase also benefits from considering two aspects identified in the analysis of Deleuze's work on cinema. These are the relational and the becoming dimensions. The understanding of these two dimensions is expanded through the work of Gilbert Simondon on individuation. Thus, this phase attempts to read the relationship between Turing and machine through these dimensions.

This reading informs us of a number of characteristics from which human-computer interaction can be understood. Firstly, the whole is the relationship and not the computer or the human. These are elements that compose the whole through participatory relationships as individual units and, simultaneously, as participants in these relations. This composition requires a dynamic background in which the relations between elements manifest. This background ensures the achievement of short-term objectives and sets the foundation for long-term aims. Other potentials could appear in the course of time due to the modulation of relations, development of systems and the incoming of new participants. In practical words, the background could be thought of as an application field where the human and computer are

participants in a task completion. If the task is thought of as a relation in-between human and computer, then, the question would not be about the effect of virtual embodiment on humans, as posed in chapter one, but how both of them could take part and extend the other's skills, abilities and potentials for further achievements. The same question could be thought in relation to disciplines, how they could extend each other while participating in a specific background.

Secondly, the role of affective modality in the relationship between the human and machine should be reconsidered. This affective account is beyond that of the physical interaction in Hansen's analysis, as it is based on forces and qualities that do not have practical implications. Practical implications and inventions, as a future dimension, become the effect of these forces and qualities and not a precedent to it. Affectivity appears within the dynamic background and participatory relationship to constitute this future dimension of becoming. Practically, if the human and virtual embodiment participated in a task, an affective bond could emerge between them. This could be intensified, as seen in the second part of this thesis, through qualitative progression, that is, by extending the embodied character qualities and functions to participate in different task requirements.

Finally, it could be argued that there is immanence between the human and computer to the degree of communication, and there is polarization to the degree of difference. In other words, the background and participatory relationship between the human and computer set them as a transductive unit,

without erasing the difference between them or the singularity peculiar to each of them. This enables new dimensions and relations of becoming to appear. Practically, instead of seeing the human and computer as identical or seeking to effect this identity, the focus should be on allowing new forms of information, potentials and modes of individuation in-between them.

7. Conclusion and future implications

7.1 Summary

The aim of this conclusion is to summarize the previous cases about embodiment in HCI, new media and AI, and to present points for the future phase of the research. This thesis aims to rethink the relationship between the human and machine embodiment within a transdisciplinary approach. A transdisciplinary approach is problem-based and goes across and beyond disciplinary boundaries. It preserves the research as a process of becoming, or individuation where each phase leads to another phase. Machine embodiment is generally understood as the opposition of Cartesian mind/body dualism where, for the former, the body and emotions have a role in the human mind. Although studies in AI and HCI developed to conceptualize machine embodiment, in practice, the influence of the Cartesian effect of the split ensured it remained within concepts such as 'embodied cognition', which put the mind in service of the body. Machine or virtual embodiment means equipping the software or hardware with a body that reflects its cognition or intelligence.

A transition has taken place within scientific and neuroscientific with emphasis on the interconnection (anatomical) and interrelation (e.g. behaviour) between mind and body. Consequently, embodiment, especially in AI and HCI studies, is realized in the 'embodied effect', which suggests that having a body makes other elements such as emotions, intelligence and non-verbal communication behaviours of a machine visible. These, in turn, have positive effects on human-

computer relationships and on human embodiment, interaction and task completion. The relationship between human and machine embodiment is perceived within this effect.

The first phase of this research focused on investigating the human-computer relationship within objective reality and the contradictions in this reality motivated the movement to the second phase. This phase explores what exists at the empirical level in the HCI field. Chapter one of this thesis presents an analytical study, using a meta-analysis or a quantitative review of experimental studies, in the field of pedagogical agents (PA). This study aimed to find out the effect size of embodied agents on participants and to resolve the on-going contradiction in the evaluative studies' findings. The findings do not confirm the "person effect", that is, the positive effect of virtual embodiment on participants and show issues related to the persistence of mind/body effect. Moreover, they present a lack of theoretical basis for the definition of embodiment and embodied effect, as well as the misapplication of conventional methodology in evaluating embodied conversational agents (ECA). The 'embodied effect' was not evaluated as the embodied interaction was overlooked. Neither participants' embodiment (e.g. actions or activities), nor the relation between them and virtual embodiment was mentioned. The focus was on embodiment, which was reduced to an image and evaluated as a mental or cognitive effect, measured through verbal judgments that take place after the interaction.

This redirects the research to find how embodiment is perceived within a different discipline. The second phase of the transdisciplinary approach looked

for embodiment and embodied interaction in new media, where Mark Hansen has shown interest in defining a model of embodiment in interacting with new media. This model is based on '*Erlebnis*', which is a short subjective and corporeal experience. Hansen claims to focus on a phenomenological concept of embodiment beyond representational and cognitive models, where embodied perception and embodied affectivity are seen as phenomenological modalities. Hansen's focus is on the participant's embodiment, so his illustration from Artwork is broader than the previous chapter. Besides the interaction with interface embodiment, which he terms Digital Facial Image (DFI), he also provides analysis of embodiment in virtual environments and virtual reality. For the benefits of understanding 'embodiment', this analysis does not exclude the broader area in Hansen's account. This is because it seems that the theoretical and philosophical work Hansen engages in in his analysis, are more useful to our understanding of embodiment and embodied constituents than Hansen's work itself. On the one hand, Hansen's account in itself does represent a way of experiencing DFI or ECA (in HCI, this way of interaction is referred to as the 'agent misuse') and, theoretically, it is a way of interpreting or using technology. On the other hand, it is restrictive.

This restriction is evident in two ways, firstly, due to Hansen's use of technology as a medium for constant projection of a mental model of patriarchal order as a model of embodiment. The 'technology is female' model limits the technological situations, as interaction is explained in relation to knowledge of the human body's functions as a vehicle of reproduction, therefore this projection of

patriarchy on technology does not allow a critique of embodiment in technological situations. Such critique might be confused with the critique of the social situations, morals, ethics or female positions rather than situations involving technology. Second, Hansen insists on mapping technology to the body of participants rather than cognition, this means his account is explicitly dominated by mind/body, affection/perception and subject/object polarizations. Generally, it shows a lack of theoretical or scientific support for these polarizations. Reasonably, then, this transfer does not stand for phenomenological experience of technology per se and thus, it fails to accommodate for an experience of technology or technicality, or the relationship in-between the human and technology.

Through his engagement with different theoretical, scientific and philosophical work, Hansen introduces us to Gilles Deleuze's transformation of Henri Bergson's theory of embodiment in cinema.¹¹⁶ This transformation demonstrates a different way of embodying technology, which makes us rethink virtual embodiment and its relationship to the human. Deleuze seems to present us with 'embodied cinema' or we can even say 'cinema intelligence', with the emphasis that creative thinking is not in repeating what is there, but in showing difference. Cinema's powers and potentialities are in bringing what is cinematic about cinema, which is creating new images, extracting effects and forming relations peculiar to its own techniques. Embodied cinema is perceived in relation to movement and time images within the perspectives of relation and becoming. The movement-image is a linear direct presentation of events while

the time image presents time indirectly and in an irrational way. Movement images have a direct impact or effect on the viewer while the film as a whole has durational effect. Deleuze does not deny the difference between the cinema as a body and the human body, instead, he used natural embodiment to empower cinema and used the cinema's embodiment to extend natural embodiment.

This account redirects the research to analyze a different account of the relationship between the human and the computer, that has produced such a relation. This is the work of Alan Turing on machine intelligence. This phase shows how the Turing machine has influenced the relationship between human and machine, leading to the emergence of new research fields such as AI and HCI. There are two aspects of this account, first, Turing's relationship to the machine, which is described as affective, as there is a counter-becoming between Turing and the machine, where Turing is becoming-machine and the machine is becoming-Turing. This counter-becoming has led to a mixed character in Turing's writing as he describes the Turing machine, the Turing test, the Turing imitation game, the child machine learning through experience and the adult machine learning through imitation. Second, the Turing machine is important in the account of virtual embodiment since it presents the foundation on which AI and HCI research has developed to date. Here, Turing identified a number of qualities for man-machine transformation. This transformation should be based on, extracting "comparable circumstances" between human and machine, through having experience with machines. Turing also defined

intelligence as an “emotional concept” experienced through the effect of the machine, rather than the rules of its behaviour as mentioned in chapter six of this thesis. This definition of intelligence has been overlooked in scientific culture until recently, due to the change of approach to mind/body split as explained in the introduction.

7.2. Points for future phase

This research consists of an analytical study and philosophical or theoretical studies, focusing on the relationship between human and computer or machine embodiments. I think there are two future paths that might complete the circle of this research. The first one is an integrative phase where the analysis of applications could be based on a hybrid of interpretations and theories. The second path is using the analyses in this thesis to inform the design and evaluation of interactive applications or systems using virtual embodiment. Reasonably, this could be seen as a solution to some of the issues in chapter one. Currently, I am interested in following the latter path as a future phase of my research. This could be achieved through eliciting some points that address the shortcomings observed in chapter one of this thesis. Here are some of the characteristics deduced from these cases and the theoretical work underpinning them:

First, embodied perception is seen in the extended action or movement. Perception is the selection of images of interest and the reaction to them. It is influenced by the variation of images, distance between the perceiver and perceived, and time of reaction. The selection of images and actions is affected

by memory and affection. It might be explained, to a great extent, by a tendency towards movement and the extended action upon the object. Sensorimotor knowledge mediates between the perceiver and the environment. The perceiver knows that they can access the virtual information through some movement (e.g. head or eye movement). They have awareness and expectations of the changes that could take place, based on their movement or action and the objects movement. Perception is based on perspectival properties of the object, which are determined by the perceiver's location or vantage point.

Based on this, variation in participants ECA's movement coordination need to be rethought. Sensorimotor skills that participants exhibit during the interaction could be explored in relation to their perceptions. The same variations should be considered in designing ECA, not only in relation to its technical background, but also in relation to the participant and the outside environment.

Second, embodied affectivity stresses the inseparability between affection and perception. The selected and embodied action is not a perceptual indicator only, but is also an indicator of affection. Affectivity or sensations have a role in prefiguring the immediate future action. Embodied affection can be achieved through suggestibility and imitation. Affectivity could be explained through 'qualitative progression', which describes the gradual progress or alternation in intensities of affective states. This progress takes place on both physical and psychic levels. The degree of intensity of all the different affective states, such as muscular effort sensations, aesthetic affect, affective sensations and representative sensations, depends on two aspects that vary from one type of

affectivity to the other. The first aspect is the degree of power of the sensation that correlates to the number of the participating muscles and sensations. The second one is the degree of depth, which depends on the nature of the heterogeneous feelings, memories, ideas, and perceptions that participate in the affective state. As the progress proceeds by elements changing their nature and joining in, the subjective level and a difference in response from one person to the other is ensured. This ensures variation in the affective effect.

Embodied affectivity is important in modeling, designing and evaluating the interaction with ECA. Affectivity is not a new concept in HCI and affective computing has already made some progress (some examples are provided in chapter one). Muscle contraction and the degree of intensity of affects could be seen as measures for the embodied involvement with ECA. At the same time, the latter could be designed and modeled to extract certain emotional affects, ECA which can bring different combinations of affective states or alter perceptions.

Third, the evaluation can be captured through the process rather than the outcome. The process reveals the changes in embodied behaviors, actions, emotions and their intensity, that take place during the interaction. These changes show how the outcome is achieved rather than the outcome itself.

Fourth, becoming is a continuous process through which the relation between the human and computer is changed within an extended period. Becoming implies change in embodied behaviors, affectivity and perception and reveals

the formation of new relations, skills and abilities. It also reveals new requirements and developments.

Fifth, dynamic background and participational relationships could be seen as fields or applications, in which both human and machine interact and simultaneously participate. This implies information circulation between the two systems regarding a certain context or task.

8. Appendices

8.1. Appendix 1. Meta-analysis Keywords

8.1.1. Definitions

Publication bias: The tendency of researchers and editors to publish significant findings which bias the results of systematic reviews toward published research. It is usually represented by graphical aids such as the funnel plot of standard error by effect size. A symmetrical funnel indicates the absence of bias while an asymmetrical one indicates the opposite. The bias is detected using a number of methods such as 'Fail-safe N' analysis and the 'trim and fill' method.

'Fail-safe N' analysis: Detects the file drawer studies which could be available but unpublished because of their insignificant results. It computes the number of null studies to nullify the effect size.

'Trim and fill' method: Locates the missing studies and fills in the missing values on the right and left of the funnel plot based on the standard error and Hedges's g .

Chronological cumulative analysis: Cumulates the results chronologically by adding the sample of participants to the second study and aggregating the effect size. This increases the precision (p -value) of the effect size.

Sufficiency of studies: Examines the need for additional studies to establish the effectiveness of pedagogical agents on learning.

Stability of results: Examines the possibility that the addition of other studies might change the effect size aggregated.

Hedges's g: An inferential index that measures the magnitude of the effect based on the bias-corrected standardized mean difference. It is computed by using the square root of the mean square error from analysis of variance for the differences between two groups. The conventional interpretation is that an effect is small ≤ 0.20 , medium $=0.50$, or large ≥ 0.80 .

Fixed effect model: Estimates the 'true effect size' of the combined studies based on the assumption that the variation between effect sizes is because of within-study error and therefore assigns the highest weight to the study with the largest participants.

Random effect model: Estimates the mean effect size of the combined studies based on the assumption that the variation between effect sizes is because of within-study error and discrepancy between studies.

Binomial effect size display (BESD): A general purpose effect size display used to practically interpret the results based on the change in the success rate attributed to the treatment procedure.

Heterogeneity test: Focuses on measuring the variation between the effect sizes and studies. Significant p-value indicates that there are differences

between the effect sizes and rejects homogeneity. The observed dispersion is measured by Cochran's Q-value. If the Q-value is less than or equal to the degree of freedom (the number of studies minus one) then there is no evidence of difference between effect sizes or the difference is attributed to sampling error. In these cases the p-value is insignificant. However, if the Q-value exceeds the value of the degree of freedom and the p-value is significant, then the discrepancy between effects sizes reveals a real variation between studies.

Diagnostic regression/residuals: The analysis used to identify individual studies that could bias the results. The outlier study has a significant standardized residual.

Sensitivity analysis: The analysis demonstrates how the removal of one study could affect the effect size. It is used to determine the influential studies among the collected sample.

I-squared: An index to measure the variance between effect sizes. It is not affected by the number of studies. It has a range of zero to one hundred where the values of 25, 50 and 75 are perceived as low, moderate and high, respectively.

Tau-squared: An index of measuring between-study variance

8.1.2. Effect size calculations

Q-value

$$I^2 = \left(\frac{Q - df}{Q} \right) * 100$$

Weighted mean: The pooled average of the different sample sizes.

$$\bar{X} = \frac{\sum Xi}{N} \quad (Xi = \text{mean, } N = \text{number of sample sizes})$$

Pooled standard deviation

$$S_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - K}}$$

8.1.3. *Included studies*

1. Atkinson, R. K. (2002) 'Optimizing Learning From Examples Using Animated Pedagogical Agents.' *Journal of Educational Psychology* 94(2): 416–427 **(two studies)**.
2. Babu, S., Suma, E., Barnes, T. and Hodges, L. F. (2007) 'Can immersive virtual humans teach social conversational protocols?' Virtual Reality Conference. Charlotte, NC, 10-14 March. IEEE: 215–218 **(one study)**.
3. Baylor, A. L. (2002) 'Expanding preservice teachers' metacognitive awareness of instructional planning through pedagogical agents.' *Educational Technology Research & Development* 50(2): 5-22 **(one study)**.
4. Baylor, A. L. (2003) 'Effects of image and animation on agent persona. Does the presence of image and animation enhance pedagogical agent persona?' *Journal of Educational Computing Research* 28(4): 373–394 **(one study)**.
5. Beun, R.-J., de Vos, E. and Witteman, C. (2003) 'Embodied Conversational Agents: Effects on Memory Performance and Anthropomorphisation,' in Rist, T., Aylett, R., Ballin, D. and Rickel, J.

(eds) *Intelligent Virtual Agents* Lecture Notes in Computer Science 2792. Berlin / Heidelberg: Springer. 315-319 **(one study)**.

6. Choi, S. and Clark, R. E. (2006) 'Cognitive and affective benefits of animated pedagogical agents for learning English as a second language.' *Journal of Educational Computing Research* 34(4): 441–466 **(one study)**.
7. Conati, C. and Zhao, X. (2004) 'Building and evaluating an intelligent pedagogical agent to improve the effectiveness of an educational game,' in *Proceedings of the 9th international conference on Intelligent user interfaces*. Funchal, Madeira, Portugal: New York: ACM Press. 6-13 **(one study)**.
8. Craig, S., Gholson, B. and Driscoll, D. (2002) 'Animated pedagogical agents in multimedia educational environments: Effects of agent properties, picture features, and redundancy.' *Journal of Educational Psychology* 94(2): 428–434 **(one study)**.
9. Craig, S., Graesser, A., Sullins, J. and Gholson, B. (2004) 'Affect and learning: an exploratory look into the role of affect in learning with AutoTutor.' *Learning, Media and Technology* 29(3): 241-250 **(one study)**.
10. Dirkin, K. H., Mishra, P. and Altermatt, E. (2005) 'All or nothing: levels of sociability of a pedagogical software agent and its impact on student perceptions and learning.' *Journal of Educational Multimedia and Hypermedia* 14(2): 113-128 **(one study)**.
11. Duggan, M. H. and Adcock, A. B. (2007) 'Animated Agents Teaching Helping Skills in an Online Environment: A Pilot Study.' *Journal of Interactive Online Learning* 6(1). Online at <<http://www.ncolr.org/jiol/>> (consulted Spring 2007) **(one study)**.
12. Dunsworth, Q. and Atkinson, R. K. (2007) 'Fostering multimedia learning of science: Exploring the role of an animated agents image.' *Computers & Education* 49(3): 677–690 **(one study)**.
13. Holmes, J. (2007) 'Designing agents to support learning by explaining.' *Computers & Education* 48(4): 523-547 **(one study)**.
14. Hubal, R. C. and Day, R. S. (2006) 'Informed consent procedures: An experimental test using a virtual character in a dialog systems training application.' *Journal of Biomedical Informatics* 39(5): 532-540 **(one study)**.

15. Jackson, G. T., Ventura, M., Chewle, P. and Graesser, A. (2004) 'The Impact of Why/AutoTutor on Learning and Retention of Conceptual Physics,' in Lester, J. C., Vicari, R. M. and Paraguaçu, F. (eds) *Intelligent Tutoring Systems Lecture Notes in Computer Science 3220*. Berlin / Heidelberg: Springer-Verlag. 501–510 **(one study)**.
16. Mayer, R. E., Dow, G. T. and Mayer, S. (2003) 'Multimedia Learning in an Interactive Self-Explaining Environment: What Works in the Design of Agent-Based Microworlds?' *Journal of Educational Psychology December 95(4)*: 806-812 **(one study)**.
17. Mitrovic, A. and Suraweera, P. (2000) 'Evaluating an animated pedagogical agent in ' in Gauthier, G., Frasson, C. and VanLehn, K. (eds) *Intelligent tutoring systems Lecture Notes in Computer Science 1839*. Berlin / Heidelberg: Springer. 73-82. **(one study)**.
18. Moreno, R., Mayer, R. E., Spires, H. A. and Lester, J. C. (2001) 'The case for social agency in computer-based teaching: do students learn more deeply when they interact with animated pedagogical agents?' *Cognition and Instruction 19 (2)*: 177–213 **(four studies)**.
19. Moundridou, M. and Virvou, M. (2002) 'Evaluating the persona effect of an interface agent in a tutoring system.' *Journal of Computer Assisted Learning 18(3)*: 253-261 **(one study)**.
20. Robertson, J. and Good, J. (2003) 'Using a collaborative virtual role-play environment to foster characterisation in stories.' *Journal of Interactive Learning Research 14(1)*: 5-29 **(one study)**.
21. Silverman, B. G., Holmes, J., Kimmel, S., Branas, C., Ivins, D., Weaver, R. and Chen, Y. (2001) 'Modeling emotion and behavior in animated personas to facilitate human behavior change: The case of the HEART-SENSE game ' *Health Care Management Science 4(3; ABI/INFORM Global)*: 213-228 **(one study)**.
22. Van Vugt, H. C., Konijn, E. A., Hoorn, J. F., Keur, I. and Eliens, A. (2007) 'Realism is not all! User engagement with task-related interface characters.' *Interacting with Computers 19(2)*: 267-280 **(one study)**.
23. Xu, D. and Wang, H. (2006) 'Intelligent agent supported personalization for virtual learning environments.' *Decision Support Systems 42(2)*: 825-843 **(one study)**.

9. References

- Agamben, G. (1993) *The Coming Community*. Minneapolis: The university of Minnesota Press.
- Aleven, V. and Koedinger, K. (2002) 'An effective metacognitive strategy: learning by doing and explaining with a computer-based Cognitive Tutor.' *Cognitive Science*, 26(2), pp. 147-179.
- Aleven, V., Koedinger, K. R. and Cross, K. (1999) Tutoring Answer Explanation Fosters Learning with Understanding. In: *Proceedings of the 9th International Conference on Artificial Intelligence in Education, AIED '99*. Amsterdam, IOS Press, pp. 199 - 206.
- André, E., Müller, J., and Rist, T. (1996) The PPP persona: a multipurpose animated presentation agent. In: *Proceedings of the Workshop on Advanced Visual Interfaces* Gubbio, Italy, May 27 - 29. ACM Press New York, NY, USA pp. 245 - 247
- André, E., Rist, T. and Müller, J. (1998) 'WebPersona: a lifelike presentation agent for the World-Wide Web ' *Knowledge-Based Systems*, 11(1), pp. 25-36.
- Antle, A. N., Marshall, P. and Hoven, E. v. d. (2011) Embodied interaction: Theory and practice in HCI. In: *Workshop at the 29th ACM International Conference on Human Factors in Computing Systems*. Vancouver, Canada, 7-12 May Simon Fraser University.
- Arroyo, I., Woolf, B. P., Cooper, D., Burleson, W. and Muldner, K. (2011) 'The impact of animated pedagogical agents on girls' and boys' emotions, attitudes, behaviors and learning.' *11th IEEE International conference on Advanced Learning Technologies (ICALT)* Athens, GA, 6-8 July. Conference.
- Atkinson, R. K. (2002) 'Optimizing learning from examples using animated pedagogical agents.' *Journal of Educational Psychology* 94(2), pp. 416-427.
- Aylett, R., Louchart, S., Dias, J., Paiva, A., and Vala, M. (2005) FearNot! - An Experiment in Emergent Narrative. In: *Proceedings of the Fifth International Conference on Intelligent Virtual Agents*. Kos, Greece, pp. 305-316.
- Babu, S., Suma, E., Barnes, T. and Hodges, L. F. (2007) 'Can immersive virtual humans teach social conversational protocols?' *IEEE Virtual Reality Conference*. Charlotte, North Carolina, USA, March 10 - 14. IEEE, pp. 215-218.
- Bailenson JN, A. E., Beall AC, Guadagno RE, Dimov A, Blascovich J (2004) Comparing behavioral and self-report measures of embodied agents, social presence in immersive virtual environments. In: *proceedings of the 7th annual international workshop* Valencia, Spain PRESENCE, pp. 216-223.
- Bains, P. (2002) 'Subjectless subjectivities,' in Massumi, B. (ed.) *A shock to thought: expression after Deleuze and Guattari*. Routledge, pp. 101-116.

- Barker, L. J. (2003) 'Computer-assisted vocabulary acquisition: The CSLU vocabulary tutor in oral-deaf education.' *Journal of Deaf Studies and Deaf Education*, 8, pp. 187-198.
- Barsalou, L. W., Niedenthal, P. M., Barbey, A. K. and Ruppert, J. A. (2003) 'Social embodiment.' *The Psychology of Learning and Motivation*, 43, pp. 43-92.
- Baylor, A. (1999) 'Intelligent agents as cognitive tools for education' *Educational Technology*, 39(2), pp. 36-40
- Baylor, A. L. and Kim, Y. (2004) 'Pedagogical agent design: The role of agent realism, gender, ethnicity, and instructional role,' in Lester, J. C., Vicari, R. M. and Paraguaçu, F. (eds) *Intelligent Tutoring Systems Lecture Notes in Computer Science 3220*. Berlin / Heidelberg: Springer, pp. 592-603.
- Baylor, A. L., Rosenberg-Kima, R.B and Plant, E.A. (2006) 'Interface agents as social models: The impact of appearance on females' attitude toward engineering.' *Human factors in computing systems, CHI Montréal, Québec, Canada, April 22-27*. ACM, pp. 526-531.
- Ben Ammar, M., Neji, M. and Gouardères, G. (2006) Conversational embodied peer agents in affective e-learning In: *Workshop on motivational and affective issues. 8th International Conference on ITS*. Jhongli, Taiwan, June 26 -30. The university of Sussex, pp. 29-37.
- Benford, S., Bowers, J., Fahlén, L. E., Greenhalgh, C. and Snowdon, D. (1995) User embodiment in collaborative virtual environments. In: *CHI'95 Proceedings of the SIGCHI conference on Human factors in computing systems Denver, CO, USA, May 7*. ACM Press/Addison-Wesley Publishing Co., pp. 242-249.
- Benjamin, W. (1968) 'On some motifs in Baudelaire,' in Arendt, H. (ed.) *Illuminations*. New York: Schocken Books, pp. 155–200.
- Bergson, H. (1914) *Dreams*. New York: B.W. Huebsch.
- Bergson, H. (1950) *Time and Free Will: An Essay on the Immediate Data of Consciousness*. Edinburgh, UK: The Riverside Press.
- Bergson, H. (2004) *Matter and Memory*. Dover Publications Inc. .
- Beun, R.-J., de Vos, E. and Witteman, C. (2003) 'Embodied conversational agents: Effects on memory performance and anthropomorphisation,' in Rist, T., Aylett, R., Ballin, D. and Rickel, J. (eds) *Intelligent Virtual Agents Lecture Notes in Computer Science 2792*. Berlin / Heidelberg: Springer, pp. 315-319.
- Biswas, G., Leelawong, K., Schwartz, D. and Vye, N. (2005) 'Learning by teaching: A new agent paradigm for educational software.' *Applied Artificial Intelligence*, 19(3/4), pp. 363-392.
- Bogue, R. (2003) *Deleuze on Cinema*. New York and London: Routledge.
- Borenstein, M., Hedges, L. V., Higgins, J. P. T. and Rothstein, H. R. (2009) *Introduction to Meta-Analysis*. Sussex: Willey.
- Bosseler, A. and Massaro, D. W. (2003) 'Development and evaluation of a computer-animated tutor for vocabulary and language learning in children with autism.' *Journal of Autism and Developmental Disorders* 33 (6), pp. 653 - 672.

- Bowman, C. D. D. (2011) 'Student use of animated pedagogical agents in a middle school science inquiry program.' *British Journal of Educational Technology*, 43(3), pp. 359-375.
- Brahnam, S. and Angeli, A. D. (2008) 'Special issue on the abuse and misuse of social agents.' *Interacting with Computers*, 20(3), pp. 287-291.
- Brahnam, S. and Angeli, A. D. (2012) 'Gender affordances of conversational agents.' *Interacting with Computers*, 24(3), pp. 139-153.
- Brahnam, S., Karanikas, M. and Weaver, M. (2011) '(Un)dressing the interface: Exposing the foundational HCI metaphor "computer is woman".' *Interacting with Computers*, 23(5), pp. 401-412.
- Brooks, R. A. (1991) 'Intelligence without representation' *Artificial Intelligence* 47(1-3), pp. 139-159.
- Buchanan, I. (2008) 'Five theses of actually existing schizoanalysis of cinema,' in Buchanan, I. and MacCormack, P. (eds) *Deleuze and the schizoanalysis of cinema*. London and New York: Continuum, pp. 1-14.
- Burgoon, J. K., Bonito, J. A., Bengtsson, B., Cederberg, C., Lundeberg, M., and Allspach, L. (2000) 'Interactivity In human-computer interaction: A study of credibility, understanding, and influence.' *Computers in Human Behavior*, 16, pp. 553–574.
- Burleson, W. (2006) *Affective learning companions: strategies for empathetic agents with real-time multimodal affective sensing to foster meta-cognitive and meta-affective approaches to learning, motivation, and perseverance*. PhD Thesis. MIT.
- Cassell, J., Bickmore, T., Campbell, L., Vilhjálmsón, H. and Yan, H. (2001) 'More than just a pretty face: conversational protocols and the affordances of embodiment.' *Knowledge-Based Systems*, 14(1-2), pp. 55-64.
- Cassell, J., Bickmore, T., Campbell, L. and Vilhjálmsón, H. (2000) 'Human conversation as a system framework: Designing embodied conversational agents,' in Cassell, J., Sullivan, J., Prevost, S. and Churchill, E. (eds) *Embodied Conversational Agents*. Cambridge: The MIT Press, pp. 29-63.
- Chandler, P. and Sweller, J. (1991) 'Cognitive load theory and the format of instruction' *Cognition and Instruction*, 8(4), pp. 293-332.
- Chi, D., Costa, M., Zhao, L. and Badler, N. (2000) The EMOTE model for effort and shape. In: *Proceedings of the 27th annual conference on Computer graphics and interactive techniques* New York, NY, USA ACM Addison-Wesley, pp. 173–182.
- Choi, S. and Clark, R. E. (2006) 'Cognitive and affective benefits of animated pedagogical agents for learning English as a second language.' *Journal of Educational Computing Research*, 34(4), pp. 441-466.
- Chou, C.-Y., Chan, T.-W. and Lin, C.-J. (2003) 'Redefining the learning companion: the past, present, and future of educational agents.' *Computers and Education*, 40(3), pp. 255-269.
- Chou, C. Y., Chan, T. W. and Lin, C. J. (2002) 'An approach of implementing general learning companions for problem solving.' *IEEE Transactions on Knowledge and Data Engineering*, 14(6), pp. 1376-1386.

- Clark, R. E. and Choi, S. (2005) 'Five design principles for experiments on the effects of animated pedagogical agents.' *Journal of Educational Computing Research*, 32(3), pp. 209-225.
- Cohen, J. (1994) The earth is round ($p < .05$). In: *American Psychologist*. December 1994. by the American Psychological Association., Vol. 49, pp. 997-1003.
- Colebrook, C. (2002) *Gilles Deleuze*. London and New York: Routledge. Routledge critical thinkers.
- Colebrook, C. (2006) *Deleuze: A Guide for the Perplexed*. London and New York: Continuum
- Colman, F. (2011) *Deleuze and Cinema: The Film Concepts* (1st edn). Oxford-New York: Berg.
- Cooper, S., Dann, W. and Pausch, R. (2003) Teaching objects-first in introductory computer science. In: *Proceedings of the 34th SIGCSE technical symposium on computer science education*. New York, NY, USA, Jan. 2003. ACM, Vol. 35, pp. 191-195.
- Copeland, J. (ed.) (2004) *The Essential Turing: Seminal Writings in Computing, Logic, Philosophy, Artificial Intelligence, and Artificial Life: Plus The Secrets of Enigma*. Oxford: Clarendon Press.
- Coryn, C. L. S. and Hattie, J. A. (2006) The transdisciplinary model of evaluation. *Journal of MultiDisciplinary Evaluation* 3(4).
- Craig, S., Gholson, B. and Driscoll, D. (2002) 'Animated pedagogical agents in multimedia educational environments: Effects of agent properties, picture features, and redundancy.' *Journal of Educational Psychology*, 94(2), pp. 428-434.
- Craig, S., Graesser, A., Sullins, J. and Gholson, B. (2004) 'Affect and learning: an exploratory look into the role of affect in learning with AutoTutor.' *Learning, Media and Technology*, 29(3), pp. 241-250.
- Damasio, A. (1994) *Descartes' Error: Emotion, Reason, and the Human Brain*. New York: Avon Books.
- Daniel, L. G. (1998) 'Statistical significance testing: A historical overview of misuse and misinterpretation with implications for the editorial policies of educational journals.' *Research in the Schools*, 5(2), pp. 23-32.
- Darves, C. and Oviatt, S. (2004) 'Talking to digital fish: Designing effective conversational interfaces for Educational software,' in Ruttkay, Z. and Pelachaud, C. (eds) *From Brows to Trust*. the Netherlands: Kluwer Academic Publishers, pp. 271-292.
- De Carolis, B., Pizzutilo, S., Cozzolongo, G., Drozda, P. and Muci, F. (2006) 'Supporting students with a personal advisor.' *Educational Technology and Society*, 9(4), pp. 27-41.
- Dehn, D. M. and Van Mulken, S. (2000) 'The impact of animated interface agents: a review of empirical research.' *International Journal of Human-Computer Studies*, 52(1), pp. 1-22.
- Deleuze, G. (2004) *Difference and Repetition* (New Ed edn). London and New York: Continuum.
- Deleuze, G. (2005a) *Cinema 1: The Movement Image*. London and New York: Continuum.

- Deleuze, G. (2005b) *Cinema 2: The Time Image*. London and New York: Continuum.
- Deleuze, G. and Guattari, F. (2004) *A Thousand Plateaus: Capitalism and Schizophrenia*. London and New York: Continuum.
- Depraz, N. (2008) 'The rainbow of emotions: at the crossroads of neurobiology and phenomenology.' *Continental Philosophy Review*, 41(2), pp. 237-259
- Derks, D., Fischer, A. H. and Bos, A. E. R. (2008) 'The role of emotion in computer-mediated communication: A review.' *Computers in Human Behavior*, 24(3), pp. 766-785.
- Dirkin, K. H., Mishra, P. and Altermatt, E. (2005) 'All or nothing: levels of sociability of a pedagogical software agent and its impact on student perceptions and learning.' *Journal of Educational Multimedia and Hypermedia*, 14(2), pp. 113-128.
- Domagk, S. and Niegemann, H. M. (2005) The effect of pedagogical agents on student's motivation and the learning outcomes. In: *Proceedings of the 11th European Conference for Research on Learning and Instruction (EARLI)*. Nicosia, Cyprus: University of Cyprus., p. 200.
- Dostal, R. J. (2006) 'Time and phenomenology in Husserl and Heidegger,' in Guignon, C. B. (ed.) *The Cambridge Companion to Heidegger*. Cambridge: Cambridge University Press, pp. 120-148.
- Dourish, P. (2004) *Where the Action is: The Foundations of Embodied Interaction*. Cambridge: The MIT Press.
- Duval, S. and Tweedie, R. (2000) 'Trim and fill: a simple funnel-plot-based method of testing and adjusting for publication bias in meta-analysis.' *Biometrics*, pp. 455-463.
- Epstein, R. (2009) *The Quest for the Thinking Computer*. In Epstein, R., Roberts, G. and Beber, G. (eds) *Parsing the Turing Test: Philosophical and Methodological Issues in the Quest for the Thinking Computer*, pp. 3-12. Springer.
- Ertas, A., Maxwell, T., Rainey, V. P. and Tanik, M. M. (2003) 'Transformation of higher education: The transdisciplinary approach in engineering.' *IEEE Transactions on Education*, 46(2), pp. 289-295.
- Faraco, R. A., Rosatelli, M. C. and Gauthier, F. A. O. (2004) Adaptivity in a learning companion system. pp. 151-155.
- Feyzi-Behnagh, R. and Azevedo, R. (2012) 'The Effectiveness of a Pedagogical Agent's Immediate Feedback on Learners' Metacognitive Judgments during Learning with MetaTutor,' in Cerri, S., Clancey, W., Papadourakis, G. and Panourgia, K. (eds) *Lecture Notes in Computer Science, Intelligent Tutoring Systems 7315*. Springer Berlin / Heidelberg, pp. 651-652.
- Fiedler, A., Gabsdil, M. and Horacek, H. (2004) A tool for supporting progressive refinement of Wizard-of-Oz experiments in natural language. In: *Intelligent Tutoring Systems 2004*. Maceio, Alagoas, Brazil, August/September 2004. Springer, Vol. 3220, pp. 325-335.
- Franklin, S. and Graesser, A. (1997) Is it an Agent, or just a Program?: A Taxonomy for Autonomous Agents. In: *Proceedings of the intelligent*

- Agents III Agent Theories, Architectures, and Languages*. Budapest, Hungary, August 12-13. Springer-Verlag, Vol. 1193, pp. 21-35.
- Frasson, C., Mengelle, T., Aïmeur, E. and Gouardères, G. (1996) *An actor-based architecture for intelligent tutoring systems*. *Intelligent Tutoring Systems*, pp. 57-65.
- Friedrich, O. (1983) *Machine of the year: The computer moves In*. *Time* 121, pp. 1-13.
- Funtowicz, S. and Ravetz, J. (2008) 'Values and uncertainties,' in Hadorn, G. H., Hoffmann-Riem, H., Biber-Klemm, S., Grossenbacher-Mansuy, W. and Zemp, E. (eds) *Handbook of transdisciplinary research*. Springer Verlag, pp. 361-368.
- Gallagher, S. and Varela, F. (2001) 'Redrawing the map and resetting the time: Phenomenology and the cognitive sciences,' in Crowell, S., Embree, L. and Julian, S. J. (eds) *The Reach of Reflection: Issues for Phenomenology's Second Century*. Center for advanced research in Phenomenology, inc., pp. 93-132
- Genova, J. (1994) 'Turing's sexual guessing game.' *Social Epistemology*, 8(4), pp. 313-326.
- Gibbs, A. (2010) 'After Affect: Sympathy, Synchrony, and Mimetic Communication,' in Gregg, M. and Seigworth, G. J. (eds) *The Affect Theory Reader*. Durham & London: Duke University Press, pp. 186-205.
- Gilbert, J., Wilson, D.-M. and Gupta, P. (2005) 'Learning C with Adam.' *International Journal on E-Learning*, 4(3), pp. 337 - 350.
- Glass, G. V. (1976) 'Primary, secondary, and meta-analysis of research.' *Educational Researcher*, 5(10), pp. 3-8.
- Goldman, A. and de Vignemont, F. (2009) 'Is social cognition embodied?' *Trends in Cognitive Sciences*, 13(4), pp. 154-159.
- Goodman, B., Soller, A., Linton, F. and R., G. (1998) 'Encouraging student reflection and articulation using a learning companion.' *International Journal of Artificial Intelligence in Education*, 9, pp. 237-255.
- Graesser, A. C., Chipman, P., Haynes, B. C. and Olney, A. (2005) 'AutoTutor: An intelligent tutoring system with mixed-initiative dialogue.' *IEEE Transactions on Education*, 48(4), pp. 612 - 618.
- Guerlac, S. (2006) *Thinking in time: an introduction to Henri Bergson*. New York: Cornell University Press
- Gulz, A. (2005) 'Social enrichment by virtual characters - differential benefits.' *Journal of Computer Assisted Learning*, 21(6), pp. 405-418.
- Gulz, A. and Haake, M. (2006) 'Design of animated pedagogical agents--A look at their look.' *International Journal of Human-Computer Studies*, 64(4), pp. 322-339.
- Gulz, A., Haake, M., Silvervarg, A., Sjöden, B. and Veletsianos, G. (2011) 'Building a Social Conversational Pedagogical Agent: Design Challenges and Methodological approaches,' in Perez-Marin, D. and Pascual-Nieto, I. (eds) *Conversational Agents and Natural Language Interaction: Techniques and Effective Practices*. Hershey, PA: Information Science Reference - IGI Publishing, pp. 128-155.

- Hadorn, G. H., Hoffmann-Riem, H., Biber-Klemm, S., Grossenbacher-Mansuy, W. and Zemp, E. (eds) (2008) *Handbook of transdisciplinary research*. The Netherlands: Springer Verlag.
- Hall, L. W., S; Dautenhahn, K; Sobral, D; Paiva, A; Wolke, D. and Newall, L. (2004) Designing empathic agents: Adults vs Kids. In: *Intelligent Tutoring Systems , 7th International Conference, ITS*. LNCS 3220 Springer, pp. 604-613.
- Hansen, M. (2000) *Embodying technesis: Technology beyond writing*. Michigan: The university of Michigan press.
- Hansen, M. (2006a) *Bodies in code: Interfaces with digital media*. New York and London: Routledge.
- Hansen, M. (2006b) *New philosophy for new media*. Cambridge: The MIT Press
- Hansen, M. B. N. (2004a) 'Communication as Interface or Information Exchange? A Reply to Richard Rushton.' *Journal of Visual Culture*, 3(3), pp. 359-366.
- Hansen, M. B. N. (2004b) 'The time of affect, or bearing witness to life.' *Critical Inquiry*, 30(3), pp. 584-626
- Hansen, M. B. N. (2006c) 'Media theory.' *Theory, Culture and Society*, 23(2-3), pp. 296-306.
- Harp, S. F. and Mayer, R. E. (1998) 'How seductive details do their damage: A theory of cognitive interest in science learning.' *Journal of Educational Psychology*, 90(3), pp. 414-434.
- Hartmann, B., Mancini, M. and Pelachaud, C. (2005) 'Implementing expressive gesture synthesis for embodied conversational agents,' in Gibet, S., Courty, N. and Kamp, J.-F. (eds) *Gesture in human-computer interaction and simulation LNAI Lecture Notes in Computer Science 3881*. Berlin / Heidelberg: Springer, pp. 188-199.
- Hayles, N. K. (2008) *Electronic literature: new horizons for the literary*. Notre Dame, Indiana: University of Notre Dame press.
- Heffernan, N. T. and Koedinger, K. R. (2002) 'An intelligent tutoring system incorporating a model of an experienced human tutor,' in Cerri, S. A., Gouardères, G. and Paraguaçu, F. (eds) *Intelligent Tutoring Systems Lecture Notes in Computer Science 2363*. London: Springer-Verlag pp. 596-608.
- Heidegger, M. (1976) 'The Age of the World View.' *Boundary 2, Martin Heidegger and Literature*, 4(2), pp. 340-355.
- Heidegger, M. (1977) 'The age of the world picture,' in *The question concerning technology and other essays*. New York and London: Garland Publishing Inc., pp. 115-154.
- Hietala, P. and Niemirepo, T. (1998) 'The competence of learning companion agents.' *International Journal of Artificial Intelligence in Education*, 9, pp. 178-192.
- Hodges, A. (1997) *Turing, a natural philosopher*. London: Phoenix.
- Hodges, A. (2011) *Alan Turing*. The Stanford Encyclopedia of Philosophy. Available from <http://plato.stanford.edu/archives/sum2011/entries/turing> (Accessed 08 January 2012).

- Holmes, J. (2007) 'Designing agents to support learning by explaining.' *Computers and Education*, 48(4), pp. 523-547.
- Hopkins, J. F. and Fishwick, P. A. (2001) A three-dimensional human agent metaphor for modeling and simulation. In: *Proceedings of the IEEE*. Feb 2001. Vol. 89/2, pp. 131-147.
- Hubal, R. C. and Day, R. S. (2006) 'Informed consent procedures: An experimental test using a virtual character in a dialog systems training application.' *Journal of Biomedical Informatics*, 39(5), pp. 532-540.
- Hunter, J. E. and Schmidt, F. L. (1990) *Methods of meta-analysis: Correcting error and bias in research findings*. Sage Publications (Newbury Park).
- Hunter, J. E. and Schmidt, F. L. (2004) *Methods of meta-analysis: Correcting error and bias in research findings*. Newbury Park: Sage Publications, Inc.
- Jackson, J. (1994) 'Chronic pain and the tension between the body as subject and object,' in Csordas, T. J. (ed.) *Embodiment and Experience: The existential ground of culture and self*. Cambridge, UK: Cambridge University press, pp. 201-228.
- Jennings, N. and Wooldridge, M. (1996) 'Software agents.' *IEEE review*, 42(1), pp. 17-20.
- Jeung, H. J., Chandler, P. and Sweller, J. (1997) 'The role of visual indicators in dual sensory mode instruction.' *Educational Psychology*, 17(3), pp. 329-343.
- Johnson, W. L., Erin, S., Andrew, M. and Catherine, L. (2003) 'Evolution of user interaction: the case of agent adele.' *Proceedings of the 8th international conference on Intelligent user interfaces*. Miami, Florida, USA, ACM Press, p. 93-100.
- Johnson, W. L. and Rickel, J. W. (2000) 'Animated pedagogical agents: Face-to-Face interaction in interactive learning environments.' *International Journal of Artificial Intelligence in Education*, 11(July 1999), pp. 47-78.
- Ju, W., Nickell, S., Eng, K. and Nass, C. (2005) 'Influence of colearner agent behavior on learner performance and attitudes.' *CHI '05 extended abstracts on Human factors in computing systems*. Portland, OR, USA, ACM Press, p. 1509-1512.
- Kahn, K. (1996) 'ToonTalk--an animated programming environment for children.' *Journal of Visual Languages and Computing*, 7(2), pp. 197-217.
- Katayama, L. (2009) *Man marries videogame character in Japan (first-ever man/game wedding)*. [video online].
- Kehoe, C., Cassell, J., Goldman, S., Dai, J., Ian Gouldstone, I., MacLeod, S., O'Day, T., Pandolfo, A., Ryokai, K. and Wang, A. (2004) *Out of the Lab and into the World: Bringing Story Listening Systems to the Classroom*. In (AERA), A. E. R. A. (ed.) Annual Meeting, Poster Presented at AERA 2004.
- Kim, Y., Baylor, A. L. and Shen, E. (2007) 'Pedagogical agents as learning companions: The impact of agent emotion and gender.' *Journal of Computer Assisted Learning*, 23(3), pp. 220-234.

- Lambert, G. and Flaxman, G. (2000) 'Cinema and the Outside,' in Flaxman, G. (ed.) *The Brain is the Screen. Deleuze and the Philosophy of Cinema*. Minneapolis: The University of Minnesota Press pp. 253 - 292.
- Lassègue, J. (1996) 'What kind of Turing test did Turing have in mind?' *Tekhnema*, 3, pp. 37-58.
- Lassègue, J. (2009) 'Doing Justice to the Imitation Game; a farewell to formalism,' in Epstein, R., Roberts, G. and Beber, G. (eds) *Parsing the Turing Test: Philosophical and Methodological Issues in the Quest for the Thinking Computer*. Springer pp. 151-169.
- Laurel, B., Oren, T. and Don, A. (1990) Issues in multimedia interface design: media integration and interface agents. In: *Proceedings of the SIGCHI conference on Human factors in computing systems: Empowering people*. Seattle, Washington, US April 01-05. pp. 133-139.
- Lawlor, L. (2003) *The challenge of Bergsonism*. London and New York: Continuum.
- Lester, J. C., Converse, S., Stone, B. A., Kahler, S. and Barlow, T. (1997a) Animated pedagogical agents and problem-solving effectiveness: A large-scale empirical evaluation. In: *Proceedings of the Eighth World Conference on Artificial Intelligence in Education*. Kobe, Japan, 19-22 August IOS Press, pp. 23-30.
- Lester, J. C., Converse, S. A., Kahler, S. E., Barlow, S. T., Stone, B. A. and Bhogal, R. S. (1997b) 'The persona effect: affective impact of animated pedagogical agents.' *Proceedings of the SIGCHI conference on Human factors in computing systems*. Atlanta, Georgia, United States, March 22-27. ACM Press, p.359-366.
- Lester, J. C. and Stone, B. A. (1997) 'Increasing believability in animated pedagogical agents.' *Proceedings of the first international conference on Autonomous agents*. Marina del Rey, California, United States, 5 - 8 February. ACM Press, p. 16-21.
- Lester, J. C., Stone, B. A., O'Leary, M. A. and Stevenson, R. B. (1996) 'Focusing Problem Solving in Design-Centered Learning Environments,' in Frasson, C., Gauthier, G. and Lesgold, A. (eds) *Intelligent Tutoring Systems Lecture Notes in Computer Science 1086*. Berlin/Heidelberg: Springer, pp. 475-483.
- Lester, J. C., Stone, B. A. and Stelling, G. D. (1999a) 'Lifelike pedagogical agents for mixed-initiative problem solving in constructivist learning environments.' *User Modeling and User-Adapted Interaction*, 9(1-2), pp. 1-44.
- Lester, J. C., Voerman, J. L., Towns, S. G. and Callaway, C. B. (1999b) 'Deictic believability: coordinated gesture, locomotion, and speech in lifelike pedagogical agents.' *Applied Artificial Intelligence*, 13(4-5), pp. 383-414.
- Lester, J. C., Voerman, J. L., Towns, S. G., Callaway, C. B. and FitzGerald (2000) 'Deictic and Emotive Communication in Animated Pedagogical Agents,' in Cassell, J., Sullivan, J., Prevost, S. and Churchill, E. (eds) *Embodied Conversational Agents*. Cambridge: MIT Press, pp. 123-154.
- Lewis, M. D. (2005) 'Bridging emotion theory and neurobiology through dynamic systems modeling.' *Behavioral and Brain Sciences*, 28(02), pp. 169-194

- Licklider, J. C. R. (1960) 'Man-computer symbiosis.' *IRE Transactions on Human Factors in Electronics*, HFE-1(1), pp. 4-11.
- Link, K. E., Kreuz, R. J. and Graesser, A. C. (2001) 'Factors that influence the perception of feedback delivered by a pedagogical agent.' *International Journal of Speech Technology*, 4(2), pp. 145-153.
- Lipsey, M. W. and Wilson, D. B. (2001) *Practical meta-analysis*. Thousand Oaks, CA: Sage Publications, Inc. Applied Social Research Methods. 49.
- Machado, I., Prada, R. and Paiva, A. (2000) Bringing drama into a virtual stage. In: *In Proceedings of the Third international Conference on Collaborative Virtual Environments*. San Francisco, California, United States ACM, pp. 111-117.
- Mackenzie, A. (2006) *Transductions: bodies and machines at speed*. London and New York: Continuum.
- Manovich, L. (2001) *The language of new media*. Cambridge: The MIT press.
- Marks, J. (2005) 'Thought,' in Parr, A. (ed.) *The Deleuze dictionary*. Edinburgh: Edinburgh university press, pp. 278-280.
- Marsella, S. (2002) 'Pedagogical soap socially intelligent agents for interactive drama,' in Weiss, G. (ed.) *Socially Intelligent Agents Multiagent Systems, Artificial Societies and Simulated Organizations 3*. Springer Us, pp. 141-148.
- Marsella, S. C. (2003) 'Interactive Pedagogical Drama: Carmen's Bright IDEAS Assessed,' in *Intelligent Virtual Agents Lecture Notes in Computer science 2792*. Berlin/Heidelberg: Springer, pp. 1-4.
- Marshall, P., Rogers, Y. and Scaife, M. (2002) PUPPET: A Virtual Environment for Children to Act and Direct Interactive Narratives. In: *Proceedings of the Second International Workshop on Narrative and Interactive Learning Environments*. Edinburgh, Scotland, August 6 - 9. Interact Lab, pp. 8-15.
- Martin, J.-C., Niewiadomski, R., Devillers, L., Buisine, S. and Pelachaud, C. (2006) 'Multimodal complex emotions: Gesture expressivity and blended facial expressions.' *International Journal of Humanoid Robotics*, 3(Special issue "Achieving Human-Like Qualities in Interactive Virtual and Physical Humanoids"), pp. 269-291.
- Massumi, B. (2002) *Parables for the virtual: Movement, affect, sensation*. Durham and London: Duke University Press. Post-contemporary interventions.
- Massumi, B., Boever, A. D., Murray, A. and Roffe, J. (2009) Technical mentality" Revisited: Brian Massumi on Gilbert Simondon. *Parrhesia* 7. http://www.parrhesiajournal.org/parrhesia07/parrhesia07_massumi.pdf (consulted 25.05.2011).
- Maturana, H. (2002) 'Autopoiesis, structural coupling and cognition: a history of these and other notions in the biology of cognition.' *Cybernetics and Human Knowing*, 9(3-4), pp. 5-34.
- Max-Neef, M. A. (2005) 'Foundations of transdisciplinarity.' *Ecological Economics*, 53, pp. 5-16.
- Mayer, R. (2005) *Cambridge handbook of multimedia learning*. Cambridge, UK: Cambridge University Press.

- Mayer, R. E., Dow, G. T. and Mayer, S. (2003) 'Multimedia learning in an interactive self-explaining environment: What works in the design of agent-based microworlds?.' *Journal of Educational Psychology*, 95(4), pp. 806-812.
- Mayer, R. E. and Moreno, R. (1998) 'A split-attention effect in multimedia learning: Evidence for dual processing systems in working memory.' *Journal of Educational Psychology*, 90(2), pp. 312-320.
- McQuiggan, S., Lee, S. and Lester, J. (2006) Predicting User Physiological Response for Interactive Environments: An Inductive Approach. In: *Proceedings of the Second Conference on Artificial Intelligence and Interactive Entertainment*. Marina del Rey, California, American Association for Artificial Intelligence, pp. 60-65.
- Merleau-Ponty, M. (2002) *Phenomenology of perception*. London and New York: Routledge.
- Merrill, D. C., Reiser, B. J., Michael Ranney, M. R. and Trafton, J. G. (1992) 'Effective tutoring techniques: A comparison of human tutors and intelligent tutoring systems.' *The Journal of the Learning Sciences*, 2(3), pp. 277-30.
- Meyers, C. (2009) Japanese man takes video game character as wife. *Reuters [online]*.
- Michael, J., Rovick, A., Glass, M., Zhou, Y. and Evens, M. (2003) 'Learning from a computer tutor with natural language capabilities.' *Interactive Learning Environments*, 11(3), pp. 233 - 262.
- Mitrovic, A. and Suraweera, P. (2000) 'Evaluating an animated pedagogical agent in ' in Gauthier, G., Frasson, C. and VanLehn, K. (eds) *Intelligent tutoring systems Lecture Notes in Computer Science 1839*. Berlin / Heidelberg: Springer, pp. 73-82.
- Mohamad, Y., Hammer, S., Haverkamp, F., Nöker, M. and Tebarth, H. (2002) 'Evaluational Study: Training with Animated Pedagogical Agents.' *Proceedings 8th International Conference on Computer Helping People with Special Needs (ICCHP)*. Linz, Austria, July 15-20. Wien/Heidelberg: Springer, pp.117-124.
- Mohamad, Y., Velasco, C., Damm, S. and Tebarth, H. (2004) 'Cognitive Training with Animated Pedagogical Agents (TAPA) in Children with Learning Disabilities,' in Miesenberger, K., Klaus, J., Zagler, W. and Burger, D. (eds) *Computers Helping People with Special Needs Lecture Notes in Computer Science 3118*. Verlag Berlin Heidelberg: Springer, pp. 187-193.
- Montuori, A. (2008) 'Foreward: Transdisciplinarity,' in Nicolescu, B. (ed.) *Transdisciplinarity- Theory and practice*. Cresskill, USA: Hampton Press. Inc.
- Mørch, A. I. and Nævdal, J. E. B. (2004) 'Helping Users Customize Their Pedagogical Agents: Issues, Approaches and Examples,' in Negoita, M., Howlett, R. and Jain, L. (eds) *Knowledge-Based Intelligent Information and Engineering Systems Lecture Notes in Computer Science 3213*. Berlin / Heidelberg: Springer pp. 131-139.

- Moreno, R. and Flowerday, T. (2006) 'Students' choice of animated pedagogical agents in science learning: A test of the similarity-attraction hypothesis on gender and ethnicity.' *Contemporary Educational Psychology*, 31(2), pp. 186-207.
- Moreno, R. and Mayer, R. E. (1999) 'Cognitive principles of multimedia learning: The role of modality and contiguity.' *Journal of Educational Psychology*, 91(2), pp. 358-368.
- Moreno, R., Mayer, R. E. and Lester, J. C. (2000) Life-Like Pedagogical Agents in Constructivist Multimedia Environments: Cognitive Consequences of Their Interaction. In: *Proceedings of the World Conference on Educational Multimedia, Hypermedia, and Telecommunications (ED-MEDIA)*. Montreal, Charlottesville, 2000. AACE Press, pp. pp. 741-746.
- Moreno, R., Mayer, R. E., Spires, H. A. and Lester, J. C. (2001) 'The case for social agency in computer-based teaching: do students learn more deeply when they interact with animated pedagogical agents?' *Cognition and Instruction*, 19 (2), pp. 177–213.
- Moskal, B., Lurie, D. and Cooper, S. (2004) Evaluating the effectiveness of a new instructional approach. In: *Proceedings of the 35th SIGCSE technical symposium on computer science education*. New York, NY, USA, Mar. 2004. ACM, Vol. 36/1, pp. 75-79
- Mosteller, F. and Colditz, G. A. (1996) *Understanding research synthesis (meta-analysis)*. Annual Review of Public Health 17, pp. 1-23. Palo Alto, CA , USA: Annual Reviews.
- Moundridou, M. and Virvou, M. (2002) 'Evaluating the persona effect of an interface agent in a tutoring system.' *Journal of Computer Assisted Learning*, 18(3), pp. 253-261.
- Nakanishi, H., Shimizu, S. and Isbister, K. (2005) 'Sensitizing social agents for virtual training.' *Applied Artificial Intelligence*, 19(3), pp. 341 - 361.
- Nass, C. and Moon, Y. (2000) 'Machines and mindlessness: Social responses to computers.' *Journal of Social Issues*, 56(1), pp. 81-103.
- Nass, C., Moon, Y., Fogg, B. J., Reeves, B. and Dryer, D. C. (1995) 'Can computer personalities be human personalities?' *International Journal of Human-Computer Studies*, 43(2), pp. 223-239.
- Newman, M. H. A., Turing, A. M., Jefferson, S. G. and Braithwaite, R. B. (2004) 'Can Automatic Calculating Machines Be Said to Think?,' in Shieber, S. M. (ed.) *The Turing test: verbal behavior as the hallmark of intelligence*. MIT Press, pp. 117-132.
- Nicolescu, B. (1999) The transdisciplinary evolution of learning. In: *the symposium on Overcoming the Underdevelopment of Learning at the Annual Meeting of the American Educational Research Association*. Montreal, Canada, April 19-23.
- Nicolescu, B. (2002) *A New Vision of the World—Transdisciplinarity*. The design and delivery of inter-and pluri-disciplinary research, pp. 108-113. Denmark: The Danish Institute for Studies in Research and Research Policy.
- Nicolescu, B. (2005) 'Transdisciplinarity - Past, Present and Future.' *Paper presented at the Second World Congress of Transdisciplinarity: 'What*

- education for sustainable development? Attitude—research—action*. Vitória, Vila Velha, Brazil, September 6 - 12. CETRANS.
- Nicolescu, B. (2008a) 'The Idea of Levels of Reality,' in Weislogel, E. (ed.) *Science and Religion* Transdisciplinarity in Science and religion. Bucharest, Romania: Curtea Veche publishing house, pp. 11-25.
- Nicolescu, B. (2008b) 'In Vitro and in vivo knowledge-Methodology of transdisciplinarity,' in Nicolescu, B. (ed.) *Transdisciplinarity- Theory and practice*. Cresskill, USA: Hampton Press. Inc.
- Nicolescu, B. (2010) 'Methodology of transdisciplinarity--levels of Reality, logic of the included middle and complexity.' *Transdisciplinary Journal of Engineering and Science*, 1(1), pp. 19-38.
- Nicolescu, B. (ed.) (2008c) *Transdisciplinarity- Theory and practice*. Cresskill USA: Hampton Press. Inc.
- Niedenthal, P. M., Barsalou, L. W., Winkielman, P., Krauth-Gruber, S. and Ric, F. (2005) 'Embodiment in attitudes, social perception, and emotion.' *Personality and Social Psychology Review*, 9(3), pp. 184-211.
- Noë, A. (2004) *Action in perception*. Cambridge: The MIT Press. Representation and Mind.
- Noma, T., Zhao, L. and Badler, N. I. (2000) 'Design of a virtual human presenter' *Computer Graphics and Applications*, 20(4), pp. 79-85.
- Ohlsson, S. (1986) 'Some principles of intelligent instructional science.' *Instructional Science*, 14 (3-4), pp. 293- 326.
- Okonkwo, C. and Vassileva, J. (2001) 'Affective pedagogical agents and user persuasion,' in Stephanidis, C. (ed.) *Universal access in HCI: towards an information society for all3*. Mahwah, NJ, US: Lawrence Erlbaum Association, Inc., pp. 397-401.
- Oxford (2012). Oxford Dictionaries Online. Oxford: Oxford University Press.
- Paiva, A., Dias, J., Atilde, Sobral, D., Aylett, R., Woods, S., Hall, L. and Zoll, C. (2005) 'Learning by feeling: Evoking empathy with synthetic characters.' *Applied Artificial Intelligence*, 19(3), pp. 235-266.
- Paiva, A., Machado, I. and Prada, R. (2001) Heroes, villains, magicians, ...: dramatis personae in a virtual story creation environment. In: *In Proceedings of the 6th international conference on intelligent User interfaces* Santa Fe, New Mexico, USA, January, ACM Vol. 14 - 17, pp. 129-136.
- Papadopoulos, M. A. and Gkiazouris, I. (2007) 'A critical evaluation of meta-analyses in orthodontics.' *American Journal of Orthodontics and Dentofacial Orthopedics*, 131(5), pp. 589-599. e7.
- Payr, S. (2003) 'The virtual university's faculty: an overview of educational agents.' *Applied Artificial Intelligence*, 17(1), p. 1.
- Picard, R. (1995) *Affective computing*. Perceptual Computing Section technical report: 321. Cambridge: M.I.T Media Laboratory
- Picard, R. (1997) *Affective computing*. Cambridge, MA: MIT Press.
- Picard, R. (1999) *Affective computing for HCI*. In: *Proceedings of the 8th International Conference on Human-Computer Interaction*. Munich, Germany, August 22-26. Lawrence Erlbaum, pp. 829-833.

- Picard, R. (2003) 'Affective computing: Challenges.' *International Journal of Human-Computer Studies*, 59(1-2), pp. 55-64.
- Piccinini, G. (2001) 'Turing's rules for the imitation game.' *Minds and Machines*, 10, pp. 573-582.
- Poggi, I., Pelachaud, C., De Rosis, F., Carofiglio, V. and De Carolis, B. (2005) 'GRETA. A Believable Embodied Conversational Agent,' in Stock, O. and Zancarano, M. (eds) *Multimodal Intelligent Information Presentation Text, Speech and Language Technology*. The Netherlands: Kluwer Academic Publishers, pp. 3 - 25.
- Pohl, C. and Hadorn, G. H. (2007) *Principles for designing transdisciplinary research*. Germany: Oekom verlag.
- Prada, R., Paiva, A., Machado, I. and Gouveia, C. (2002) "You cannot use my broom! I'm the witch, you're the prince": Collaboration in a virtual dramatic game. In: *In proceedings 6th international conference on Intelligent Tutoring Systems*. Biarritz, France, Springer, Vol. 2363, pp. 913-922.
- Rasseneur, D., Delozanne, E., Jacoboni, P. and Grugeon, B. (2002) 'Learning with Virtual Agents: Competition and Cooperation in AMICO,' in Cerri, S., Gouardères, G. and Paraguaçu, F. (eds) *Intelligent Tutoring Systems Lecture Notes in Computer Science 2363*. Springer Berlin/Heidelberg, pp. 61-71.
- Raudenbush, S. W. (1994) 'Random effects models,' in Cooper, H. and Hedges, L. V. (eds) *The handbook of research synthesis*. New York: Sage, pp. 301-321.
- Reeves, B. and Nass, C. (1998) *The media equation: how people treat computers, television, and new media like real people and places*. Stanford, California: CSLI, Cambridge University Press.
- Rehm, M. and André, E. (2005a) Catch me if you can: exploring lying agents in social settings. In: *Proceedings of the fourth international joint conference on Autonomous agents and multiagent systems*. Utrecht, Netherlands, July 25-29. ACM, pp. 937-944.
- Rehm, M. and André, E. (2005b) Informing the design of embodied conversational agents by analyzing multimodal politeness behaviors in human-human communication. In: *Proceedings of the AISB Symposium for Conversational Informatics*. Citeseer, pp. 144-151.
- Robertson, B. C., H. Macleod, and P. Wiemer-Hastings (2004) 'Children's interactions with animated agents in an intelligent tutoring system.' *International Journal of Artificial Intelligence in Education*, 14, pp. 335-357.
- Robertson, J. and Good, J. (2003) 'Using a collaborative virtual role-play environment to foster characterisation in stories.' *Journal of Interactive Learning Research*, 14(1), pp. 5-29.
- Rodowick, D. N. (1997) *Gilles Deleuze's time machine*. Durham and London: Duke University Press

- Rosenthal, R. and DiMatteo, M. R. (2001) 'Meta-analysis: Recent developments in quantitative methods for literature reviews.' *Annual review of psychology*, 52(1), pp. 59-82.
- Roy, E. I. (1998 [2008]) *The New Philosophy: Henri Bergson*. Project Gutenberg.
- Rushton, R. (2004) 'Response to Mark B.N. Hansen's 'Affect as medium, or the "Digital-Facial-Image"'. ' *Journal of visual culture*, 3(3), pp. 353-357.
- Rushton, R. (2008) 'Passions and actions: Deleuze's cinematographic cogito.' *Deleuze Studies*, 2(2), pp. 121-139.
- Rushton, R. (2009) 'Deleuzian spectatorship.' *Screen*, 50(1), pp. 45-53.
- Russell, S. J. and Norvig, P. (1995) *Artificial intelligence: a modern approach*. Englewood Cliffs, NJ: Prentice hall
- Ryokai, K., Vaucelle, C. and Cassell, J. (2003) 'Virtual peers as partners in storytelling and literacy learning.' *Journal of Computer Assisted Learning*, 19(2), pp. 195-208.
- Saygin, A., Cicekli, I. and Akman, V. (2000) 'Turing Test: 50 years later,' in *Minds and machines* 10. The Netherlands: Kluwer Publishers, pp. 463-518.
- Scriven, M. (2008) 'The Concept of a transdiscipline: And of evaluation as a transdiscipline.' *Journal of MultiDisciplinary Evaluation*, 5(10), pp. 65-66.
- Selker, T. (1994) 'COACH: a teaching agent that learns.' *Communications of the ACM*, 37(7), pp. 92-99.
- Shah, H. and Warwick, K. (2009) 'Emotion in the Turing Test: A downward trend for machines in recent Loebner Prizes,' in Vallverdú, J. and Casacuberta, D. (eds) *Handbook of research on synthetic emotions and sociable robotics: New applications in affective computing and artificial intelligence*. Hershey, PA, USA: Information Science Reference, pp. 325-349.
- Shieber, S. M. (ed.) (2004) *The Turing test: verbal behavior as the hallmark of intelligence*. Cambridge: The MIT Press
- Shields, R. (2005) *The Virtual* London and New York: Routledge.
- Shields, R. (2006) 'Virtualities.' *Theory, Culture & Society*, 23(2-3), pp. 284-286.
- Shneiderman, B., Plaisant, C., Cohen, M. and Jacobs, S. (2009) *Designing the User Interface: Strategies for Effective Human-Computer Interaction*. Addison-Wesley: Pearson Education.
- Silverman, B. G., Holmes, J., Kimmel, S., Branas, C., Ivins, D., Weaver, R. and Chen, Y. (2001) 'Modeling emotion and behavior in animated personas to facilitate human behavior change: The case of the HEART-SENSE game ' *Health Care Management Science*, 4(3; ABI/INFORM Global), pp. 213-228.
- Simondon, G. (1980 [1958]) *On the mode of existence of technical objects*. London: University of Western Ontario
- Simondon, G. (1992) 'The genesis of the individual ' in Crary, J. and Kwinter, S. (eds) *Incorporations (Zone 6)*. Zone Books, pp. 297-319.
- Simondon, G. (2009) Technical Mentality. *Parrhesia* 7. http://www.parrhesiajournal.org/parrhesia07/parrhesia07_simondon2.pdf (consulted 25.05.2011).

- Sklar, E. and Richards, D. (2006) The use of agents in human learning systems. In: *Proceedings of the fifth international joint conference on Autonomous agents and multiagent systems*. Hakodate, Japan, May 8 - 12. ACM Press, pp. 767-774.
- Smith, D. C., Cypher, A. and Spohrer, J. (1994) *KidSim: programming agents without a programming language*. Communications of the ACM 37, pp. 54-67
- Snow, C. P. (1990) 'The Two Cultures.' *Leonardo, New Foundations: Classroom Lessons in Art/Science/Technology for the 1990s*, 23(2/3), pp. 169-173.
- Sproull, L., Subramani, M., Kiesler, S., Walker, J. H. and Waters, K. (1996) 'When the interface is a face.' *Human-Computer Interaction*, 11(2), pp. 97-124.
- Stagoll, C. (2005) 'Concepts,' in Parr, A. (ed.) *The Deleuze dictionary*. New York: Columbia University Press, pp. 50-51.
- Stanley, T. D. (2001) 'Wheat from chaff: Meta-analysis as quantitative literature review.' *The Journal of Economic Perspectives*, 15(3), pp. 131-150.
- Stern, D. N. (1998) *The interpersonal world of the infant*. London: Karnac Books.
- Sterrett, S. G. (2003) 'Turing's two tests for intelligence,' in Moor, J. (ed.) *The Turing test: the elusive standard of artificial intelligence* Netherlands: Kluwer Academic Publisher, pp. 79-98.
- Sugrue, C. (1997) *Complexities of teaching: Child-centred perspectives*. London, UK: The Falmer Press. New prospects 5.
- Thrift, N. (2007) *Non-representational theory: space, politics, affect*. Oxon and New York: Taylor & Francis.
- Tonner, P. (2009) 'The Return of the Relative: Hamilton, Bergson, Merleau-Ponty and French Phenomenology.' *Trivium Publications Pittsburgh, PA*, 11(1 & 2), pp. 307-318.
- Toscano, A. (2007) *Technical Culture and the Limits of Interaction: A Note on Simondon*. In Brouwer, J. and Mulder, A. (eds) *Interact or Die!*, pp. 198-205. Rotterdam: NAI.
- Turing, A. (2004a) 'Can Digital Computers Think?,' in Copeland, J. (ed.) *The Essential Turing: Seminal Writings in Computing, Logic, Philosophy, Artificial Intelligence, and Artificial Life: Plus The Secrets of Enigma*. Oxford: Clarendon Press, pp. 482-486.
- Turing, A. (2004b) 'Intelligent Machinery, A Heretical Theory,' in Copeland, J. (ed.) *The Essential Turing: Seminal Writings in Computing, Logic, Philosophy, Artificial Intelligence, and Artificial Life: Plus The Secrets of Enigma*. Oxford: Clarendon Press, pp. 472-475.
- Turing, A. (2004c) 'Intelligent Machinery,' in Copeland, J. (ed.) *The Essential Turing: Seminal Writings in Computing, Logic, Philosophy, Artificial Intelligence, and Artificial Life: Plus The Secrets of Enigma*. Oxford: Clarendon Press, pp. 410-432.
- Turing, A. (2004d) 'Lecture on the Automatic Computing Engine (1947),' in Copeland, J. (ed.) *The Essential Turing: Seminal Writings in Computing,*

- Logic, Philosophy, Artificial Intelligence, and Artificial Life: Plus The Secrets of Enigma*. Oxford: Clarendon Press, pp. 378-394.
- Turing, A. M. (1950) 'Computing Machinery and Intelligence.' *Mind*, 59, pp. 433-460.
- Turing, A. M. (2004e) 'Can Digital Computers Think? ,' in Shieber, S. M. (ed.) *The Turing test: verbal behavior as the hallmark of intelligence*. MIT Press, pp. 111-116.
- Turing, A. M. (2004f) 'Intelligent Machinery, A Heretical Theory,' in Shieber, S. M. (ed.) *The Turing test: verbal behavior as the hallmark of intelligence*. MIT Press, pp. 105-110.
- Van Mulken, S., André, E. and Müller, J. (1998) The persona effect: how substantial is it? In: *People and Computers XIII: Proceedings of HCI'98*. Berlin, Germany, Springer, pp. 53-66.
- Varela, F. J. (1995) 'The reenactment of the concrete.' *The Artificial Life Route to Artificial Intelligence*, pp. 320-338.
- Varela, F. J. (2000) *The Specious Present: A Neurophenomenology of Time Consciousness*. Stanford University Press. Available from http://www.franzreichle.ch/images/Francisco_Varela/Human_Consciousness_Article02.htm (Accessed 07/01/2010).
- Varela, F. J. and Depraz, N. (2005) 'At the source of time: valence and the constitutional dynamics of affect: The question, the background: How affect originally shapes time.' *Journal of Consciousness Studies*, 12, pp. 61-81.
- Varela, F. J., Thompson, E. and Rosch, E. (1992) *The embodied mind: Cognitive science and human experience*. Cambridge: The MIT Press.
- Veletsianos, G. (2012) 'How do learners respond to pedagogical agents that deliver social-oriented non-task messages? Impact on student learning, perceptions, and experiences.' *Computers in Human Behavior*, 28(1), pp. 275-283.
- Veletsianos, G., Scharber, C. and Doering, A. (2008) 'When sex, drugs, and violence enter the classroom: Conversations between adolescents and a female pedagogical agent.' *Interacting with Computers*, 20(3), pp. 292-301.
- Wang, H., Chignell, M. and Ishizuka, M. (2006) Empathic tutoring software agents using real-time eye tracking. In: *Proceedings of the 2006 symposium on Eye tracking research & applications*. San Diego, California, March 26 - 29. ACM Press, pp. 73-78.
- Wang, H., Yang, J., Chignell, M. and Ishizuka, M. (2007) 'Character Agents in E-Learning Interface Using Multimodal Real-Time Interaction,' in *Human-Computer Interaction. HCI Intelligent Multimodal Interaction Environments* Lecture Notes in Computer science. Berlin/Heidelberg: Springer, pp. 225-231.
- Waters, K. A. (1987) Muscle model for animation three-dimensional facial expression. In: *Proceedings of the 14th annual conference on Computer graphics and interactive techniques*. July 1987. ACM SIGGRAPH Vol. 21, pp. 17-24

- Wilson, E. (2011) *New APPS interview: Elizabeth Wilson*. <http://www.newappsblog.com/2011/05/new-apps-interview-elizabeth-wilson.html>: APPS: Art, Politics, Philosophy, and Science
- Wilson, E. A. (2004) 'Imaginable computers: Affects and intelligence in Alan Turing,' in Tofts, D., Jonson, A. and Cavallaro, A. (eds) *Prefiguring cyberspace: an intellectual history*. The MIT Press, pp. 30-51.
- Wilson, E. A. (2008) 'Affect, artificial intelligence, and internal space.' *Emotion, Space and Society*, 1(1), pp. 22-27.
- Wilson, M. (2002) 'Six views of embodied cognition.' *Psychonomic Bulletin & Review*, 9(4), pp. 625-636.
- Wolf, F. M. (1986) *Meta-analysis: Quantitative methods for research synthesis*. Beverly Hills, CA: Sage Publications, Inc.
- Wonisch, D. and Cooper, G. (2002) Interface Agents: preferred appearance characteristics based upon context. In: *Virtual conversational characters, Application, methods and research challenges in conjunction with HF2002 and OZCHI2002*. Melbourne, Australia, November 2002.
- Woods, S., Hall, L., Dautenhahn, K. and Wolke, D. (2007) 'Implications of gender differences for the development of animated characters for the study of bullying behavior.' *Computers in Human Behavior*, 23(1), pp. 770-786.
- Woods, S., Hall, L., Sobral, D., Dautenhahn, K. and Wolke, D. (2003) 'Animated Characters in Bullying Intervention,' in *Intelligent Virtual Agents Lecture Notes in Computer Science 2792*. Berlin/Heidelberg: Springer, pp. 310-314.
- Yee, N., Bailenson, J. N. and Rickertsen, K. (2007) A Meta-Analysis of the Impact of the Inclusion and Realism of Human-Like Faces on User Experiences in Interfaces. In: *CHI 2007 Proceedings. Faces & Bodies in Interaction*. San Jose, CA, USA, April 28-May 3, 2007. pp. 1-10.
- Ziemke, T. (2003) What's that thing called embodiment? In: *Proceedings of the 25th Annual Meeting of the Cognitive Science Society*. Boston, Massachusetts, USA, 31 July - 2 August. Lawrence Erlbaum, pp. 1305-1310.
-

10. Notes

1 The scientific aim of developing the homologous technology and the artist's usage of the developed technology should be noted.

2 Wilson has investigated six approaches of embodied cognition. (1) cognition is situated; (2) cognition is time-pressured; (3) we off-load cognitive work onto the environment; (4) the environment is part of the cognitive system; (5) cognition is for action; (6) offline cognition is body based. Only the last one, which has received less attention in cognitive sciences, focuses on the role of the body.

3 This research was the foundation for almost all design and research in ECA studies from different fields, tending to verify, maximize or apply embodiment to acquire the persona effect.

4 My emphasis.

5 Oxford Online Dictionaries: <http://oxforddictionaries.com/definition/english/auto->(accessed 3rd December 3, 2012)

6 Line of flight here is seen as a line that passes through heterogeneous systems drawing them a part.

7 Emphasized in source.

8 Nicolescu differentiates transdisciplinary from multidisciplinary (which is disciplinary goal-oriented while researching the topic from different perspectives), and interdisciplinary (which is concerned with method transfer; the Meta-analysis study in this research is an example of interdisciplinary because it uses a research method usually applied in medical contexts in HCI field).

9 Nicolescu uses capital 'R' to emphasize the pragmatic and ontological meaning of Reality as 'resistance' to accentuate its relational view.

10 Nicolescu's transdisciplinary approach share similar foundations with Gilbert Simondon's approach of individuation or transindividual. However, there is not enough space in this thesis to explore this relation between the two.

11 If "the faith in truth and objectivity of science ... is overthrown" (Funtowicz and Ravetz 2008, p.364) because science cannot be separated from the researcher's subjectivity, it is because science attempts to be 'performative', a performance without a performer, where authentic scientists, more than any other people, realize that this is an 'illusion'. Citations by authors' names refer exactly to this point; that is, to the researcher's researching for knowledge rather than universal facts discovered by someone thinking in a certain way. On the other hand, it might be that the research culture can no longer be separated from the culture where the human being is 'transformed into a commercial object' and thus researchers become the 'doers' of research rather than researchers of knowledge.

12 Two meta-analyses – one from communication studies and another for PA – were published after starting this research which find small effect sizes but neither of them identified the reasons for the continually contradictory studies.

13 The search was refined by 2009 but no more studies were identified.

14 For example the same material was used with two distinct age groups of learners (Moreno 2001).

15 It is an odd task in itself to set a theory by principally aiming at reversing someone else work, i.e. Deleuze's work of Bergson. This celebrated 'reversing' of Bergson clearly overturns Deleuze, who championed the work of Bergson, as Guerlac has termed it, as the "object of so many hatreds" instead of Bergson.

16 This argument could be extended to our previous case study by asserting the focus on the embodied image effect and the disregard for the participant's embodiment suggests that affectivity and perception are located in the image qualities and are unsupported by the participant's body.

17 An interview with Deleuze on A Thousand Plateaus and assemblages is posted on October 8, 2009 at laval subjects blog, <http://larvalsubjects.wordpress.com/2009/10/08/deleuze-on-assemblages>.

18 Hansen, M. B.N. (2006) *New Philosophy for New Media*. Cambridge: The MIT Press.

19 A concept related to Deleuze's conceptualization of the cinema as having a real vocation by raising the action-thought to the supreme power of "monism" (2005b, p.156).

20 It seems that as HCI argues for the 'newness' of the virtual embodiment, Hansen argues for the 'newness' of the participant's embodiment. It might actually be that this debate is not of much relevance to Hansen, himself, as much to the 'newness' or let us say the 'illusion of the newness' that seems to possess both the science and art research cultures. The newness is conceived as an objective to be achieved or an outcome to be measured, rather than an effect of development or becoming. Yet, we come to realize that the newness, if available, is reaped less and, therefore, we become 'old wine in new bottles'; but with mass publication, mass media and mass disciplines, beside our advancement and caution with our environment, we are in the age of 'new recycled bottles'. This understanding of the newness-driven culture appropriates Hansen's assertion that the comparison evaluating today's situation, between the cinema and computer, such as that presented by Manovich, regardless of their "correctness", could lead us to "divorce our theorizing of new media (and particularly our understanding of new media art) from the empirical givens of today's most prevalent new media forms and conventions" (2006b, p.35). This announcement, however, renders paradoxical Hansen's interest in comparing and negatively criticizing different media theorists and Gilles Deleuze in particular. Simply, common sense informs us that the 'correct' comparison could not lead to divorce our understanding of the new relations but the inverse, that such understanding will enhance our theorizations and appropriates them that we might decide to divorce some of our old relations; except the 'correctness' will deprive the new relations from the glorious effect associated with newness. We are looking for novelty, and we know that the 'new' is never wholly novel. Specifically, if we consider the human being, the image and their relating nature we might find that it is a matter of difference, adjustment, adaptation, variation and creativeness rather than newness. This lends us to rephrase Hansen's assertion. Even the "fact that HCI extends the sway of immobility must" actually NOT "be seen as occasion for criticism of the cinematic heritage of new media" but rather an opportunity for the "exploration of unheeded or unprecedented alternatives" (Hansen 2006b, p.35). That is simply because we would not be able to identify these as 'alternatives' in the first place in order to entitle them as 'unheeded or unprecedented', which brings us to appreciate the significance of understanding the repetition and the difference between the heritage, the inherited and the new in terms of the body, technology, art and science, in themselves, and the interdynamic interaction between them. On the other hand, criticizing the cinematic heritage will only limit our evaluation of the alternatives to negativities and oppositions instead of following a developmental perspective. What we observe is no longer a cinema and a computer, art and science – although these should not have been observed as distinct from the very beginning – but a constitutive change tending towards maximal interlacing between them. If we cannot historicize media independently from the evolution of the human, as Hansen has pointed out (2006a), we also cannot historicize it independently from its philosophy and thinkers, and for sure, we certainly cannot build new philosophy solely on negative criticism. Indeed, this sounds as if new civilizations cannot emerge except on the complete destruction of old civilizations and their heritage; that each time we have to begin from emptiness and wait to end in emptiness.

21 This is in reference to his analysis of cultural critic Robert Markley's work 'Virtual Realities and Their Discontents.' (Hansen 2000, p.53).

22 My emphasis.

23 This is from Benjamin, *On some motifs in Baudelaire* (1968).

24 Transduction is a Simondonian term referring to a process of individuation where an activity extends itself in all directions. As a process of becoming, each layer reaches a stage of amplifying and condensing to form the basis for the next layer. In the introduction to my research methodology, this forms the phase transition.

25 It might also be said that the technology, for Hansen, is the other emphasising his concept of 'otherness'. In other words, Hansen perceives and feels (as his model is based on phenomenological

experience) that the technology is the other's body and to this other's body he brings what he identifies the woman's body with. It is not the female body that is technological because this is the type of technesis Hansen is against since his model calls for taking advantage of what is given rather than going beyond that to theoretical or scientific reductive models that would not fit even if embodiment is addressed. Indeed, if there is transformation from the female body to technology then this is, at least for Hansen, should be seen to enhance the technological Other without 'reducing' it to a different entity as Hansen's account informs us that he is against such reductions. But, do not we always start from that which we are familiar with? It is fair enough to say that the going beyond that which is familiar remains questionable in Hansen's account.

26 Emphasized in source.

27 This is not to say that a methodology or procedure cannot be deduced from philosophical thought. It is a matter of synthesis or analysis. Synthesis appears when for example a number of frames are designed, keyframed and added to a timeline where a transition between them is selected so the movement looks natural and the effect is achieved. On the other hand, an analysis that starts from the product might actually emphasize that which does not look natural as part of the whole effect.

28 Bergson, *Matter and Memory*, The choice of images (2004, pp.26–27).

29 This an important point in relation to the previous chapter because a representation is not constitutive of the body. This point has been overlapped in designing and evaluating PA as pointed previously. Two programmes using AI technology and those using a mere animation technique could present the same image but one has an intelligent-model underline the representation, the other one is merely representational.

30 Being-becoming is an ontological perspective while becoming-being is ontogenesis perspective (individuation).

31 Emphasized in source.

32 Deleuze asserts, "the essence of the cinematographic movement image lies in extracting from vehicles or moving bodies the movement which is their common substance, or extracting from movements the mobility which is their essence" (2005a, p.24). Extraction, here, does not mean that it tears or separates movement or mobility away from its object but making these as qualities of power by intensifying them or suppressing other parts of the object.

33 This is related to the work of Bresson (2005a, p.112).

34 The name is spelt as Jorge Iven in Deleuze (2005a, p.113).

35 Deleuze pointed out that "the naturalist time seems to be under an inseparable curse ... It is therefore inseparable from an entropy, a degradation" (2005a, p.131).

36 King Midas is a fairytale based on a Greek mythology. Midas was so possessed by his desire for gold that he wished that everything he touched would become gold. His wish was answered as he was asked to choose between the golden touch and love. Midas chose the golden touch. Gradually, his happiness started to disappear as he realized that he could not enjoy touching anything anymore. Midas learned that the golden touch was nothing but a curse when he touched his own daughter and turned her into gold. Midas regretted his wish and wished to get rid of the golden touch. His wish was answered.

37 Bergson also uses 'living body' and 'living matter' to refer to the physical body apart from the brain.

38 It is important to note here that perception does not subtract from the image what interests it but isolates it by suppression, where some other influences become unconsciously isolated and others might not be perceived as they might not be in the being's space.

39 In his essay about dreams these take the form of outlines regulated by memory.

40 'Prolong' is used in translated text of *Matter and Memory* which could mean 'extend.' It could be a matter of translation or there might be a qualitative difference between the two words where 'prolong' could imply that the continuity in the process is presupposed.

41 As referred to by Bergson (2004, p.25).

42 Actual perception as measured by the degree of utility (2004, p.71).

43 Subjective perception is distinguished by simple subtraction (Deleuze 2005a, p.66).

44 A structural coupling is based on the living system's interaction with those changes in the environment or medium that only keeps the maintenance of its autopoietic organization (the composite unity or totality). That is, it appears to know how to live while conserving its internal autopoietic relations and its adaptation with the medium it exists in (Maturana 2002, p.17), yet it is blind to the consequences rising from its interaction with other molecules (Maturana 2002, p.8). A 'structural coupling' is formed, where certain structures (components and the relations between them) of its organization are selected, leading to the triggering of a determined structural change in the organization. Although it forms a recursive spontaneous and congruent relation with the medium to re-establish itself – thus conserving the autopoietic organization – destruction or disintegration could occur in the absence of these conditions. In effect, within the autopoietic system the conserved organization conserves the virtual organization for the organism and, at the same time, relegates evolution and reproduction to historical networks of self-interest interactions that cause structural change but maintain and protect the physical boundaries of the organization.

45 This challenges Bergson's and Deleuze's image ontology (2006b, p.174). But what becomes a core issue here is where the creation process itself is not fundamentally impured by affection and memory; learning.

46 In *The Embodied Mind* Varela and the co-authors (1992) base some of their notions regarding mind/body unity, consciousness, "mindfulness/awareness", "groundlessness" and "own-being" on the Buddhist tradition: Madhyamika or "middle way". These are transferred in Hansen's account of new media.

47 What Hansen conceives as deterritorialization of Bergson is rather reterritorialization of phenomenology.

48 It could be wondered whether Hansen has taken notice of this reversal effect of his analysis or not. While the touch, here, changes any-whatever into a valuable materiality that is gold, it strips the life out of it turning it into a non-living matter. It could be presumed that this turning from living to non-living does not matter for the subject. However, with the touch the subject also turns all the qualities and effects into one quality that is the effect of gold. Consequently, two movements appear. Firstly, the body loses its interest in its surroundings and secondly, it loses its interest in the golden touch. That is because it develops into a learned cause-effect pattern that communicates the same effect.

49 This move, as Hansen explains, marks the "passage from interactivity to dynamics" (Hansen 2006b, p.167) related to the difference Depraz noted between the phenomenological (Husserl, Paarung) and the Chilean school of autopoietic (acoplamiento) experiential-conceptual structures (Depraz 2008, pp.239–240).

50 Emphasized in the source.

51 Emphasized in the source.

52 In opposition to the previous account, that absolute survey does not need a supplementary dimension; Hansen views VR as a technical supplementation to the absolute survey.

53 What Hansen means by "absolute subjectivity" or what makes this subjectivity "absolute" is unclear – whether it is the primary consciousness, "subjectless" subjectivity or the primary and secondary consciousness as an absolute unit, a whole. In relation to VR, Hansen explains that it "mediates an absolute survey of nothing other than the space of the body itself – that paradoxical being which is neither object nor absolute subjectivity" (2006b, p.177). By the end of the chapter, however, Hansen insists that VR facilitates "a technical expansion of the (human) domain of absolute subjectivity and of the (human) capacity for affective self-intuition" (2006b, p.196).

54 Rowlands (2006) has criticized the 'sensorimotor knowledge' as actually being ambiguous and that instead of placing representation within the visual, it is placed in this 'knowledge'. This is an argument I

agree with as I do experience similar difficulty with this concept, which Noë seems to take pains to explain in precise terms without falling into Rowlands's representational grip due to Noë using – as Rowlands points out – descriptions such as perceivers' "expectation", "knowledge" and "awareness", which raises the question about the form of this knowledge and these expectations. However, Rowlands dismisses the idea of the 'virtual' representation and action which forms the main theme of his book: perception as 'virtual' action. Noë avoids the relevance of time, memory and habit in establishing the sensorimotor knowledge which he argues not to be propositional. I think what Noë is trying to envisage here is a position closer to Bergson's work on memory and motor habit, where the latter is perceived as acted or lived and draws on automatic reactions.

55 It should be noted that Bergson has already considered how the environment might actually affect the sleeper and the content of the dream such as the sleeping statues and dreaming of floating or flying.

56 This might even result in what Noë calls change or "inattentional blindness", where the viewer focusing on certain details might fail to notice the change or other details brought into the image (2004, p.51).

57 Here. Deleuze focuses on a kind of division between the camera's and character's (the viewer could be identified with the character from a similar point of view) perspectives seen in Pasolini's thesis elaborating on Bakhtin's linguistic forms as the 'free indirect discourse' which is of two subjects (reporter and reported). Pasolini takes that as a matter of style, where the character sees the world in a certain way and the camera sees the character and the world.

58 As pointed out previously, Hansen has already referred to his aim in eschewing the deep theoretical bias that lies at the heart of Bergson's ontology "by decoupling human freedom from the capacity to translate material stimuli into mental representations," insists "we open entirely new possibilities" (2000, p.72).

59 Rushton relates this to Hansen's claim that the DFI is an answer to the "late capitalist semiotic machines" and for Rushton it is the same.

60 Emphasized in the source.

61 The difference between affection and emotion should be noted in relation to body and brain. Whereas affection or intensity appears in the body, emotions, the qualified affections, are localized in the brain.

62 Emphasized in the source.

63 Hansen presents the quotation of Deleuze that argues exactly the opposite of what he is saying.

64 A further discussion of the time-image will be presented in temporality section.

65 Provided that 'affective power' is transferable!

66 We can also claim that there is no image, generally, that does not 'trigger' affectivity.

67 As we are not accustomed to observing ourselves directly, but perceive ourselves through forms borrowed from the external world, we are led to believe that real duration, the duration lived by consciousness, is the same as the duration which glides over the inert atoms without penetrating or altering them. Hence it is that we do not see any absurdity in putting things back in their place after a lapse of time, in supposing the same motives acting afresh on the same persons, and in concluding that these causes would again produce the same effect (1950, p.154).

68 For Bergson, space is discrete while duration is continuous.

69 "A large number of psychic states are accompanied, in fact, by muscular contractions and peripheral sensations. Sometimes these superficial elements are co-ordinated by a purely speculative idea, sometimes by an idea of a practical order. In the first case there is intellectual effort or attention; in the second we have the emotions which may be called violent or acute: anger, terror, and certain varieties of joy, sorrow, passion and desire" (1950, p.27).

70 Deleuze's theorization of the liberation of affect is related to the body without organs (BwO) or Spinoza's ethics of what the body can do, where he perceives affects, especially desire, as constrained by

the organism. Yet, in this context, ‘qualitative progression’ is more related to Bergson’s presentation, especially when we think about it in relation to hypnotism and suggestibility.

71 Rushton (2008), at first, undoes Hansen’s criticism of Deleuze in relation to cinematic spectatorship and interaction by bringing in the Deleuzian concept of “cinematographic Cogito” which, as he notes, is explicitly taken from Bergson’s article ‘Memory of the present and false recognition’. Deleuze’s understanding of Cogito, as Rushton (2008, p.127-128) explains, presupposes a double-spectatorship experience; one is receptive and embodied as it responds automatically to the images, and the other one is transcendental and intellectual that monitors and semi self-reflects on the interaction. In relation to cogito, Deleuze does not support mind/body dualism but rather his view is influenced by Bergson’s monism.

72 The out-of-field refers to the virtual effect, first, at the end of a frame that actualizes the viewer’s virtuality into the second one, and at the end of a film that opens it without actualization of the viewer’s virtuality.

73 In a way the set tells the viewer, ‘yes, you are right in thinking this or in feeling that way or not.’

74 This does not mean that the whole notion of ‘liberating affects’ has no support. This could be explained in terms of olfactory perception which related to chemical molecular such as pheromones. But, here, we are dealing with visual perception and affection where other scientific findings such as nerve mirroring (we could also say imitation) could be more relevant.

75 As Noë’s analysis of perception shows, some brain stimulation can bring some impressions.

76 Apparently this is the same vocation Hansen sees in new media but instead of the three Bergsonian concepts of crude perception, auditory image and idea, Hansen stops with the sensorimotor circuits.

77 It should be noted that Deleuze has already noted the decline of the “shock” and Bensmaïa (2005, p.148) has noted the reduction of its noetic dimension to a “nooshock”.

78 In other words, Hansen refuses to provide the image with a level of subjectivity. That is to say, ‘my failure to forge contact is affective’ rather than ‘this responsiveness is affecting me’.

79 I represent the definitions here in order to re-emphasize their connection within Varela’s work.

80 Appraisal is defined as a causal and temporal evaluation of a situation directed towards the self, that is, one’s goals and well-being, through which meaning is constructed and the individual makes sense of the world (Lewis 2005, p.170).

81 Heidegger forwarded the primacy of time over affects (Varela and Depraz 2005, p.154).

82 Emphasized in the source.

83 Emphasized in the source.

84 Gordan’s work represents the interval or cut between images which characterizes the movement-image (the curve of movement, prediction and out-of-field exemplified by his experience) rather than the interstice between images that characterizes the time-image.

85 Although instead of unit of information, I would prefer to refer to it as ‘affect’.

86 For Massumi the words intensity and affects refer to the same meaning but for Bergson intensity defines the degree of power and degree of depth of affects. That is intensity is a dimension of the emotion, which is identified after our consciousness awareness of the affects. In this way, what is missed within the half-second is not intensity but the molecular movement or the qualitative progression that is the building-up of intensity.

87 Massumi comments that it is Deleuze who actually reopened the path to these authors, including Spinoza.

88 The word claimed is used here because no evidence to support this polarization was provided by Hansen. The presented neurocognitive accounts in chapter four show that such polarization does not exist.

89 Emphasized in source (quotation as in source).

90 This criticism is directly applicable to the feminist theories.

91 Simondon's work is not fully translated into English language. This thesis makes use only of the translated sections.

92 Turing has pointed to this attitude towards machines asserting that the nature of machine is seen in doing "the same thing over and over as long as it keeps going"(Turing 2004c, p.410).

93 This definition is based on the associative law or property in mathematics which is applied to operations such as addition and multiplication where the change in the way elements are grouped does not change their result (e.g. $2 + 3 + 4 = 9$ is associative with $(2 + 3) + 4 = 9$). An associative translation into symbols could be (i.e. $a + b + c = (a + b) + c$).

94 This also means that the provision of alternatives of the same design or implementation- such as modern computers- does not mean the original design Turing machine itself is faulty or abstract. Even if the provided alternatives could function in a better way than the original or initial design, they remain alternatives provided in the course of development. In this way, they have an associated relation of being actual probability representing the future or the 'fate' of the original design.

95 We can take the meta-analysis study in chapter one as illustration of this point where it is applied to resolve problem of the increasing number of studies that decreases qualified applicable findings. The literature review or the state-of-art is the representation of the incalculable struggle to which meta-analysis study adds itself as a struggling point that is another representation. Meta-analysis' quality is in quantifying the already existing quantity. The already existing quantity of a phenomenon forms its representations. As pointed in the chapter, the choice of the random mean effect, unlike the fixed method, means this set of studies represents a larger set of studies whether exists or not. Publication bias describes the problem where all meta-analyses have to find and claim finding, after a thoroughly search, all the studies in the field but at the same time have to admit that out there, there could be studies that are not found. In this way, the publication bias forms a solution by reserving a space in the meta-analysis' quality to call for more studies thus securing quantity as quality by the quality itself.

96 Turing argues that the validity of Lady Lovelace's and other researchers' position that the machines cannot originate anything but can do 'whatever we know how to order it to perform' is based on how the machines are used rather than how they can be used (2004a, pp.111–112).

97 Turing points out that there are two rooms; one of them is for the interrogator (Turing 1950, p. 434).

98 My emphasis.

99 In the machine imitation game anything the discrete state machine (as B), as the woman – Turing provides the tasks of the 'mother' as an analogy for the discrete state machine (1950, p.438), describing them as predictable – can perform, the universal digital computer can perform.

100 Shieber makes the point about the possibilities of the instructions that will be provided to the interrogator; that is, will s/he be informed that the competitors are man/woman, machine/human, machine/woman or machine/man. Turing has not proposed any change in the interrogator's instruction simply because in all cases both players constantly compete on being identified as the woman and in the machine imitation game on being identified as the discrete state machine.

101 Except our beliefs and preferences.

102 It should be noted that most of the confusion is due to the researchers' overgeneralization of the 'test' over the 'game' and 'thinking' over 'imitation', ignoring the fact that Turing is intelligent enough to know the differences, similarities and relations between them. Looking at the following quotation informs us that the great effect of playing the imitation game should be considered within game theory.

It might be urged that when playing the 'imitation game' the best strategy for the machine may possibly be something other than imitation of the behaviour of a man. This may be, but I think it is unlikely that there is any great effect of this kind. In any case there is no intention to investigate here the theory of the game, and it will be assumed that the best strategy is to try to provide answers that would naturally be given by a man (1950, p.435).

103 Another point is raised by Genova that “Turing attempting us to misread” (1994, p.315) by using ‘C’ to refer to both the interrogator and computer. Using ‘C’ is likely to add another character to the universality of the computer – besides the exclusion of women and desecrate state machines – which is it cannot distinguish whether B is a man or a woman; thus “making one equal to two” (Turing 1950, p.443).

104 This clarifies the points of some researchers who are interested in Turing’s previous work and see this work as continuum to it. The continuity still exists but it does not block the existence of the difference.

105 In this argument, Turing does not even use players A and B but an interrogator and witness.

106 Piccinini (2001, p.577) has already mistaken the ‘specimen questions and answers’ as a conversation between the interrogator and player A. Actually, Turing would have used C for the interrogator as he does in the preceding section but here he used Q and A which simply means ‘Question’ and ‘Answer’ (Piccinini 2001, p.577). Hodges also insists that the Q/A sample interrogation contradicts the “literal meaning of the words” advocated by other authors as the gendered interpretation of the game (Hodges 1997, p. 37).

107 This can be observed in the problems of the scientific research such as: the misinterpretation of the probability test, the increase of contradictive results and findings, the reduction of scientific hypothesis to unsupported assumptions based on the misunderstanding that contribution to knowledge is obtained through testing what has not been tested yet, the mass publication and the publication of the same content under different titles, the increase of conferences as the ‘scientist’s Hollywood’ ... etc.

108 Raman and Compton effects are two phenomena related to light scattering in physics. Raman Effect describes “a change of wavelength exhibited by some of the radiation scattered in a medium. The effect is specific to the molecules which cause it, and so can be used in spectroscopic analysis”. Compton Effect describes “an increase in wavelength of X-rays or gamma rays that occurs when they are scattered” (Oxford 2012).

109 It could be understood that the degree of perfection refers to a practical stable quality of the object but it varies in relation to the object’s level whether it is an element, ensemble or individual.

110 These two processes are analogue to condensation and amplification in human being individuation.

111 Organology is used to refer to the study of organs as element, whereas mechanology refers to the study of the complete technical objects.

112 This process could be seen as viral becoming which takes place as the technical object does not engender its own species.

113 In 1985 Epstein set the Loebner Prize Competition offering US\$100,000 in prize money to developers of a computer program that could fool people into thinking it was a person (2008, p.3).

114 In 2009, Reuters reported a real marriage of a Japanese man called ‘Sal9000’ to a video game character called Nene Anegasaki. The couple met in a dating simulation game called ‘Love Plus’. Online at: <http://www.reuters.com/article/2009/12/20/us-japan-videogame-idUSTRE5BJ1XX20091220>,

Video at: <http://www.youtube.com/watch?v=26mWFuOWwuU>. Accessed 6.08.2011.

115 Contradictory to the use of pleasure/punishment system, Turing states that “these definitions do not presuppose any feelings on the part of the machine” (1950, p.457).

116 The literature review shows that there is quite a lot of research going on the embodiment which now includes affective computing. Here, my account will be kept in relation to the section and findings.