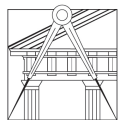




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Embodied Emotions: Observations and Experiments in Architecture and Corporeality, Vol. I

Doutoramento em Arquitectura

Especialidade em Teoria e Prática do Projecto

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Tese especialmente elaborada para a obtenção do grau de doutor

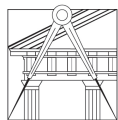
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Abstract

This thesis is dedicated to the topic of the relationship between the Body and Architecture, in particular regarding the contemporary “embodied mind” theory. It includes a theoretical review on the topic based on the study of the different ways Architecture has followed the transformations that the views on the Body have endured throughout Western history, under the evolution and influence of different disciplines such as philosophy, technology, science, religion and art. Within this context, the thesis proposes a methodology based on performance arts, which explores the use of embodied practices in design education. Such a methodology aimed at testing how it is possible to influence users’ emotions using architectural space. The thesis argues that this can be achieved through a process of empathy between the users’ body and architectural space. To support this claim, the thesis presents a set of experiments undertaken in the context of architectural teaching. The results of such experiments were evaluated through the analysis of video and photo documentation, as well as through quantitative and qualitative data collected using emotion measurement tools and questionnaires, respectively.

Keywords

Body (Human) – Architecture – Embodied Mind – Empathy - Performance Art

Resumo

Esta tese é dedicada ao tema da relação entre Corpo e Arquitetura, em particular ao paradigma contemporâneo da “mente encarnada”. A tese inclui uma revisão teórica sobre o tema, com base no estudo do modo como a Arquitetura acompanhou ao longo da história as transformações ocorridas no entendimento do Corpo Humano sob a influência de diferentes disciplinas, como a filosofia, a tecnologia, a ciência, a religião e a arte.

Dentro deste contexto, a tese propõe uma metodologia baseada nas artes performativas e explora o uso de práticas corporais no ensino da arquitetura. Tal metodologia teve como objetivo testar como é possível influenciar as emoções dos utilizadores através do espaço arquitetônico. A tese argumenta que tal pode ser conseguido através de um processo de *empatia* entre o Corpo e o Espaço. Para comprovar esta hipótese, a tese apresenta um conjunto de experiências realizadas no contexto do ensino de arquitetura. Os resultados de tais experiências foram avaliados através da análise de documentação vídeo e fotográfica e de dados quantitativos e qualitativos recolhidos através de instrumentos biométricos de medição psico-fisiológica e de questionários, respectivamente .

Palavras-Chave

Corpo (Humano) – Arquitetura – Mente Encarnada – Empatia - Performance Art

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List of Acronyms

CAD – Computer-Aided Design

CAM – Computer-Aided Manufacturing

CDA – Curso de Doutoramento em Arquitectura

DFKI – Deutsche Forschungszentrum für Künstliche Intelligenz GmbH

eCAADe - Education and research in Computer Aided Architectural Design in Europe

EEG - Electroencephalography

EM – Emotion Measurement

ETSAB – Escola Tècnica Superior d'Arquitectura de Barcelona

FA/ULisboa – Faculdade de Arquitectura da Universidade de Lisboa

FAUTL – Faculdade de Arquitectura da Universidade Técnica de Lisboa

INESC - Instituto de Engenharia de Sistemas e Computadores

ISCTE – Instituto Superior de Ciências do Trabalho e da Empresa

IST – Instituto Superior Técnico

MIT – Massachusetts Institute of Technology

MRI – Magnetic resonance imaging

PhD - Doctor of Philosophy

RP – Rapid Prototyping

TUK – Technische Universität Kaiserslautern

TV - Television

UCSB – University College Santa Bárbara

UCSD – University College San Diego



*Habe nun, ach! Philosophie, Juristerei und
Medizin, Und leider auch Theologie
Durchaus studiert, mit heißem Bemühn.
Da steh ich nun, ich armer Tor!
Und bin so klug als wie zuvor;*

Faust, 31

Introduction

Steps towards a Corporeal Architecture

Motivations

Personal motivations

This thesis is grounded on a lifelong interest in the human body as artistic material. Therefore, the reasons to pursue research on this topic come mostly from personal interest. As a consequence, this introduction contains some biographical references which go beyond pure research facts, but they were considered important for understanding the work presented herein. The reader might find them different from what is usually expected from scientific writing, but hopefully s/he will understand their significance.

The first step in the exploration of the human body started with the decision to pursue art studies during the last three years of the author's high-school training. At that time, the focus of interest was mainly in drawing and painting, but the expression of emotions and movement began to take shape as the main topic of interest for two reasons – first, due to the author's passion for theater and performance art, which was taken as a complementary educational activity in her early teens, and second, due to the author's own maladjustment to sports and motor coordination in general, which made any kind of physical prowess seem fascinating and interesting for observation and study. When the author had to decide which academic degree and career to pursue after high school, studying architecture seemed an appropriate way of exploring the intertwined concepts of movement and space.

After the first approaches to such questions in the design studio, the author came to think more about the importance of restrictions in the design process and how these restrictions are mostly a consequence of the human body's condition. The idea that the human body also is conditioned by architecture was deeply implanted in the author's own reading of architectural space. Since then, the archetypal notion of architecture as the primal shelter of the body and the classical analogy of architecture as a body itself were responsible for an understanding of architecture as a vital extension of the body. These ideas, as well as the notions of movement, rhythm, proportion and architecture as a container for the body, were explored during the author's architectural studies.

In spite of being a student of architecture, the author maintained a growing interest in art, especially performance and body art. It was during the time as an architecture student that the opportunity to visit exhibitions with works by artists such as Rebecca Horn, Marina Abramović, and Helena Almeida emerged. It also was during this time the author became aware of the work by Mathew Barney. The first glimpses at Barney's "Cremaster Cycle" and "Drawing Restraint" triggered the idea of combining the interests on the body and on performance in space for a specific endeavor someday. In the summer of 2007, a year before finishing the Diploma in Architecture, the author found, at a bookstore in Porto, Francesca Alfano Miglietti's "Extreme Bodies: the use and abuse of the Body in Art" through which she was introduced to the works of Stelarc, Brakhage and to Gilles Deleuze's "body without organs," amongst other impressive works.

In that same year, the author started to practice yoga and Pilates, thereby finding another way of understanding the body, this time around from the inside-out.

The practice of these disciplines of self-awareness changed completely the perception of the world and of architecture. Skills such as motor coordination improved significantly, together with the capacity to conceive spaces and visualize geometry. A new reading of the built environment prompted thoughts about motion, matter, weight, effort, texture and scent, and the author began to think about architecture as an immersive experience that could be consciously designed by the architect. Quotes by masters of architecture, such as Le Corbusier, Louis Khan, and Frank Lloyd Wright started to make sense and memories of visits to sacral spaces, such as Westminster Abbey in London or Mosteiro da Batalha in Portugal gained a new significance. The remembrance of architectural theory classes in which medieval pilgrimage churches were given as examples of some of the most complex achievements in the history of building brought back synesthetic impressions from childhood like the pungent smell of fresh flowers, incense, and candles that one felt while helping to prepare the church for catholic mass. The new worldview that was gained through these embodied practices of self-awareness seemed not only to increase the general quality of life and well-being, but also allowed the author to draw a map that could be used to understand and explore the relationship between body, movement, architecture, experience, and emotion in design.

Disciplinary Motivations

The decision to start the PhD program at the Faculty of Architecture of the Technical University of Lisbon was natural since the curriculum offered by the school matched the author's research interests in Architecture. The Doctoral Program in Architecture (*Curso de Doutoramento em Arquitectura* - CDA) included five areas of specialization and the decision to pursue the specialization on "Design

'Theory and Practice' was based on the fact that the author wanted to develop a project on the theme of the "body" that had both a theoretical foundation and a concrete application, such as the conception and construction of an object, of a performance, or of an architectural space. The idea was to integrate the designed "object" in an interactive context like an exhibition, but as the author's research evolved, it seemed that the most fitting application for the acquired knowledge was in the teaching of architecture.

The first year of the CDA, which the author started in October 2008, consisted of coursework that included two mandatory courses, Research Methodology and Thesis Preparation Seminar, and several elective courses, that permitted one to choose them according to his or her research interests. The author's choice included "Computer Programming for Architecture", "History of Construction", "Architecture, Film and Multimedia", "Ephemeral and experimental architecture", "Color and Light in Architecture and Urban Design", "Digital Design and Fabrication", "Shape Grammars" and "What is meant by Design?".

The last course turned out to be one of the most influential in structuring the author's thesis proposal and it was taught by Professor Duarte Cabral de Mello, who was her tutor in the first year of the CDA, and later became her thesis supervisor. To him the author owes countless and invaluable exchanges of knowledge, the acquisition of a critical eye towards the profession of architect, and the thinking of its ethical responsibility towards society. Unfortunately, Professor Cabral de Mello's health did not allow him to continue following this research and it was with great sadness that the author had to accept his departure in 2013.

Hopefully, this thesis will be able to convey some of his thoughts and honor his friendship and wisdom.

Scope and Organization

The knowledge acquired with the coursework part of the CDA, as well as the author's own independent research on the topic of the Body were fundamental to structure this thesis. After this first year, however, it was necessary to go through a period of three years, exclusively dedicated to literature review, to visit architectural works and exhibitions, to participate in conferences, to discussion with specialists and peers, and to study and practice disciplines of somatic self-awareness.

The fact that the word "body" brings immediately a never-ending source of topics to which it is related, makes the task of choosing to which "body" one is referring to particularly difficult. The thesis reviews some of the most important topics related to the "body", meaning the Human body, concretely in the context of the historical evolution of architectural theory and practice, starting with Vitruvius's treatise and ending in the 21st century. The thesis makes this historical review taking in consideration contemporary scientific concerns brought by the recent "embodied mind" theory and the complex changes in society that have occurred in the Digital Age.

The author believes that even after a significant but necessary disciplinary reduction, the study of particular body-related topics such as the issues of gender, human-animal relations, the body as the locus of power, the body as a conveyor of signs, the fashion body, or the

diseased body, just to name a few, would be important to attain a more holistic understanding of the subject. The disciplinary reduction was made following the chronology of architectural history and taking into account scholarly work that addressed the subject of the “body” in architecture, particularly through treatises. Most likely, this chronology is incomplete, as the oldest document of Western architecture known to refer to its relation to the body is Vitruvius’ *De Architectura*, which was written around 15 BC.

This thesis is organized into fourteen chapters. After the opening chapter, “Introduction,” Chapter 1 describes the context in which the thesis emerged and evolved, introduces the main question, and then presents the hypothesis and the methodology used to test it. Chapters 2 through 10 provide a historical account on the topic of emotions as a consequence of architectural space, with the aim of demonstrating that this topic has been approached in the history, theory and practice of architecture, at least since Vitruvius. These chapters represent an original contribution to the academic realm since there is no other scholarly work that makes such a review, with the exception of Pallarmaa’s and Mallgrave’s contributions on the topics of “corporeal architecture” and “embodied architecture,” respectively. Chapter 11 defines the concept of emotions from a contemporary perspective and describes the techniques used to qualify and quantify emotions, which were used as a basis for the experimental work presented in Chapter 12. The “Conclusion” closes the document by presenting the main conclusions and outlining future work.

This thesis thus includes an experimental approach that aims to confirm some of the theoretical assumptions. This was accomplished by developing the set of experiments addressed in Chapter 12, which aimed at showing that architectural space does

affect emotions, that it is possible to design artefacts (objects and architectural spaces) to trigger specific emotions, and that their effectiveness in triggering such emotions can be verified by quantifiable means. These experiments implemented the topics of “corporeal architecture,” “embodied architecture,” and “emotional design” in the context of architecture teaching.

Most importantly, the thesis aims to contribute to the scientific realm with knowledge that was extracted from such experiments, using a methodology that translates into quantifiable data changes in the emotional landscape of human bodies when interacting with design objects, immersive architecture models, and specific architectural settings. The thesis evolves gradually from an extensive theoretical review to the description of the experiments undertaken in an architectural teaching context, which tested and confirmed the hypothesis on different scales, settings and conditions.

The last chapter of the thesis presents the general conclusions that emerged from the research as a whole. The possibility of rethinking the role of embodied practices in the teaching and practice of architecture, and their integration with CAD/CAM and emotion measurement technologies is discussed within the theoretical and technological framework provided by the thesis. The concluding chapter presents and discusses possible paths for future research.

Research Problem

Social interaction in cyberspace is a very important aspect of communication today, as a growing number of individuals and groups are using the same tools for leisure and work, such as email and social networks.

These modes of interaction are subjecting the body to very specific and limited tasks that are mostly mechanical and passive and this is leading to reflections on the kind of consequences it can have on the human body, in short or medium terms. As digital space blurs with physical space, it is urgent to understand the impact on contemporary living, in what concerns the body as a holistic system and its health as an organism dependent on sensory stimulation. Medical studies are already relating an increase in pathologies such as the lack of visual acuity, muscular skeletal disorders, obesity, insomnia and depression with the excess of human-computer interaction. It also leads to concerns with, younger generations, as they seem to grow in hyper stimulation, and even children begin to show signs of overloaded stress, such as troubles in concentrating while studying.

Many software and hardware designers, supported by new studies on the human brain, think that the majority of information systems used today disregards the whole potential of the human mind, while conditioning and limiting it at the same time. (Lanier, 2010) The excess of images and the primacy of vision over the other senses also express the superficiality of media culture and of some architecture. Many buildings are designed with this kind of approach, in part due to the use of digital tools that are primarily oriented to the production of images on a flat screen.

At the same time, knowledge on instinctive actions of the human body and mind has grown considerably in the last years, due to studies of the human brain in cognitive sciences (Varela, 1991) and neurosciences. (Damásio, 1995) These have shed new light on the sensorial experience of the body and also on the role of emotions and subconscious thinking in reasoning and acting, breaking the chains of Cartesian Dualism. Descartes' *cogito ergo sum* (I think therefore I

am) motto was replaced by a holistic approach to the issue of the body. This view of the human body and mind as a single entity and the implications that it raises, are changing research areas such as Biology, Artificial Intelligence, Robotics, and Social and Behavioural Sciences. This knowledge has already been applied to the configuration of space in extreme conditions, such as space travel or military training, in order to ensure the comfort of the crew. (Durão, 2009)

In Computer Sciences and in the design of human-machine interfaces this knowledge has been applied to the development of intuitive means of interaction between users and software or hardware, promising a future where human-computer interaction will be less passive and more natural. In the Arts, some contemporary artists such as Olafur Eliasson and Bob Wilson have founded Neuroaesthetics based on the knowledge developed by neurosciences and are applying it to projects and installations that explore intentionally the potential of the senses as media. Performance artist Marina Abramović is raising funds to open a research centre dedicated to the study and preservation of “Immaterial Arts,” and it is planned that this center will integrate Art, Science, and Technology with the goal of achieving an integral understanding of what it means to be human. In the field of philosophy, Somaesthetics (Shusterman, 2008) has appeared as a new branch of research that combines theoretical reflection on the body in the phenomenological tradition, with embodied practices such as yoga or martial arts. The goal is to encourage participants to think through the body in order to improve body consciousness and so enhance one’s knowledge, performance, and pleasure. Some contemporary architects such as Peter Zumthor, Steven Holl, and Juhani Pallasmaa are defending a return to this phenomenological standpoint in architectural design, trying to express in their work the importance of the sensorial experience of the body in architectural space, “a unique way of being

that speaks to all my senses at the same time.” (Merleau-Ponty, 1945)
To Pallasmaa, “*the dehumanization of contemporary architecture and cities can be understood as a consequence of a neglect of the body [...] an imbalance in our sensory system, [being] today’s growing experiences of alienation and loneliness related to a certain kind of pathology of the senses.*”

The new attitudes towards the body and the emergent knowledge brought by neurosciences promise to offer many and new possibilities for exploration and most likely a paradigm shift. New technological equipment allows a better understanding of how the human brain works and this may enable architects to better understand human requirements and how to provide for spaces that will host human activities in a better way and correlate such with responses in the human brain and mind. (Eberhard, 2009)

Architects and scientists will collaborate more to determine what we build and why and how it will enhance the human experience. (Chong, 2009) However, there still isn’t an approach in architectural practice that joins in an organized system or methodology the knowledge the scientific community already has on the perceptive mechanisms of the human body, ancient systems of developing somatic and corporeal awareness, and the means of architectural conception, in order to design with more assurance or with specific intents. Society will eventually grow to understand that by designing the structures we live in, architects are sculpting users’ brains and affecting their behavior and that there are advantages in integrating this new knowledge in both teaching and practice.

In this context, and inspired by new developments in other areas of knowledge besides architecture, the central problem of this thesis is: “*is it possible to consciously influence users’ emotions through design?*”

In this thesis the author argues that this may be achieved through empathy between the dweller and the architectonic space and she puts forward the hypothesis that it is possible to influence the dweller's emotions through design by the conscious conditioning of the dweller's behaviour in space. To support this claim, it is proposed a methodology that incorporates concepts borrowed from phenomenology, sensory design, performance art, and emotion measurement. By empathy the author refers to the concept of *emföhlung*, as defined by Wölfflin and Lipps, and confirmed by recent evidence from neurosciences that points to the role of “mirror neurons” in human perception, by refining the concept of transposing oneself (mirroring) onto another object as a fundamental part of humans' emotional bonding with world and their understanding of the world.

Research Strategy

The research strategy was driven by two main premises. The first premise, according to the scope of this thesis, was the need for developing multidisciplinary work, which required:

- Going beyond the disciplinary boundaries of architecture to learn about the human body in adjacent areas like somaesthetics, performance art, kinesiology, neurosciences, cognitive and behavioral sciences, and digital technology;
- Looking outside Portugal for finding and contacting with other sources of relevant knowledge and references, and to discuss ideas with foreign specialists and peers.

As implied by the research problem, the second premise was the convergence between theoretical investigation and practical experimentation, which required exploring the academic environment and the reality of architectural teaching for formulating, developing, and testing ideas. In accordance to these premises, a set of activities was strategically defined in order to feed and support the development of the research in its different domains:

- Academic: course attendance, independent research and teaching;
- Practice: projects and experiments;
- Contacts: buildings, companies, and specialists;
- Dissemination: papers, publications, communication, lectures, and exhibitions.

The development of these activities evolved according to the research plan included in the PhD proposal and it moved gradually from the study of a diverse group of theoretical references and the acquisition of technical skills towards the execution and evaluation of specific and practical experiments within a multidisciplinary pedagogical context. A summarized description of each step of the methodology is provided below. The courses taken within the doctoral program in architecture (CDA) were important to formulate the research problem more clearly and to pin down the initial intuitions with more consistent thoughts. The seminars on “Programming and Computation for Architecture” and “Digital Design and Fabrication” broadened the author’s view on such tools and their potential. The former belief of CAD as a reduced means of exploration in design given by the first experiences in office practice was replaced by the notion that these are still recent tools in a transient state and that in a near future more corporeal means of

digital interaction with computers for design purposes will be broadly available, in a way similar to the evolution of the video-game consoles. A brief overview and exploration of the potentials of parametric design has also shown that what some contemporary critics perceive as a current trends in digital design actually have their roots in Renaissance treatises by authors like Alberti and, therefore, undeniable connections to the relation between body and architecture, addressed in this thesis.

The topic of perception was directly addressed in courses like “Color and Light in Architecture and Urban Design” and “Architecture, Film and Multimedia” and it was through the provided reading lists that the author became aware of the relevance of Juhani Pallasmaa’s work on architecture and the senses. Pallasmaa’s writings led to a discipline called phenomenology and to the work of authors like Maurice Merleau-Ponty, Henri Bergson and Edith Stein, whose work in turn led to Richard Shusterman’s somaesthetics, John Dewy’s body-mind philosophy, António Damásio’s approach to neurosciences, and Francisco Varela’s notion of the “embodied mind.” Damásio and Varela’s holistic thoughts on the human body and their integral view of body, mind and soul helped to realize that it would be important to have such theoretical foundation of this research to go beyond the scope of the Cartesian paradigm.

It also seemed that these philosophers and scientists could back up most of the thoughts and believes collected through the author’s direct experiences in the practice of disciplines of corporeal awareness, such as yoga and Pilates. In an attempt to understand how cognitive sciences justify their research with qualitative data, the author came to know the concept of “emotion measurement” (Lang, et.al, 1993) and learned that current scientific paradigms uses biometric data transmitted by measuring tools as signs of emotional reactions.

This is backed up by the contemporary scientific belief on emotions and feelings as biological reactions acquired by evolution. In this sense, science is currently trying to map the human brain through the use of technologies of brain scanning and brain wave monitoring. Also, other areas such as information technology or marketing are taking advantage of this new knowledge for their own purposes.

The author's readings aimed at creating a map of the "state of the art" have shown that contemporary architectural theory and practice ignored these topics for the most part, particularly, the potential use of emotion measurement tools to evaluate users' experience of architectural space. These new measuring tools were useful to get direct feedback from the user's body and understand through the interpretation of biometric signals how architectural space interfered with the user's emotions, while conditioning his movement. These tools could, thus, support a corporeal approach to the pedagogy of architecture.

The approach offered by shape grammars and the possibility of including parametric rules and implements them in a digital environment seemed ideal to address the issue of human body movement and its relation to architectural space. This was how a first serious attempt to establish a notation to describe movement was made and, in addition to the course with Prof. José Duarte in the CDA and a workshop with Prof. George Stiny from MIT, the author had the opportunity to visit the MIT Design Computation Group and discuss her work further with Prof. Terry Knight and Prof. Edith Ackermann. These discussions were important to perceive the potential of shape grammars as a creative tool for exploring movement and space.

The methodological plan designed for the PhD proposal foresaw the use of a 4d interactive environment, the Allosphere, to simulate the experience of architectural spaces in a fully immersive environment and to study the psycho-physiological reactions of the subjects in the experiments while moving through space. At the time, the author was more inclined to use virtual simulations exclusively, but as more knowledge on the thesis' topics was acquired, it seemed necessary to include real material objects in the experiments like props, as they are better in conveying corporeal feelings by enabling the haptic exploration of weight and effort.

As a result, at that time an effort was placed on finding an institution with the appropriate technology and know-how to conduct the experiments. Presentation and discussion of the evolving research at conferences was instrumental in this regard as, contacts with professionals in areas related to the research could be established. These included Prof. David Hirsh from UCLA, a specialist in neurosciences, and Stelarc, a performance artist dedicated to the use of biometric technologies to evaluate the body's reaction to the insertion of foreign objects, body extensions, and restrictions. To find an institution where to undertake experiments to test this thesis hypothesis was difficult because it had to provide both appropriate machinery and subjects for the experiments, preferably students of architecture. In 2012, an invitation to visit lab at the IST/ULisboa by Prof. Joaquim Jorge and Bruno Araújo gave me the opportunity to finally learn how to operate with emotion measurement tools and to participate as a subject in experiments on sensorial design in immersive environments. This experience provided me with knowledge for designing the experiments, while contributing to improve my technical competences.

The experiments were finally implemented after an invitation by Prof. Andreas Kretzer to visit the Digitale Werkzeuge at TU Kaiserslautern, in the second semester of 2013.

During the visit, there was the opportunity to develop in collaboration two projects dedicated to the thesis' topic, which are described and documented in detail in Chapter 12 as mentioned. These projects were developed in a pedagogical context, one with students of architecture, the workshop "Feel your Design," and another with students of media and communication technologies, the elective course on Digital Tools dedicated to the topic of *Raummetaphern* (spatial metaphors). In the meantime, a partnership with Prof. Didier Stricker and Marcus Weber at the DFKI was established, and this provided me with the technological means to include emotion measurement, attention assessment, and biometric monitoring in the experiments with the students, as well as the specialized knowledge for processing the collected data.

Following the success of these experiments, the author was invited to stay as a Visiting Scholar at the Digitale Werkzeuge during the following two semesters, and received a proposal for a Teaching Commission dedicated to the topic of Corporeal Architecture. This provided the perfect ground for further experimentation, also described in detail in Chapter 12. The writing of the thesis benefited from early writing activity as well as material collected, presented and published along the research, but mostly from this experimental work, which validated the hypothesis and opened up paths for further investigation.

Methodology

The measuring of emotions in the experiments described in this thesis took in consideration that the human body is the first and most accurate medium for testing and measuring the emotional experience of using architectural spaces and design objects. This standpoint is supported by the work on emotion measurement of Kim, Cho and Tim. (2015) The combined use of various assessment tools in these experiments (SAM chart, Presence Questionnaires, and biometric medical platform) follows the Multi-Componential Response approach described in Chapter 11.

The performative aspects of each experiment were inspired by the somatic practices of performance art as approached by Schlemmer at the Bauhaus in the 30s, by biometric-based performances made by Stelarc in the 90s, by basic notions of psychology as defined by Plutchik's Wheel of Emotions in 1980, and by the evaluation of users' experience of Virtual Reality scenes through a Presence Questionnaire. The author finds important to mention that copyrights of Oskar Schlemmer's archive did not make it available to the public until 2015, and so the design of the experiments described in this thesis was mainly based on the analysis of the scarce graphic material available before, mostly the diagrams included as images in Chapter 8. It also is important to mention that Schlemmer had no precise method and his teaching practice was, for the great part, based on his own personal interest and study of the human body in motion, which he developed through drawing, painting and performance.

Schlemmer's notations don't pin down specific choreographies and, similarly to Meyerhold's Biomechanics, were meant as an instrument for helping students in the development of objects, by triggering their

imagination and awareness of the relationship between body and space. Examples of this approach are the costumes of the *Triadisches Ballet* described in Chapter 8, which were meant to explore how the body performs in space, specifically when its physical characteristics are altered by the introduction of elements that expand, restrict or condition its movement. The author follows Schlemmer's approach, by integrating basic notions of kinesiology and somatic awareness systems, namely, yoga and Pilates, techniques of Performance Art, and the author's study on the role of emotion and sensual perception in the experience of architectural space, presented in chapters 1 to 10.

The sensorial training of the students participating in the experiments used specific physical exercises to prepare them for each class assignment. The emotional effect of designed objects or architectural spaces on the human body, while this performed "with" or "in" them, respectively, was assessed through the use of emotion measurement methodologies, namely, the already mentioned Multi-Componential Response approach. The sensorial training of the students was thought of as the pilot system of training for future designers and architects. It focuses on the sensorial training of students to increase their corporeal awareness, meaning physical and psychological awareness as a whole. The system also was inspired in other somatic training systems, such as Dalcroze's *Eurythmics*, Meyerhold's *Biomechanics*, and Laban's *Choreutics*, as described in Chapter 8. The author practiced such systems as part of the research process and they have directly informed the creation of *The Grammar of Movement* presented in Chapter 12.

The Grammar of Movement was initially conceived as an aiding tool for the notation of the human body movements in relation to space and it was useful for the author to identify the

fundamental aspects to take into account in the sensorial training of students participating in the experiments. The proposed Grammar of movement was defined in the Cartesian representation of space, which caused difficulties in considering some topological aspects that have a role in movement. These difficulties could be overcome through the use of schemas, (Stiny, 2006) but the grammar would still be restricted to the Cartesian, two-dimensional representation of space. The Grammar was shown to be too abstract for university students and colleagues, who were not used to work within the shape grammar framework, or had trouble understanding its algebraic formulation. This caused additional difficulties because the experimental part of the thesis involved the direct participation of students and members of the teaching staff of the Fachbereich Architektur TUKaiserlautern, who both participated as subjects and evaluators of students' work. Also, after an in depth study on the work of Laban and Schlemmer and, specifically, after finding about the possibility of using contemporary technologies, such as motion capture, the author realized that there is no real necessity to create a new system of movement notation. In fact, Laban's system is still widely accepted, although Labanotation, as it is called, continues to cause problems to dancers who find it too abstract.

The Grammar of Movement can be used for the purpose of movement notation, being less abstract than Laban's system and it is one of the original contributions of this thesis. A detailed description of the Grammar as a pilot project is provided in Chapter 12 and in Appendix V. The Experiments designed to test the thesis hypothesis were called “#1-Raummetaphern”, “#2-Feel Your Design”, “#3-Corporeal Architecture” and “#4-De Humani Corporis Fabrica,” respectively.

They were conceived to explore and evaluate the emotional experience of design objects on different scales of perception, ranging from wearable, meaning body extensions and restrictions, to inhabitable, meaning 1:1 scale models of architectural settings.

Each experiment assigned students to a specific design task and the goal of each task was the conscious production of specific emotions in a user/viewer of the produced object/architectural model/architectural setting. The goal of each experiment, nevertheless, was not to evaluate emotions themselves, but rather the effectiveness with which such emotion could, or not, be triggered through design. Each of the experiments addressed a different design scale, and the parameters of Immersion, Presence, Pleasure, Arousal and Dominance were taken in consideration for the emotion measurement, according to the Multi-Componential Response approach described in detail in Chapter 11. A brief explanation of each experiment is provided below and a complete description, as well as the discussion and conclusions of each experiment, can be found in Chapter 12.

- Experiment #1 – “*Raummetaphern*” evaluated the emotional experience of body extensions by analysing changes in the sensorial perception of the user, while performing with such extensions.
- Experiment #2 – “Feel your Design” assessed the emotional experience of atmospheric architecture models by analysing changes in the sensorial perception of the viewer, while looking at models, listening to specifically created sounds (soundscape,) and inhaling specifically chosen scents (scentscape).
- Experiment #3 – “Corporeal Architecture” evaluated the emotional experience of body extensions, body restrictions, and the body

performing as an architectural element, by analysing changes in the sensorial perception of the user, while performing with the objects.

- Experiment #4 – “*De Humani Corporis Fabrica*” assessed the emotional experience of 1:1 scale architectural settings by analysing changes in the sensorial perception of the user while performing a pre-set choreography of actions.

Contributions

As originally intended in the PhD proposal, the research carried out for this thesis resulted in a diverse set of contributions, which are listed and briefly described below.

On a primary level, the major contributions of the thesis are:

- a qualified assessment of user’s emotional response to simulated architectural spaces and design objects, based on the analysis of data collected by emotion measurement and biometric tools (quantitative), as well as in questionnaires (qualitative) in the course of experiments carried out in a multidisciplinary architectural education context;

- an overview of the topic of the human body based on the current paradigm of the “embodied mind,” which can be of interest to inform the practice of architecture with knowledge not included in design guidelines or building regulations still;

- a historical review of works of architecture that explored corporeality and emotions through design, as was the case with buildings such as churches, hospitals, spas, factories and museums, as described in chapters 1 to 10;

- the description, illustration, and evaluation of a set of experiments involving the use of biometric and emotion measurement data with the goal of evaluating the user's engagement and psycho-physiological reaction to design objects and architectural spaces;
- a reflection on the role of corporeal extensions and restrictions such as design objects, tools, clothing, vehicles or architectural spaces as instruments for the conditioning of the human body and, therefore, as active participants in the user's experience of and intervention in reality.

On a secondary level, the research work developed for this thesis brought about other complementary contributions, namely:

- the discovery and suggestion of new possibilities for architects to address the "classical" topic of the human body in their designs, by taking advantage of new knowledge developed after the study of the human brain; for example, the possibility of expanding design guidelines and building regulations by including considerations regarding the emotional effect of architectural spaces on users, in addition to traditional usability factors;
- the demonstration that the use of somaesthetics (Shusterman, 2008) and, more specifically, practices from performance art, can be key in the teaching of architecture to raise awareness regarding the importance of designing from an embodied perspective and of taking into account the well-being of users;

- the proposal of strategies to implement a corporeal approach using both analogic and digital tools such as drawing, model-making, and CAD/CAM technologies, expanding their potential to support a holistic approach to design, overcoming current design limitations, and matching contemporary society concerns;
- the creation of a shape grammar that permits, first to encode and compose movements of the human body, and then to relate it to space, opening up the possibility of its use for choreographic purposes, but also for importing practices from performance art into in the teaching of architecture and design.

Thesis Organization

As already mentioned, this thesis is organized into fourteen chapters, including this “Introduction” and the “Conclusion,” where the main findings and contributions of the investigation are presented and discussed. The twelve chapters in between present the research in detail. A brief description of each chapter’s content is provided below, with the aim of providing a framework to understand how the research evolved from the initial premises towards its goals.

Introduction

This chapter presents the main motivations that led to the development of the thesis, identifying its central problem. It also presents the methodological approach followed in the research, outlines its contributions, and describes the structure and organization of the thesis document.

Chapter 1 - The Narrative Body and the Body of Paradigm

This Chapter introduces the topic of the Human body and its connection to Architecture. It provides a historical overview that considers the evolution of Architecture through history, from the point of view of embodiment or experience of architectural space through the body. This chapter presents a reflection on the idea of Human body as a servant in the Roman Empire, as Vitruvius presented to us, and reveals how the topic was assimilated into Christianity. As examples of architectural embodiment in such historical periods, the chapter navigates from the typology of the Temple to the one of the Cathedral.

Chapter 2 - The Material Body and the Immaterial Body

This Chapter describes the first time in Western history that the problem of the body and mind was addressed. The Church considered body (material, sinful) and spirit (immaterial, divine) and such a division was accepted until the Renaissance, when scholars break the clerical rules and investigate the body from the out-within. As example of architectural embodiment reflecting this change in cultural paradigm, this Chapter describes the transition from the Cathedral typology to the emergence of the Anatomical Theatre.

Chapter 3 - The Dual Body and the Embodied Mind

This Chapter discusses the emergence of Descartes' dualism. Descartes proposes a solution for the problem of the body and mind by accepting this division, but considering emotions as biological. The topic of emotions is, therefore, addressed scientifically for the first time in history. Architecture becomes a vessel to conduct the emotions of the users towards experiences of awe and ecstasy. This Chapter describes the emergence of other architectural typologies that reflected the view of the body as a vessel for emotions, going from the Anatomical Theatre to the Baroque Church.

Chapter 4 - The Beautiful Body and The Sublime Body

This Chapter presents Laugier's proposal of aesthetics as an emotional need and questions the notions of beauty. Burke argues that the body needs all emotions, either bright or dark and introduces the notion of the sublime.

Burke refers to human emotion and aesthetical experience as a consequence of corporeal experience. The embodied architecture evolves from the Baroque Church to the National Library.

Chapter 5 - The Natural Body and the Disciplined Body

This Chapter discusses Kant's proposal of the brain's own physiology as responsible for aesthetical appreciation. The focus of the notion of body shifts from the countryside to the city. The positivist notion of bodies as ill-functioning machines that need to be corrected emerges. Neurologist Charcôt addresses emotions as a scientific problem. Muybridge and Darwin use new technology to study movement as an expression of emotions. Embodied architecture shifts from the National Library to the Penitentiary.

Chapter 6 - The Fragmented Body and the Unified Body

This Chapter presents Schinkel's proposal of architecture not just as construction but as material enhanced with aesthetic feeling. Bodies start to show signs of stress induced by the first era of industrialization. The entertainment industry feeds the public's need for stimulation and relaxation through immersive media - theme parks, panoramas, dioramas and early cinema. Wagner tries to achieve the total-artwork through Opera. Ludwig of Bavaria builds a castle as a total artwork. Embodied architecture evolves from the Penitentiary to the Theme Park.

Chapter 7 - The Material Body and the Mechanical Body

This Chapter discusses how Freud proposes the notion of archetypes after psychoanalysis. Psychologists study aesthetics as a scientific problem related to "empathy." Vischer and Lipps propose "empathy" as a result of emotional bonding. Vischer proposes that empathy occurs as the human body engages with objects which arouse feelings of similarity, seeing the subject who experiences empathy as mirroring himself in the perceived objects. Wölflin proposes a psychology of architecture questioning "How is it that architecture forms are able to express an emotion or mood?" Henry van de Velde related "empathy" to the "total-artwork". Birth of Phenomenology and Taylorism takes place. The focus shifts from the Theme Park to the Assembly-Line.

Chapter 8 - The Essential Body and the Performative Body

This Chapter introduces the concept of Phenomenology as a science that proposes the study of essences through the conscious revision of sensuous, subjective experience. Phenomenology influences the interest for disciplines of somatic self-awareness that don't belong to the Western tradition. Philosophy questions the division into body and mind. There is an interest in Eastern practices like yoga and in corporeal practices to enhance aesthetic perception. (Dalcroze, Laban, Schlemmer, Itten) The focus of embodied architecture moves from the Assembly-Line to the Garden-City.

Chapter 9 - The Performative Body and the Totalitarian Mind

This Chapter discusses how Corporeal techniques such as Laban's were used to choreograph mass movements and describes their connection to practices of totalitarian regimes that use corporeal training as part of programs to condition the human mind, through the body. The Body becomes docile. A decline of the Avant-Gard movement in Europe, Art and Architecture serve the state through Propaganda. Le Corbusier proposes a tool which might unite Man with the Cosmos. Modulor fails due to a rigid ideological agenda. The architectural focus shifts from the Garden-City to the Labour Camp.

Chapter 10 - from Bodies without Organs to Organs without Bodies

This Chapter relates how the Baby-boom generation recovers from WWII with the exponential growth of cities, mass construction, and a progressive dependency on technology and natural resources. It describes how Bodies become a commodity, pacified. Increased mediatisation of culture and life through television, film, computer, and internet occurs. Man lands on the Moon, the body beats gravity through the aid of technology. The Body becomes a cyborg. First successful cloning of organs and animals is achieved. Embodied architecture evolves from the Labour Camp to the Suburban House.

Chapter 11 - The Embodied Mind and the Mind by Numbers

This Chapter presents how Virtual Reality leaves science-fiction and becomes a part of daily life. Scientific studies report an

increased growth in mental illness and other pathologies such as diabetes and hypertension due to over-use of passive means of work, such as the standard office unite of computer, desk and chair. Material body starts showing signs of neglect, of imbalance between somatic experience in real life (movement, non-artificial stimulation) and experience in virtual life. Artists regain interest in the body and sensory perception. Pallasmaa proposes a "corporeal architecture" to address collective sensory deprivation. Embodied architecture moves from the Suburban House to the Wellness-centre.

Chapter 12 - From the Inside-Out - observations and experiments in corporeality and architecture

This Chapter presents the final steps of the research process, in which the knowledge summarized in the previous chapters was applied in devising a sets of the experiments to test and verify this thesis' hypothesis under different conditions:

- The Grammar of Movement: proposes a compositional system of somatic self-awareness to be used as a tool for designers;
- Experiment #1 – “*Raummetaphern*”: evaluates changes in sensory perception in the experience of body extensions that simulate a spatial situation;
- Experiment #2 – “Feel your Design”: evaluates changes in sensory perception in the experience of atmospheric architecture models enhanced with sound and smell;
- Experiment #3 – “Corporeal Architecture”: evaluates changes in sensory perception in the experience of body extensions, body restrictions, and when the body performs as an architectural element;
- Experiment #4 – “*De Humani Corporis Fabrica*”: Fabricating emotions through architecture: evaluates changes in sensory perception in the experience of 1:1 scale architecture settings.

Conclusion

This chapter presents the final conclusions and identifies paths for further research. It is shown that it is possible to design objects and architectural spaces to trigger specific emotions in the users. It also is demonstrated the effectiveness of such artefacts to influence users' emotions can be verified by quantifiable means.

Chapter 1

The Narrative Body and The Body of Paradigm

This Chapter introduces the topic of the Human body and its connection to Architecture. It provides a historical overview that considers the evolution of Architecture through history, from the point of view of embodiment or experience of architectural space through the body. This chapter presents a reflection on the idea of Human body as a servant in the Roman Empire, as Vitruvius presented to us, and reveals how the topic was assimilated into Christianity. As examples of architectural embodiment in such historical periods, the chapter navigates from the typology of the Temple to the one of the Cathedral.

To Vitruvius, the human body was the source of all geometry. As a man of his time, Vitruvius followed the Pythagorean tradition and considered Nature as the source of all knowledge, transcript in the form of the perfect number, ten. To Vitruvius, the human body is nature's work by excellence, as the only creature with ten fingers, and the ability to think, create and fabricate objects. The Vitruvian man does not move to produce geometry, he is "*laid flat on the ground, passive, and is 'made' to produce it*".

"[It is] at once a metaphysical proposition, a ritual formula [but] above all, the architect's template", being the active agents the architect's tools – the compass and the set square". So, the Vitruvian man can be made to produce a circle, and a sphere, since to the Stoics, in the words of Cicero, they alone "*posses the property of absolute uniformity in all their parts*", "*no other shape can maintain the uniform motion and regular disposition of heavenly bodies*"².

Being static in itself, the "*architect's template*" is a tool that represents a canon of human body proportions and its use generates motions in space. The produced results are meaningful by the architect's action and the culture to which he belongs. Leonardo da Vinci rediscovered the Vitruvian man in the Renaissance and gave it its most famous drawing description in which Man isn't static at all, but standing and in motion. Leonardo called this system a "*Canon of Proportions*", where in the same drawing are systematized sixteen possible positions for the human body, generated by variations of two main ones, overlapped and inscribed in the cosmological symbols of the circle and the set square.

¹ McEWEN, Indra Regis. 2003. *Vitruvius – Writing the Body of Architecture*. Cambridge, Massachusetts, London, England. The MIT Press. pp: 178-181

² _____ *Ibid*

It must be no coincidence either that Leonardo's "Canon of Proportions" depicts a number of sixteen actions. Vitruvius says in *De Architectura* that the Romans recognized both six and ten as perfect numbers and that joined both into one to make the supremely perfect number sixteen, finding the rationale for this in the foot, that measures in average sixteen fingers. So, sixteen, the four squared number, was the agent and evidence of Roman order, while representing the Etruscan division of the sky in four cardinal signs, double squared. Leonardo's interpretation of the Vitruvian man is standing, following Roman's theology of the feet. According to McEwen, "*Arrian, writing in the second century A.D., tells the following story about the arrival of Alexander the Great in India*", in which,

"Some Indian sophists [...] were found by Alexander in the open air in a meadow, where they used to have their disputations; when they saw Alexander and his army, they did nothing than beat with their feet on the ground they stood on. When [he] enquired through interpreters what their action meant, they replied, King Alexander, each man possesses no more of this earth than the patch we stand on."³

This story gives some meaning to the similarities found in both Vitruvius' description, Leonardo's representation of the cosmological Man, and the Hindu archetypical depiction of Shiva as Nataraja, the Lord of Dancers. (Fig. 1.01) The visual image of Nataraja achieved canonical form in the bronzes cast under the Chola dynasty in the tenth century AD, being often said to be the supreme statement of Hindu art. Shiva as Nataraja is the arch-yogi of the gods and the system is a representation of the dance that generated yoga, which means in Sanskrit union of body, soul and cosmos.

³ _____ *Ibid.* pp: 52-53

It depicts the four armed body of Shiva, each one representing the four cardinal directions, therefore, a square. The balance between the motions of the limbs represents by its choreography the whirling of time and the immobility of the serene expression in his face the paradox between Eternity and Time. The ring of fire and light, the circle that circumscribes the body represents the entire universe, in cyclic rhythm and in union through motion. The gestures (*mudras*) and objects in each of Shiva's hands represent the beating pulse and the sound that makes Shiva dance, the first element of the universe and the most pervasive. In Hindu mythology this sound originated the first grammar of Sanskrit that Shiva transmitted to Panini, the great Sanskrit grammarian, and the first verse of his grammar is called the Shiva Sutra⁴.



Fig. 1.01: Shiva as Nataraja. Canonical depiction from the 10th century AD.

⁴ Source: <http://www.exoticindiaart.com/article/nataraja>

The ‘grammar’ of movements encoded in Nataraja depiction of Shiva was transmitted from generation to generation, extending many symbolic gestures and actions, related to spirituality, dance and religion. These yoga postures provide a link to some of the most primitive traditions of reverence to Nature, being based in elementary and symbolic geometrical shapes such as the triangle, square, pentagon, and hexagon, and are incrustated in the matrix of our collective subconscious. In eastern culture, Yoga practice is believed to have a very powerful psychophysiological effect in the individual, expanding his consciousness and improving his overall health and longevity.

The author believes that it could be interesting to include the study of such historical cases in another occasion and academic context. For now let’s return to the point of departure of this theoretical review, Vitruvius’ *De Architectura*. It is an invaluable source of knowledge on classical architecture, even if all the original images that accompanied the text were lost.

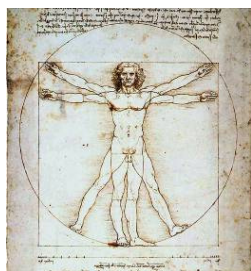


Fig.1.02: Leonardo da Vinci. Vitruvian Man. 1490.

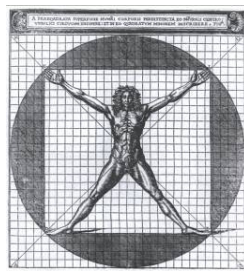


Fig.1.03: Cesare Cesariano. Vitruvian Man. 1521.



Fig.1.04: Francesco di Giorgio Martini. Vitruvian Man. 1470.

Here we must make an immediate stop, as it is important to avoid the temptation of making a sudden historical jump right to the Renaissance, when the interest in Classical Architecture (Fig. 1.05) bloomed again and many images were produced to illustrate the original text. (Figs. 1.02 to 1.04) Later, from 1743 to 1747, Piranesi would devote himself to the documentation of classical buildings in Italy. (Fig.1.05) But it isn't in fact seldom that when one searches for the topic of body and architecture the immediate mental associations are probably bringing up Leonardo's famous illustration of the Vitruvian man and the same happens if one makes, for instance, an internet or library search. Historically one doesn't find a gap in the interest in the body as an architectural subject. (Fig. 1.06) Quite the contrary, Leonardo's image simply made it more popular during the Renaissance. Already during the last stages of the Roman Empire, due to the growing influence of Christianity, classical architecture began to be adapted to serve another body, the body of Christ, embodied through its followers. (Fig. 1.06) If before buildings and the city reflected the power of the empire, its victory, prosperity, strength and youth, by the Middle Ages a new paradigm reigned and set the thinking of its time.



Fig 1.05: Giovanni Battista Piranesi. Pantheon in Rome. 1743-1747.

Fig. 1.06: Caryatid from the Erechtheion in Athens. Marble, Greek artwork, ca. 420 BC.

As the Romans replaced the Greek's gods and myths, as well as the people's habits and social order, the Christians replaced the former Classical values with the narrative and symbols of their religion. (Fig. 1.07 to 1.09)

Instead of the Olympic, victorious and healthy body of Greco-Roman tradition, the body and therefore the architecture of the Middle Ages is a humble body of pain and illness. (Sennet 2002) A body which represents the embodied suffering of Christ, made flesh by God to redeem and offer hope to the social collective that follows him. This mostly illiterate social body accepts its daily pains of hunger, plague and death as Christian architecture gives it hope through words, images and sensuous bliss. The cathedral is the place of healing, body and soul, where incense cleanses foul earthly smells and angels sing inspiring visions of the sublime in the mysterious Latin language⁵. Light showers from the high sky and Man feels united with the Divine in this sacred place.

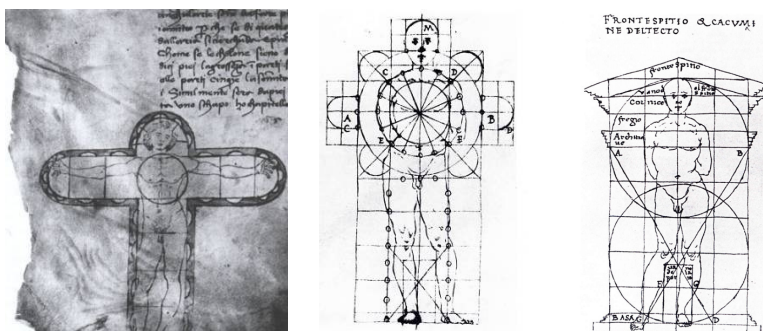


Fig. 1.07: Francesco di Giorgio Martini. Figure with proportions. 1470.

Fig. 1.08: ibid. drawing of church plan.

Fig. 1.09: ibid. drawing of church façade.

⁵ The author here calls the attention of the reader that in the Middle Ages Latin language was mostly a scholarly language, so its understanding was accessible mostly to the clergy.

One could also have referred to other religious traditions such as eastern religions, but the author chose to take as example the one which she culturally belongs to, the Christian tradition, as it seems more honest to recall embodied personal experiences and sensations, to be able to discuss the matter. Still, even if the reader doesn't accept or argues against any religious rhetoric, it is an anthropological fact that embodied, sensuous experience is a very important part in religious or mystical traditions, even in the most primitive cultures. (Levi-Strauss, 1978) It is also possible to compare it, just for the matter of somatic experience induced by context, with viewing a gladiator's fight in the Roman Coliseum, which was surely a very intense and visceral experience, or think about contemporary collective rituals such as going to a concert on a football stadium, or visiting the mall every weekend. In the case of Christianity, faith was also built upon somatic experience and empathy produced by symbols, be they images, sculptures or relics, not necessarily by a rational understanding of latin words with a rather complex meaning. It was also built upon individual participation in a collective performance, conducted by a legitimate representative of Christ. (Figs. 1.10 to 1.12)



Fig. 1.10: Eugène Viollet-Le-Duc. Medieval Architects. 1856.

Fig. 1.11: ibid. Gothic Cathedral. XIII century. 1856.

Fig. 1.12: ibid. Paris Cathedral. Vertical Section. 1856.

Here it is necessary to make another stop to pin down an important fact – the relationship between context and narrative. After the previous arguments, one can logically deduce that the body and so architecture, as conveyors of signs, follow the prevalent thinking of their time. Be that the represented body of architecture or the living human body. Both are in the culture and can't avoid but express the current paradigm. Also, regarding the previous examples, one has to accept the historical fact that theology had a rather promiscuous relationship with scientific thinking, at least until the end of the 17th century and of course, this was transmitted to different dispositions towards the body and therefore architecture as its host, and their role as locus of signs. Even so, especially if one takes a closer look at the arduous work of some medieval philosophers and thinkers regarding the topic of the body, it is surprising to see how there were already some attempts to unify diversified fields of knowledge to achieve an understanding of what it means to be human. (Roob, 2002) (Figs. 1.13 to 1.14).

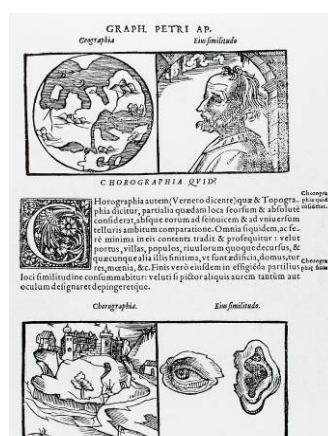


Fig. 1.13: Unknown author. Medieval Cosmology.

Fig. 1.14: Peter Apian. Cosmographicus Liber.

It is particularly interesting to see how fundamental topics of architecture such as the use of mathematics and geometry, especially in the tradition of Pythagoras and Euclid, were applied to geography, astronomy, astrology, biology and, to some extent, anatomy. In Medieval Persia, for example, Medicine was further more developed than in Europe at the same time, thanks to the possibility of dissecting human bodies to study. It was only in the Renaissance that thinkers such as Leonardo da Vinci pioneered by taking the risk of stealing or making some obscure arrangements to get their hands on the bodies of the dead. It also wasn't very likely that this would have happened before, since the plague forced dead bodies to remain buried deep into the ground, never to return to the surface.

Still, Medieval attempts to understand what it means to be human left many examples of extreme interest and artistic beauty. The sacred human body, not dissected, should remain as mysterious as the divine. In these works, mostly luminaries or charts, we find the same search for harmony and proportion, the concern for the human scale regarding the Universe and through the arduous study of geometry, finding meaning in the prevalence of certain patterns in many different aspects of man, the world and the Cosmos. (Roob, 2002) Therefore, and still under the supervision of the Church, many attempts for a Cosmology were done, mixing together the knowledge of the time, the Christian narrative, but also traces from classical mythology, these mostly hidden under intricate geometric symbols.

If one disregards the inaccuracies that come from what can be seen by contemporary eyes as a naïve mixture between scientific knowledge, religion and folklore, these obscure *Mappa Mundi* (Fig. 1.15) can already be seen as translations of a form of Holistic thinking, which opened the path for the Renaissance’s curiosity and persistency in the search for truth. These were the times when universities bloomed and so did the search of scientific evidence as a basis for knowledge.

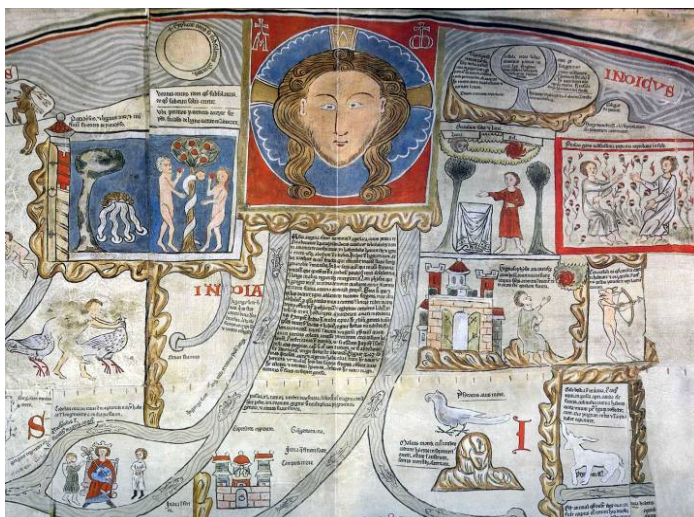


Fig. 1.15: Ebstorf Map, fragment. 1234 (?).

Science couldn’t accept mystery and speculation any more so, as Prometheus disobeyed by giving fire to mankind, so did Leonardo and his contemporaries disrobe the classical body to go beyond it’s boundaries of stone and reveal its flesh through science and art. (Figs. 1.16 to 1.18) The body of renaissance, and of course the architecture that hosts it, were still mystical and sacred, but this time not as sinful containers of flesh but as the invaluable key which holds the secrets for the understanding of the world, Macrocosmos through Microcosmos.

One could call the Renaissance body, the “body of knowledge” although this is already a very risky label, therefore we stick to the generally accepted term of “Humanist Body”. (Ashley, 1985) (Fig. 1.19)

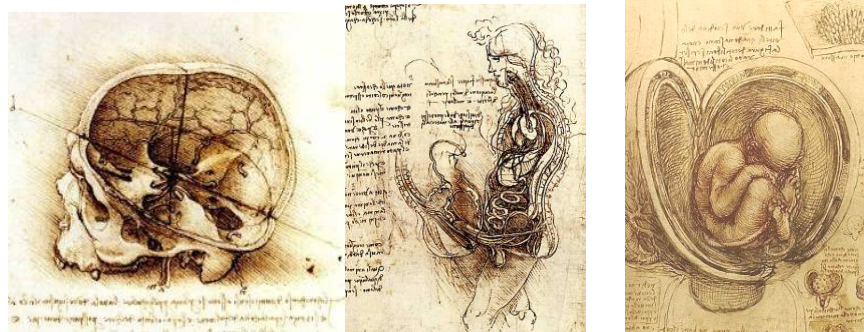


Fig. 1.16: Leonardo da Vinci. Cranial Sagittal Section. 1589.

Fig. 1.17: Leonardo da Vinci. Vertical section of the sexual act. 1490.

Fig. 1.18: Leonardo da Vinci. Representation of the foetus in uterus. 1510.

It is important to note here that for the purpose of our discussion, it is necessary to make this historical revision to understand to which extent the different approaches on the subject of the body were intimately related to time and context and how this affected architecture.



Fig. 1.19: Raphael. School of Athens. 1510.

Chapter 2

The Material Body and The Immaterial Body

This Chapter describes the first time in Western history that the problem of the body and mind was addressed. The Church considered body (material, sinful) and spirit (immaterial, divine) and such a division was accepted until the Renaissance, when scholars break the clerical rules and investigate the body from the out-within. As example of architectural embodiment reflecting this change in cultural paradigm, this Chapter describes the transition from the Cathedral typology to the emergence of the Anatomical Theatre.

Universities during the Renaissance were competitive loci of knowledge, much more released from the tight influence of the Church, as sponsorship could come from other sources such as the emerging middle class and its influential families, eager to sponsor such investigations as a strategy to affirm and display their power. Of course one has to recall examples such as the Medici's or the Borgia's, in the last case intrinsically related to the church as well. Such families supported through patronage many of the emerging artists of the Renaissance and contributed to the evolution of Humanism. This concept ruled the academia of the time, as the current belief was based on integrated knowledge. It was in such a context that the genius of Dürer, Alberti, Copernicus, Galileu and many others would flourish. (Figs. 2.01 to 2.03)

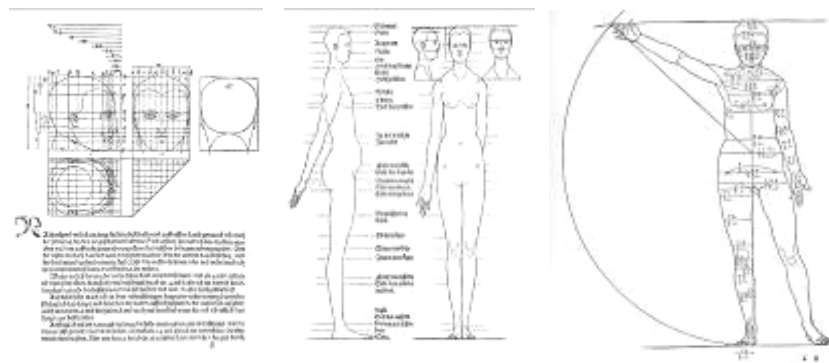


Fig. 2.01: Albrecht Dürer. Construction of the female head on the basis of the wife of 8 head lengths; Profile, En-Face, Rear View, transferred by the transfer to the floor plan. 1602.

Fig. 2.02: Albrecht Dürer. Study of face and proportions of a female body. 1602.

Fig. 2.03: Albrecht Dürer. Proportions of the human body. 1528.

Alberti left us, beyond many other works, his own treatise in architecture, *De Re Aedificatoria* defining an architectural body for his time, reaffirming the importance of Classical heritage but also leaving space for others to later expand his repertoire, like Palladio would do in his own version of classically inspired architecture *I Quattro Libri dell'Architettura*. (Figs. 2.04 to 2.06) Alberti's most important legacy regarding this particular thesis is related to his notion of *concinnitas*, what Kant would later address as “purposiveness”, as will be discussed on Chapter 6. Taking Alberti as one of the most important examples, the Renaissance man wasn't a slave of specialization as the modern man would become, but an ever-growing individual whose curiosity could be fed by the contact with many areas of knowledge such as philosophy, mathematics, geometry, astronomy and anatomy. This doesn't seem very distant from the middle ages' approach to the topic of the body, but the fundamental difference comes exactly in the influence of new technologies used in these investigations and, even more importantly, a “hands on,” embodied approach which anchored knowledge in concrete reality and not only metaphysical exploration.

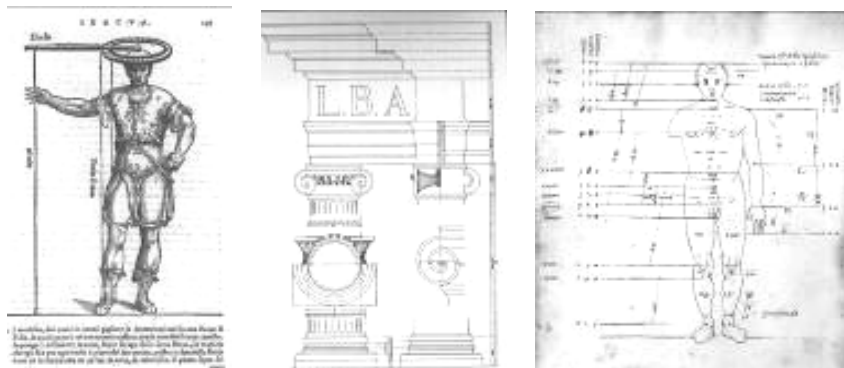


Fig. 2.04: Leon Battista Alberti. *De statua*. 1568.

Fig. 2.05: Leon Battista Alberti. Ionic order. 1969.

Fig. 2.06: Leon Battista Alberti. Study on Proportions. c. 1600.

Science was based on evidence, coming as the result of concrete experimentation. Here it is also important to pin down that the tools of the time, logically, allowed the expansion of the consciousness of what it meant to be human and as this search continued, more effort was necessary to produce tools which could allow one to “see” deeper. As a consequence, the study of anatomy wasn’t done differently by artists and scientists but by the end of the 16th century Anatomy’s importance had grown enough to make it a discipline in its own right, although intrinsically related to Medicine. This was also the dawn of rationalistic thinking and again announcing a paradigm change. The holistic body of the Renaissance, which integrated body, mind and soul, represented by anthropomorphic architecture, based on its proportions, evolved to a “body of empirical science.” (Figs. 2.07 to 2.09) It is also important to note that the Renaissance predecessors were interested in the anatomy of both the living and the dead body, probably without making a distinction between them, as we can infer by Leonardo’s machine drawings. (Fig. 2.10)



Fig. 2.07: Leonardo da Vinci. Study of a man’s torso in proportion to his head, including figures of a rider in motion. 1490.

Fig. 2.08: Leonardo da Vinci. Study of human figures at work. 1506-1508.

Fig. 2.09: Leonardo da Vinci. Study for hydraulics’ mechanism. 1490.

One can't also ignore that some of Leonardo's speculations on the role of the human brain as the main controller of the body (which included motions and emotions) were very important to establish his own specific vocabulary of signs in painting. Quoting, *"the most important task of the artist is to represent through the subjects' body what goes on in their minds."* Here in turn, we can also refer to Leonardo's anatomical studies of skulls which recall the Pantheon's dome and its importance as the symbol of the emperor and its illuminated mind, made eternal through stone. One can also understand that Leonardo's machines intended to make possible to extend human capacities and make their dreams, such as flying, come through.

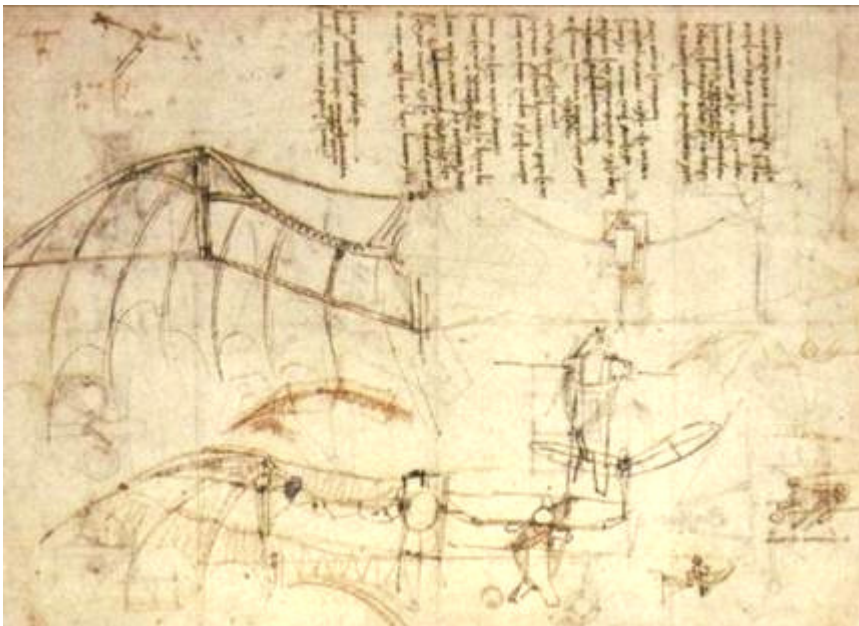


Fig. 2.10: Leonardo da Vinci. Study for flying machines. 1485.

Originally, movement and proportion, body and mind were intrinsically related in the study of the humanist body, and it was probably after Andreas Vesalius' *De Humani Corporis Fabrica* publishing that Anatomy grew definitely as a science in itself, devoted to the study of the human body. By the 17th century, universities were established all over Europe and it was important to affirm each one of them as the best sources of knowledge. Of course Medicine established itself as one of the main areas of interest and prestige and, as it is the historical custom, a new typology of building had to serve the purpose of the time. Science and particularly Medicine, transformed dissection into a ritual which should be performed for a very specific and selected audience and, as a consequence, a new space for hosting such academic events was necessary. This was how the Anatomical Theatre was created, a place to exhibit the human body to curious and eager for knowledge minds and still today this is one of the main parts of the students' of Medicine initial curriculum. (Figs. 2.11 to 2.12)

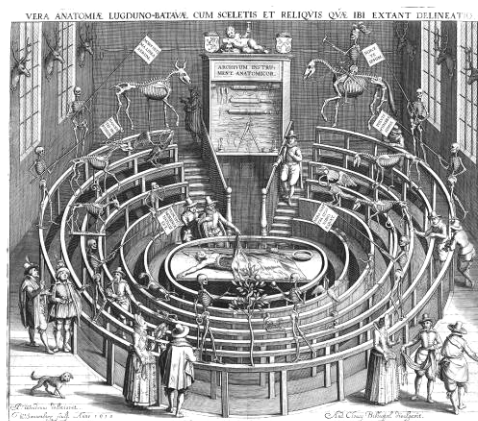
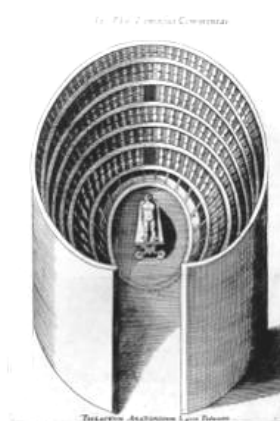


Fig. 2.11: Unknown author. *Theatrum anatomicum Lycei Patavini*, in J. Ph. Tomasini, *Gymnasium Patavium*, Undine. 1654.

Fig. 2.12: van Swanenburg after Jan Cornelis Woudanus, *University of Leiden - Vera Anatomia*. 1610.

One must also take in consideration that the 17th century brought the dawn of “scientific method” which was defined as a method or procedure that has characterized natural science, consisting in the systematic observation, measurement, and experiment, as well as the formulation, testing, and modification of hypotheses.



Fig. 2.13: Unknown artist. Anatomists. c. 16th century.

Fig. 2.14: Andreas Vesalius. *De Humani Corporis Fabrica*. 1514–1564.

Fig. 2.15: *ibid.*

One clear example can be found on Descarte’s *Le Discours de la Méthode*: “Divide each difficulty into as many parts as is feasible and necessary to resolve it.” Naturally, one must recognize the virtues of such a litany, but looking at Descarte’s philosophical work, specifically having in consideration that the matters of body, mind, soul and emotions were treated extensively, one might draw a parallel and suspect that the body cut into infinitesimal parts and exposed in the dissection table might have solved at the time some mysteries regarding its inner workings, but did not reveal the workings of its mind and soul. The body was a problem which couldn’t be solved by the study of its parts. (Figs. 2.13 to 2.15)



Fig. 2.16: Rembrandt Harmenszoon van Rijn. The Anatomy Lesson of Nicolaes Tulp. 1632.

With Descartes, we arrive at the topic of Dualism, which will be treated specifically on Chapter 3. For now we must only make notice that again a new paradigm needed to be established and as usual only technological progress could promise advancements in this field. This would still take some centuries to happen. (Fig. 2.16) The architecture of the late 17th century, or what historically was named as Baroque, was influenced by this awareness of the flesh and so the material body of architecture gave form to the immaterial spirit of God and nature, mostly inspired by the mathematical findings of Leibnitz who, being also a philosopher, called attention again to the issue of proportion, relating it to harmonic musical scales and the notion of infinite space. (Deleuze, 1988)



Fig. 2.17: Ciro Ferri. St. Agnes in Agony, paradise fresco of the dome. Roma, Piazza Navona. 1668.

It is important to note Borromini (1599-1667) and Bernini (1598-1680), who followed Michelangelo's (1475-1564) architectural legacy, as the most prominent architects of this time and both very well versed in geometry. Their buildings express a true corporeality in the sense that they sensually transmit to the dweller very strong emotions, conducting their way in a crescendo towards the sublime.

It is architecture made to host the God incarnate in the wounded Christ, who is exposed not in the dissection table, but over the altar, reaching towards the sky, his father, the Maker. Surrounding the main nave, space multiplies through illusionary paintings, chapels and sub-chapels radiate from the side naves and a complex play of convex and concave shapes adds more mystery through a calculated mastery of light and shadow. (Fig. 2.17)

The line between reality and virtuality, material and immaterial is blurred in the house of the God incarnate. Cabinets containing relics of martyrs and saints contribute as immortally preserved testimonies of the religious narrative, contributing to the visitor's experience by triggering his empathy towards the passion of Christ and his followers but strangely reminding us of the anatomical specimens saved as trophy's in the Medicine's schools' museums. As examples of best achievements in such style of architecture, we can take two examples: Borromini's *San Carlo alle Quattro Fontane* in Rome, (Figs. 2.18 and 2.19) in particular its extraordinary façade, and Bernini's piazza and colonnades which lead to St. Peter's Basilica in Rome. (Fig. 2.20)



Fig. 2.18: Francesco Borromini. Facade of Church of San Carlo alle Quattro Fontane. 1646.

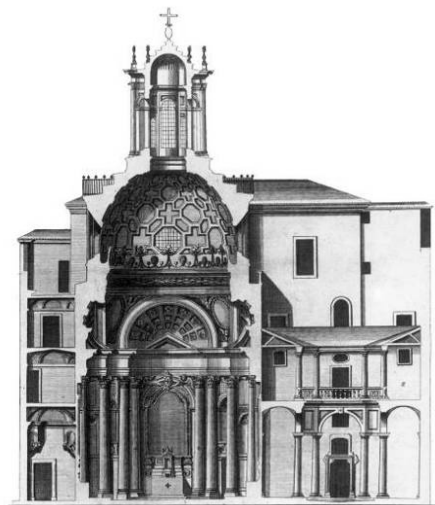


Fig. 2.19: Sebastiano Giannini. Section of San Carlo alle Quattro Fontane. 1730.

Both of them being dedicated to the Catholic narrative, these pieces represent the excellence of the Roman Baroque, but also its excess and deliberate desire to arouse mystical experiences and guide the feelings

of the followers towards the physical perception of the sublime, by the stimulation of their senses. In Catholic Rome, the subjective experience of faith happens in a place where the sense of community embraces differences of age, gender, or social hierarchy leading to a vision of the body as the collective locus of passion. Once again, philosophy and religion try to give answers to the questions left open in the dissection table of the Anatomical Theatre.



Fig. 2.20: Gian Lorenzo Bernini. St. Peter's Square, Rome. 1656 - 1667.

The mind and soul of the body were still regarded as immaterial and close to the Divine (and eternal life) and its flesh close to Death and sin. Perishable, yet sentient, the material body should be transformed and dignified through faith and corporeal punishment, as Descartes himself radically proposes in his time. Still, the interest in the topic of emotion as a consequence of sensual excitement characterizes most of the artistic body of work produced during the Baroque period, also outside of architecture. These were the times of great performances, displayed in public spaces, of fireworks, and other sensory delights like spices or oriental scents.

It is important to note that, except from Perrault who studied medicine and biology before starting to work as an architect, most artists at the time had a perspective on human dissections which was much closer to the tradition of Renaissance Humanism than Enlightenment's scientific rationalism. (Figs. 2.21 and 2.22)

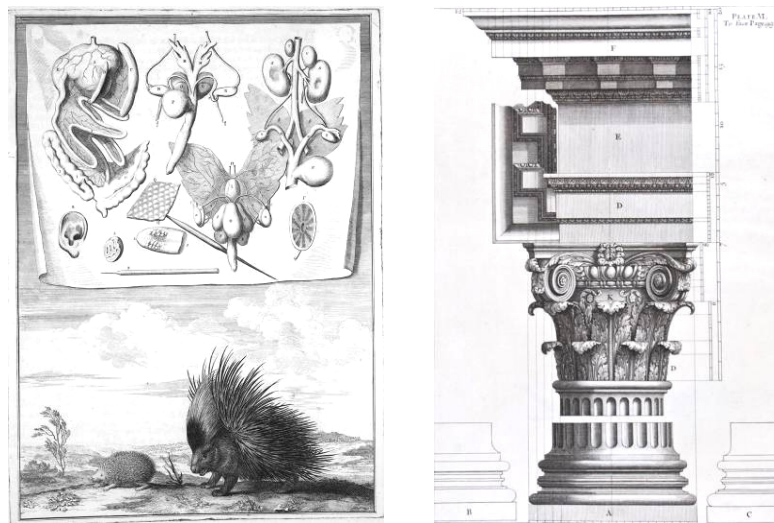


Fig. 2.21: Claude Perrault. Drawing of a hedgehog, 1688.

Fig. 2.22: Claude Perrault. Classification of the five orders of columns. 1683.

Art is the field of excellence in what concerns the experience of transmitting or creating emotions, so it is no wonder that Baroque architects, painters, sculptors and musicians could transmit more about the relationship between body, soul and emotional expression than the evidences then found on the dead corpses lying on the dissection table. But this would also change in time. As an example of the Baroque's intensive search for the sublime, we can recall now Bernini's finest piece of sculpture, "The Ecstasy of St. Teresa". This sculpture is dedicated to St. Teresa d'Ávila who was a mystical and founder of the order of the discalced Carmelites. St. Teresa would later would became the first female Doctor of Church in 1970.

St. Teresa describes in her notes about meditation a very detailed encounter with an angel, who pierced her repeatedly through her heart until she was filled with such a strong fire, which she interpreted as the love of God. (Figs. 2.23 to 2.25) The actual description is so sensuous that it is impossible for the reader to not think immediately of an erotic and very real sexual experience. It is affirmed by specialists in Eastern traditions of Buddhism that meditation can alter one's perception. It is also a verified fact that in other cultures mystical trances can induce altered states of consciousness that resemble those of an orgasm for an outside viewer. Bernini's sculpture embodies exactly an encounter between the human and the divine, the body and the spirit. There, the somatic body is shown as the medium to transmit this intense encounter.



Fig. 2.23: Gian Lorenzo Bernini. The Ecstasy of St. Theresa. 1647-1652.

Fig. 2.24: *ibid.*

Fig. 2.25: *ibid.*

Another example of an erotically charged sculpture dedicated to a religious topic during the Baroque is the one representing the death of "Blessed Ludovica Albertoni," also by Bernini. (Figs. 2.26 to 2.28) Here, death is portrayed as another rather sensually explicit moment of mystical communion with God.

Still, religion couldn't satisfy completely the enlightened scientific minds of the time and it was especially in the field of philosophy, a discipline which wasn't separated from experimental sciences, that the mind-body dichotomy became a proper topic for investigation.



Fig. 2.26: Gian Lorenzo Bernini. Blessed Ludovica Albertoni. 1671–74.

Fig. 2.27: *ibid.*



Fig. 2.28: *ibid.*

Chapter 3

The Dual Body and The Embodied Mind

This Chapter discusses the emergence of Descartes' dualism. Descartes proposes a solution for the problem of the body and mind by accepting this division, but considering emotions as biological. The topic of emotions is, therefore, addressed scientifically for the first time in history. Architecture becomes a vessel to conduct the emotions of the users towards experiences of awe and ecstasy. This Chapter describes the emergence of other architectural typologies that reflected the view of the body as a vessel for emotions, going from the Anatomical Theatre to the Baroque Church.

It is impossible to start addressing the topic of Dualism without immediately referring to Descartes as it is to him that the credits of coining the term are generally attributed. Still, it is also important to refer that the topic itself was already addressed by pre-Aristotelian philosophers and has also been a subject of study in Eastern philosophy and religion. Besides France, other European countries had their own philosophers dedicated to the question of body and soul and who were also devoted to science, although through different approaches. France and later Holland and Germany hosted respectively Descartes, Spinoza and Leibniz. In England and Scotland Bacon's, Locke's and Hume's empiricism would follow. These two branches of philosophy expressed their own particular world view, so it is understandable that each of these countries was influenced by their thinkers and so did their architecture.

Comparing the plasticity of the Roman Baroque with the clear rationalism of French Classicism provides an obvious example of the influence that context and narrative (as paradigm) play on architectural thinking and practice. Another important aspect to refer to is the influence of a multidisciplinary education which allowed architects to have knowledge on different disciplines and combine theory with practice. This came very close to Vitruvius' thinking and later Alberti's. Since the concept of Dualism is intrinsically dedicated to Descartes and therefore France, we now take French Classicism as an example of the extent of Cartesian influence on architecture. It is necessary to remember that Descartes was a philosopher, but mostly a scientist, so his work on the topic of Dualism follows the scientific method and his proposal of solving problems by addressing its parts. (Fig. 3.01) Descartes had established a school of thought which was to be called

“Cartesianism” as a particular approach to “Rationalism” and this was the basis for the education of French academics at the time, in contrast to British Empiricism. Also, it is important to notice that through this methodology, Descartes made a courageous step by separating his theory from religious beliefs and set the ground for others to solve the dichotomy of body and mind from a scientific perspective based on practical experimentation. So, it is also not impossible to conclude that his own vision of the body, which he separated in two distinct aspects, body/matter for one side and mind/spirit to the other, resulted from this conflict between scientific rationalism and the current faith. This dualist attempt to solve the problem of the body posed also other problems. First of all, Descartes had to justify and prove scientifically that there was an organic, and so corporeal, reason for the material body to function as a host for the mind.

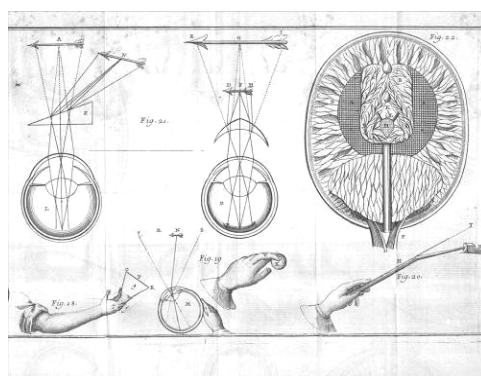
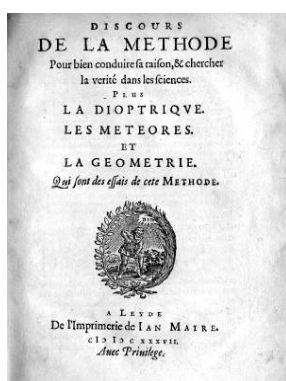


Fig. 3.01: René Descartes. Discours de la Méthode. 1637.

Fig. 3.02: René Descartes. L'Homme. 1637.

Anatomical studies had already set the hypothesis that the brain was the organ responsible for thinking. (Fig. 3.02) Descartes based his theory on his own experimental work in vivisection with animals.

At the time, it wasn't usual to perform such experiments in humans, as it was extremely painful and generally resulting in death or permanent injury of the subject. Descartes believed animals wouldn't have the same sensations as humans as they didn't possess an intellect and probably wouldn't be able to rationalize the feeling of pain. This was already an improvement from the anatomical tradition of the dissection of corpses, as it was possible to see the inner workings of a body, at least for some time. Descartes also applied his knowledge on mathematics, geometry and mechanics to his own vision of the human body's workings, and so the body was treated by Descartes as a machine with material properties. On the other hand, the mind (and soul) was immaterial and not subject to the laws of nature. (Fig. 3.03)

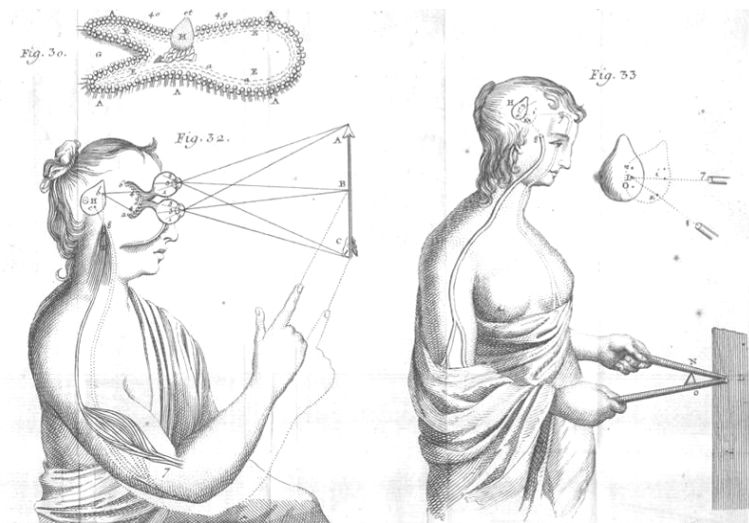


Fig. 3.03: René Descartes. L'Homme. 1637.

Descartes work was based on this dichotomy, and although a man of science, he still followed the church's belief in the impurity of the flesh and somatic desire, against the power of the controlling mind whose ability to will the flesh rendered it superior to its material

counterpart. The Flesh would always perish and rot, but the Soul would remain immortal. The link between these two was the human ability to feel emotions and Descartes explored this notion on his “Passions of the Soul”. According to his belief, the soul was seated in the pineal gland, which is located in the brain and it was this small gland that was capable of controlling the body by the management of the cerebrospinal fluid which acted through the brains’ ventricles and so controlled the nervous system and the body’s sensory capacity. In return, the nervous system, aroused by sensation, would transmit such information back to the pineal gland where sensations were interpreted as emotions and emotions received as impulses that caused the body to act. (Fig. 3.04)

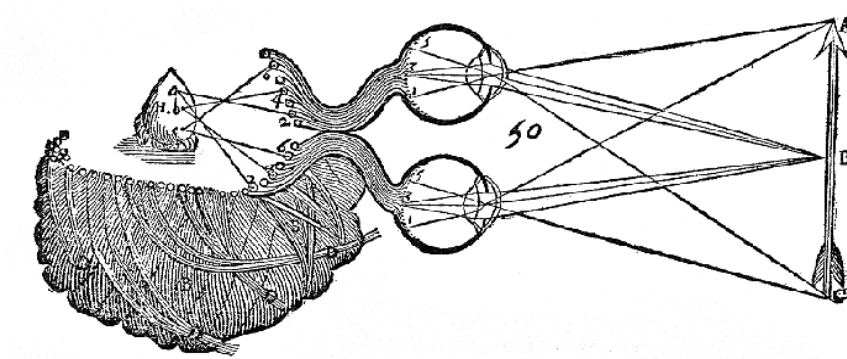


Fig. 3.04: Renée Descartes. Formation of inverted retinal images in the eyes and transmission to the brain. 1637.

Although not solved, Descartes body/mind problem would be addressed by many other philosophers for the next centuries to come, and by the 20th century, a whole set of tools would be developed and new scientific fields would emerge to dedicate their research to this topic. But first one must return forcefully to the matter of architecture and to what extent Dualist philosophy has made its influence in French Architecture.

The “Cartesian doubt” was the point of view followed by Perrault who, having studied anatomy during his Medical studies, was decided to approach both classical and Renaissance theory with the same sceptical attitude in his first challenge in the field of Architecture – the French translation of Vitruvius, was authored by Perrault who added a large number of comments to the original text and also new illustrations based on his own interpretation on use of proportions in the orders and arrangement of classical architectural elements. (Fig. 3.05 and 3.06)

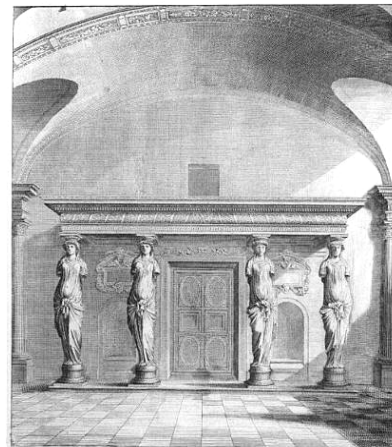


Fig. 3.05: Claude Perrault. L'Observatoire (au fond), la Colonnade du palais du Louvre (au centre), la porte Saint-Antoine (au premier plan). Planche tirée de: Dix livres d'architecture de Vitruve corrigés et traduits nouvellement en français. 1673.

Fig. 3.06: Claude Perrault. Le dix Livres d'Architecture de Vitruve. 1673.

This was possible due to his knowledge of Latin and Greek and his translation became really important to establish a theory on French Classical style as opposed to Italian Baroque. Perrault's simplification of the orders' canon, which he achieved by taking the different proportions found on all of the columns' orders (which had been measured since Antiquity and all measurements presents different

results) and simply calculated the arithmetic mean for each part. (Figs. 3.07 and 3.08) Vitruvius had already accepted that these would have changed over time. Perrault also criticized what was Alberti's view on the importance of using the same proportions in architecture such as in musical harmonies. He explained this by using his knowledge of physiology to demonstrate that the body makes a distinction between what the eye and the ear perceive, since these are two different sensory systems. Perrault found very difficult that musical harmonies, as perceived by the eye would have any influence on the "intellect". Here we immediately remember about Cartesian's Dualism, and his approach to problem solving. Even medicine would realize centuries later that perhaps the Ancients, as Perrault and his contemporaries addressed to the Renaissance Humanists weren't so wrong in their assumptions after all.

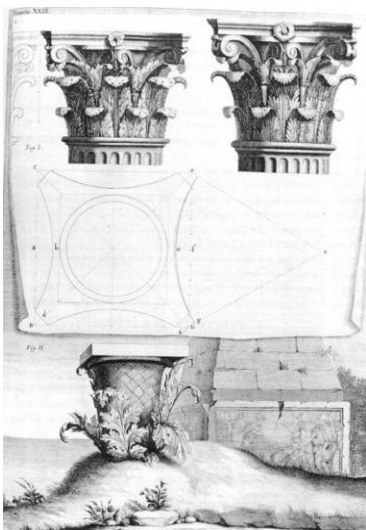


Fig. 3.07: Claude Perrault. Corinthian capital. 1683.



Fig. 3.08: Claude Perrault. L'aspect de les differents ordres de colones. 1683.

Perrault's translation of Vitruvius was meant to be used as a textbook for the Royal Academy of Architecture after its opening in 1671 and was published in 1673, having been widely accepted and making its way to the north thanks to the distribution of printed copies. It was exactly for this reason that Perrault had been commissioned to join in 1667 a three person team to prepare the design for the East Wing of the Louvre, where the king Louis XIV would live. The team consisted of the King's first architect Louis Le Vau, the King's first painter Charles Le Brun and Claude Perrault. Their design broke off with the Italian formalism by changing the proportions of the elements by adopting slender colonnades, allowing more light to enter the interior. The façade with its grouping of columns in pairs asked for the creation of a completely new structural system based on the reinforcing of masonry with a complex framework of iron. (Fig. 3.09) On his translation of Vitruvius, Perrault would explain the reasons for this radical change in the design justifying with what he believed was the essence of French "taste" which had much more affinity with the lightness of the gothic.

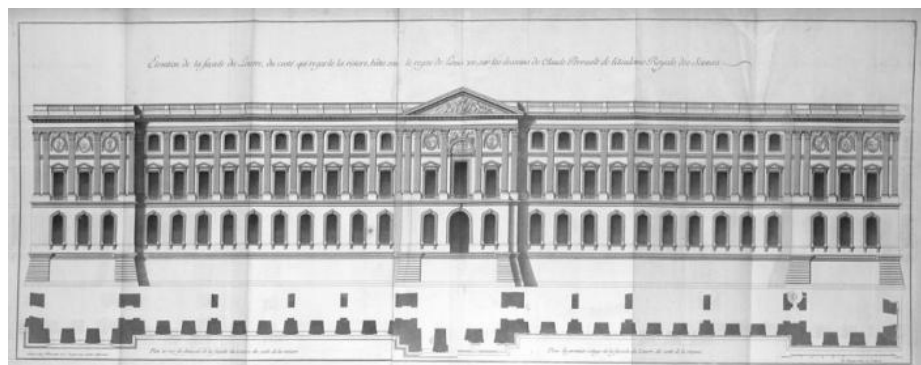


Fig. 3.09: Claude Perrault. Project pour le façade du Louvre. 1776.

The East Wing of the Louvre was also a statement of definite cultural differences between France and Italy, contributing to the polemics. But this vision of a well-established French style as clear and rationalistic would take another turn after the death of Perrault, being reinforced by King Louis XIV's decision to move the court to Versailles. From then on, architectural invention would be devoted to the overly ornamental style of the Rococo, which also spread across Europe. It was only during the Enlightenment period, with the increase of social dissatisfaction and also the growth of a political consciousness, which would lead to the French Revolution (1789-1799), that the interest on classical architecture came back. At this time, Paris was also a well established cultural central with gatherings of intellectuals happening spontaneously and not necessarily under the King's wing. Intellectual circles such as Diderot's would reveal their importance and his "Letter on the Blind" (1749) is an impressive reflection on the topics of mind and sensory perception, especially on the matter of the role of hearing and touch as (eventual) substitutes for vision. It is not to the author's knowledge that Diderot might eventually have written this letter thinking explicitly about Descartes' Dualism. But considering the revolutionary spirit of the time, perhaps there was some dissatisfaction with Descartes' solution which led to Diderot's approach to the problem of the body and the mind much closer to what would become 20th century phenomenology. The Enlightenment also brought a growing consciousness on the role of the individual and Rationalists like Descartes and Spinoza had already opened the way towards an anti-clerical approach to knowledge through logical thinking. But it is to the British empiricist Locke that the concepts of "self" and "individual" are attributed.

Locke defined in his “theory of mind” that the self is defined by a “continuity of consciousness”, in which knowledge is acquired through experience, which in turn is built upon sensory perception. He makes a clear opposition against dualism and the Cartesian notion of a human born with innate ideas. For Locke, the new-born mind is a “tabula rasa”, a concept which recalls Humanist thinking and in particular Aristotle. Locke’s ideas wouldn’t remain in England alone and would have a considerable influence in the thinking of French philosophers such as Voltaire and Rousseau, adding to the current debate on “nature vs nurture” a bigger importance to the second in what regards aspects of one’s personality, social and emotional behaviour as well as intelligence. Rousseau would have a fundamental importance in the social changes that would occur, especially through his thoughts on “The social contract” and education.

Chapter 4

The Beautiful Body and The Sublime Body

This Chapter presents Laugier's proposal of aesthetics as an emotional need and questions the notions of beauty. Burke argues that the body needs all emotions, either bright or dark and introduces the notion of the sublime. Burke refers to human emotion and aesthetical experience as a consequence of corporeal experience. The embodied architecture evolves from the Baroque Church to the National Library.

By the middle of the 18th century, Rousseau's ideas on the origins of men had inspired Laugier (1713-1769) a former Jesuit who had been assigned to sermon at King's Louis XIV but ending up being expelled and exiled for his comments on the King's political and personal excesses. His interests on architecture came from his disgust on the Rococo which went against the sobriety of Jesuit thinking, and he considered Vitruvius' work as irrelevant, as it showed only the architectural possibilities of his time. Laugier believed that architecture was based upon the supreme criterion of reason and the unique human faculty of being able to fabricate objects with the intent of preserving himself against the perils of nature, or extend the life of his provisions. (Fig. 4.01)



Fig. 4.01: Marc-Antoine Laugier. Cabane primitive (refuge, *Die Urhütte*), *Essai sur l'architecture*. 1755.

Picking up Rousseau’s ideas on primitive man, who was supposedly an uncorrupted being, relying only on his instincts, Laugier brings to us a narrative in which the first architectural elements that appear are the columns, entablature and roof, as the result of the assembling of four fallen branches into the ground, connecting them with some more as horizontal limbs and then adding some inclined branches with leaves to form a gabled canopy. Laugier’s fable pins down the moment when human intelligence, relying on instinct, makes a decision to create an alternative to a damp cave as a shelter for his body, relying only on these simple elements. (Fig. 4.02) Walls, windows and doors follow as extra-necessities and ornament is condemned as licence, as well as arches, pilasters, engaged columns and other elements which can’t be supported by “reason”, or one could say, analytical thought.

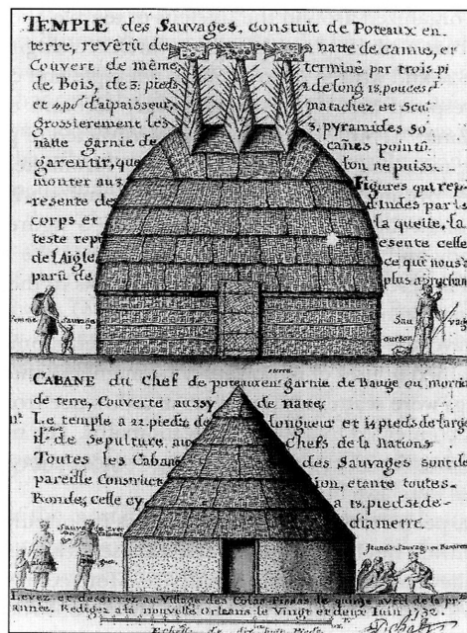


Fig. 4.02: Marc-Antoine Laugier. *Le Temple des Sauvages*. An Essay on Architecture. 1755.

For Laugier, architectural beauty comes from these essential qualities, which derive mostly from a function and in his “Essay on Architecture” he also refers, as the second principle of his theory, to the concept of *dégagement*, meaning openness. Perrault is often quoted, especially his work on the colonnade of the Louvre’s East Wing façade, although Laugier doesn’t agree on the virtues of his concept of *âpreté* or visual tension and the way this is related to visual apprehension of the picturesque, from a physiological perspective. This concept would have even more attention in the near future. By the end of the 18th century, interest in classical architecture continued to flourish, especially in France, England and Germany where societies of *Dilletanti* started to organize expeditions to look for real architectural traces of the past instead of simply relying on old images or illustrations which were more an interpretation of the text than exact reproductions of the style. (Fig. 4.03)

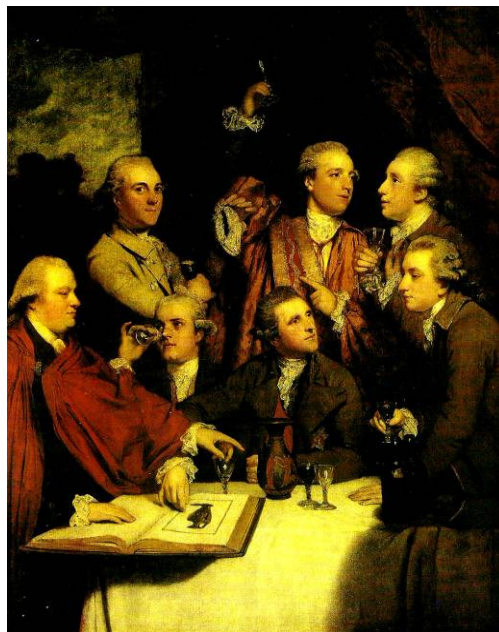


Fig. 4.03: Sir Joshua Reynolds. Members of the society of the *Dilletanti*. 1734.

These trips were motivated, on one side, by the scientific curiosity typical of the enlightened mind, on the other, by the growing interest in ancient cultures. The desire to travel to observe, collect and study foreign specimens was also one of the motivations for these expeditions. Natural sciences would evolve immensely from the direct contact with a wilder nature and this would also change the views on the origins of man and cosmos. This curiosity would also lead to the study of culture as an expression of the environment and planted the seeds of what would become anthropology. And since the invention of photography would only come a little later, the records of these travels were all done through sketches and drawings. It was particularly through the drawings of a young man named Julien David Le Roy that Perrault's earlier hypothesis that the Greeks had evolved the proportions of their buildings over time gained ground. (Fig. 4.04)



Fig. 4.04: Julien David le Roy. Drawing of the Greek ruins. 1770.

Le Roy was a painter who, being outside the circles of wealthy *dilletanti* adventured himself and spent three months in Athens on his own. His well sponsored contemporaries Stuart and Revitt had been in Rome and Athens before but didn't manage to bring with them any sketches on the major works of classical architecture. France's architectural community became shocked with the discovery of how different Greek architecture really was from the Roman and a heated debate on which would be considered best would start to take place. Le Roy tried to establish a "scientifically demonstrated" idea of the superiority of Greeks, considering specificities such as optical corrections for the sake of preserving the visual experience of harmonic proportions. On his opinion, "Greek architecture was simpler in style, more massive in its profiles and proportions and more plastic in character." (Fig. 4.05)

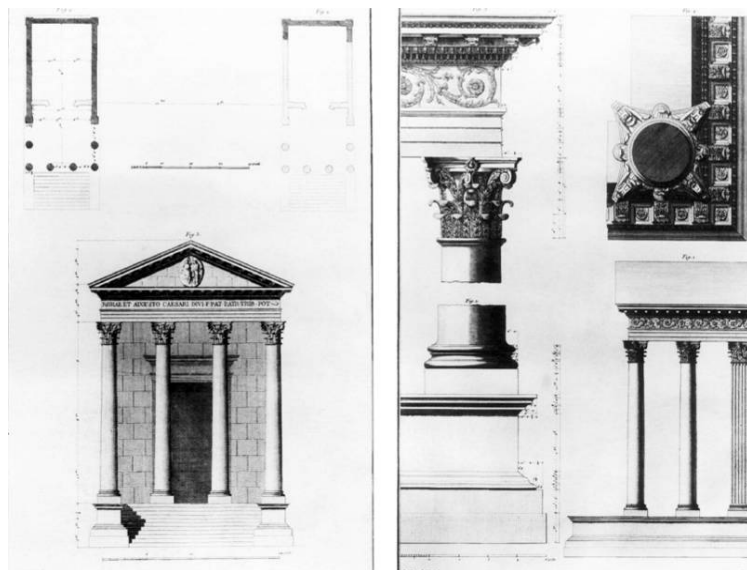


Fig. 4.05: Julien David le Roy. Plan and Elevation of Temple of Itria at Pola. *Les Ruines des plus beaux monuments de la Grèce*. 1758.

Le Roy would side with Perrault and Laugier and argue that the Parthenon's beauty wasn't necessarily dependent on the proportions of its elements. Le Roy believed that scale and play with the architectural elements, such as in the case of a colonnade, were of much more importance since they made a greater impact on the eye and so created a very strong impression in the brain. Le Roy's belief comes also close to what could be a scientific explanation to the aesthetical experience of the sublime, by relating the grandeur in a building with the physical sensations created by things such as the vastness of the ocean, the immensity of the sky and the view from the top of a mountain. As an artist, Le Roy understood the essential difference between the aesthetical experience of a painting and that of a work of architecture. While in painting, the artist must confine the elements in the space of the canvas and displace them in a self-created hierarchy, so that the viewer is subconsciously drawn to the main objects, in architecture the dweller has the possibility to explore the elements by choosing how to approach to them, being free of only visual restraints. The possibilities of interaction with these elements are only limited to the possibilities of the body who experiences it or some specific conditions of the surrounding environment to which it belongs to. Le Roy goes on further to suggest that just like in poetry, the architect guides the dweller through a series of sensations, which are given through the placement of the elements. How these sensations are interpreted as emotions is the secret lying under the mind's capacity of constructing meaning through experience, and one can suggest by following Le Roy's logic and Laugier's physiological attempts to classify the experience of architecture that design is a calculated neurological exploitation.

The author here calls the reader's attention to the last line, as here lays the most important topic of this thesis.

It wasn't only in France that the debate on the reasons for the aesthetical experience of beauty, as a result of natural human faculties, was alive. As referred to before, other big cities in Europe had their own great philosophers and in England, Locke's influence was of particular importance. Locke's empiricist proposal focuses on a view of sensations as essential to mental reasoning and the individual's construction of a worldview. Sensationalism wasn't addressed as one of the main topics of Lock's discussion but still, on the 1700's edition of his "Essay on Human Understanding", the topics of harmony and proportion would be addressed as deeply interconnected with the workings of the brain. This view would also be extended by the Scottish Hume (1711-1776) who defended that beauty wasn't necessarily related to the properties of objects themselves but to the mind's capacity for associating ideas which depend in turn from acquired memories on experiences of pleasure. Which means that to Hume, each brain possesses its own idea of beauty, based on the different subjective experiences that each individual forms through life. Still, Hume also acknowledges that if two subjects cultivate their minds in a similar way, they will nurture the same kind of feelings towards the contemplated objects and so share an aesthetic affinity. This would be one of the possibilities for the appearance of a particular style, as the reflection of culture in a specific time and context. But Hume also states that in spite of the role of subjectivism in aesthetical experience, it is possible that there are cultural invariants which probably are accepted by the brain in an almost universal way and that these come from natural and not only acquired (nurtured) properties of the human body.

This would explain the prevalence of the search for certain forms, proportions, geometrical harmonies and the use of the Golden Section (*sectio aurea*) in different cultures and historical periods.

After Hume, the Irish Burke (1729-1797) would re-affirm in 1757 on his “Philosophical Inquiry into the Origin of Our Ideas of the Sublime and Beautiful” Perrault’s physiological concerns for emotional reactions, to which he calls “organs of the mind” in order to find some “invariable and certain laws” for the matter of taste. In his book, Burke puts the concept of the “Sublime” at the same level of importance as the one of “Beauty”, but still taking a rather Cartesian opposition between both concepts. So for Burke, if beauty can be defined by what is delicate, smooth, small, clear and bright, the sublime is represented by what is dark, obscure, dangerous and even horrifying. For Burke these feelings of terror, magnitude, power, infinity, difficulty and magnificence, are as necessary as their peaceful counterparts for a healthy human existence, breaking the monotony of the day-to-day, what could be considered as a rather contemporary view on the subject of emotional health through a diversified sensory stimulation. Burke treated the Vitruvian tradition with great suspicion (if not contempt) and proposed a theory not too different from Le Roy’s on the role of the diversity on the disposal of architectural elements and especially on the intentional play with contrasts such as horizontal with vertical elements, light and shadow, to cause impact and the experience of sudden changes in the dweller, as successive sensations. Le Corbusier would perhaps recall Burke’s thoughts about the play of light and matter, brought together by mass. This tension is for Burke the physiological source of emotions as “*the muscles of the eye relax while contemplating a beautiful object, and contract at the sight of the sublime*”, a psycho-physiological approach that is

surprisingly contemporary, suggesting that human emotion and aesthetical experience arise out of the corporeal experience, in other words, the neurological processing of physical perceptions. The interest on the sublime brought along the interest on the “picturesque”. Whereas a Classical, symmetrical building would be beautiful, a Gothic building would be sublime. The theme of the garden was of particular importance and it is specifically related to the notion of “movement”, already vastly explored in Baroque churches and especially during the Rococo. By the last quarter of the 18th century, the debate on Greco-Roman architecture, as well as the reception of Piranesi’s representation of the Italian archaeological findings led to a change in taste. (Figs. 4.06 to 4.07)



Fig. 4.06: Giovanni Battista Piranesi. *Carceri* Plate VI- The Smoking Fire. 1771.

Fig. 4.07: Giovanni Battista Piranesi. *L'antechita Romanae*. 1748.

Even the standards on the aesthetical appreciation of female beauty, accepting the historical fact that at least until the 1970’s the female body was still limited to a simple role of corporeal objectification, would change.

Opposing to the classical beauty and the concurrent values of serenity, maternity and homey love, the female representation of the picturesque was related to exoticism, sin, carnal passion, danger and even death. It was particularly in England and Germany that it would reveal its influence, culminating in the Romantic period.

The reader will find more on this regard further in the text, but before we must forcefully make a stop and go to the town of Königsberg, today called Kaliningrad where Kant produced his “Critique of Pure Reason”. The “Critique” came as a natural reaction to Hume’s empiricism, unfortunately without much consequence until the launching of the second edition where Kant himself would describe in the introduction that the matters there exposed were equivalent to the Copernical revolution. Kant defies the notion of *a priori* knowledge and stands for the hypothesis that the senses aren’t just passive receptors of information which is processed by the faculties of reason and imagination as knowledge giving meaning to these stimuli, but that perhaps the brain is already involved in absorbing or choosing which stimuli it gets from the environment and is involved in structuring these sensations before they became perceptions. In short, for Kant it was possible that the perceived world is already made to conform to one’s mind and the way our brain organizes these sensations is determined by each individual’s way of thinking. Which means that, for Kant, what the senses receive are just appearances and do not correspond to a faithful representation of the outside world so the brain shapes the world and orders it in two fundamental forms: space and time. Kant would publish in 1790 his “Critique of Judgement”, where he gives a very small role to architecture, but affirms the same importance to space and time in the attribution of

meaning to the sensible world, in the matter of the appreciation of beauty, stating that the mind already brings something to the act of an aesthetic judgement. Another very important aspect regarding Kant's idea on the appreciation of beauty has to do with its sense of "purposiveness". As Mallgrave notes, "purposiveness" for Kant is, *"first of all a subjective and heuristic principle, that is, it resides in our brains and therefore is not something that exists within the object and it has to be something that allows our feelings of pleasure or displeasure to take place. (...) It is our implied trust that just as works of nature display all encompassing formal unity and lawful regularity, whose design principles are accessible to our mental faculties, so too should works of art possess some kind of inner form that implicitly at least mirrors the principles of nature."*

After reading these thoughts by Kant on aesthetics, it is unavoidable to think about classical ideas on beauty and "harmony" and especially Alberti's notion of *concinnitas* which affirms the importance on architecture's capacity to seduce the eye (meaning the senses) of the user in by the way its parts fit together, like a natural body which follows the laws of nature. Meaning that for Kant, it is the brain's own physiology that is responsible for aesthetical appreciation. Kant's ideas would be given even more credit and influence art by the middle of the 19th century and especially by the end of the 20th century, when neuroscience started to address the problem of the brain, with non-invasive research tools not only for medical purposes but also for understanding matters such as creativity, learning and aesthetics. Before we follow to the next chapter, it is necessary to refer that very important new technological developments were taking place since the second half of the 18th century, and innovations such as steam power, iron making and textiles would soon change radically the way of working and living, therefore, the body and architecture.

It was the rise of the industrial revolution, which would have its peak with the demographical explosions in the big cities during the 19th century.

Chapter 5

The Natural Body and The Disciplined Body

This Chapter discusses Kant's proposal of the brain's own physiology as responsible for aesthetical appreciation. The focus of the notion of body shifts from the countryside to the city. The positivist notion of bodies as ill-functioning machines that need to be corrected emerges. Neurologist Charcôt addresses emotions as a scientific problem. Muybridge and Darwin use new technology to study movement as an expression of emotions. Embodied architecture shifts from the National Library to the Penitentiary.

The beginning of the 19th century would bring the dawn of Industrial Revolution, important political changes, the rapid growth of cities, the increase of disease and the general feeling of the speed of time. Progress brought work, and heavy machinery such as steam boats and trains were speeding the communications between cities and countries. Steam engines also allowed intercontinental travelling and many Europeans made their adventures to start a new life in America. The countryside was progressively abandoned in favour of the promises of work and fun in the city life and the body wasn't anymore restricted to its closest vicinity. The countryside body was used to famine, hard labour and manual work, but also to fresh air and the sights of nature, now it had to adapt to other uses in the cities, as operating machines became the most current substitute for manual crafts. (Fig. 5.01)



Fig. 5.01: Unknown author Weaving Machine operated by a young girl. c.1850.

The city body was a different body, and subject to the exposure of a lot of pathogens and in many senses very poor quality of life. Children worked side to side with adults and were most of the times subject to physical exploitation, either from their families or from their employers. (Fig. 5.02) Many of these migrants were sometimes jobless, isolated and homeless, which led to heavy alcohol consumption, poor health and most of the times crime. (Levine, 1972)



Fig. 5.02: Unknown author. Sweeper and Doffer. c.1850.

As a reaction to these social problems, the 19th century saw the birth of positivism, a philosophical approach to science that defended that there is only truth in scientific knowledge and empirical evidence is only the data received from the senses which can be verified. This was also the time for the foundation of social research, which was meant to replace metaphysics for scientific method, meaning theory and observation instead of philosophical speculation.

Similarly, and as a consequence of the increase of crime, forensic pathology was also growing as a tool for investigation. The positivist philosophy implied that society must be run according to “rules”, which implied the importance of discipline, especially after the “deeds” were done. Just like in medicine, where positivism had its first impact, social difficulties were addressed as disease and therefore its cause had to be known and then the appropriate cure should be administered, as strong as possible to eradicate the evil and prevent it from recurrence. So criminal activity such as theft, prostitution and murder were considered diseases and a new area of scientific study, phrenology, promised to identify which facial features would represent an individual’s propensity for crime. (Figs. 5.03 and 5.04)

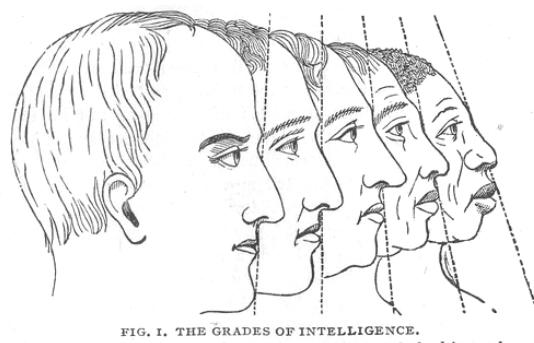
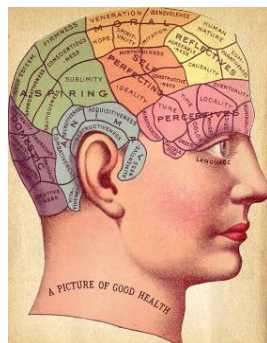


Fig. 5.03: Unknown author. Phrenology Chart. c. 1850.

Fig. 5.04: Unknown author. Phrenology Chart on the “Grades of Intelligence” according to physiognomy and skull’s size. c. 1850.

Nowadays phrenology is considered a pseudoscience, as already at the time the results didn’t proof to have scientific credibility and were mostly related to the 19th century interest on occult sciences. Still, phrenology was trying to solve the problem of the brain, body and mind, which of course was still an important subject of investigation

which would have to wait for the advances in neurosciences to affirm some solid ground. The politics of Positivism were considered an efficient way to control the problems that were afflicting the cities and since these were the days of the Grand Universal Exhibitions, (Fig. 5.05) it was necessary to control crime, disease and, especially, the undisciplined bodies that were not following the morals and social conventions of the time.



Fig. 5.05: Sir Joseph Paxton. Chrystal Palace. 1851.

England's Regent Queen Victoria was particularly sensitive to the matter of decency, which had an accentuated influence on women's wear. The Victorian body is a body of repression where natural sensuality should be refrained, concealed and demure. It was also a social mark of respectability or, the lack of it. As the corset had to appear to restrain the bodies' flesh, so did architecture have to adapt and create new typologies of body restraint. (Figs 5.07 and 5.08)

Young men also desired to be free and athletic and to be able to impress with their heroic feats. The end of the 19th century and the interest on a body of health and strength also brought the beginning of the “modern” Olympic Games. (Fig. 5.08) It was the dawn of a culture of transformation through the body, which would reach its peak on the 20th century’s fitness industry. (Fig.5.09) The concept of wellness started to be treated seriously as a health issue and body activity and the contact with fresh waters and air was prescribed as much as medication for most conditions. (Fig. 5.09)

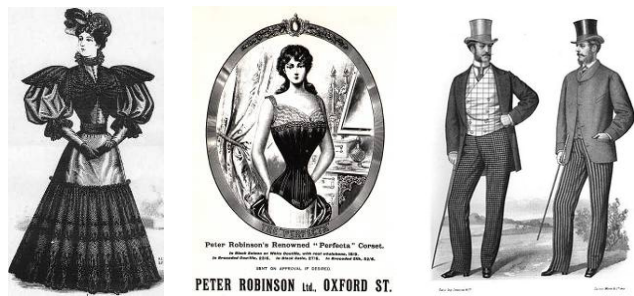


Fig. 5.06: Unknown author. Victorian Lady Dress. c.1800.

Fig. 5.07: Peter Robinson. Advertisement for the “Perfecta” corset for women. c.1850

Fig. 5.08: Unknown author. Victorian men’s fashion. c. 1850.

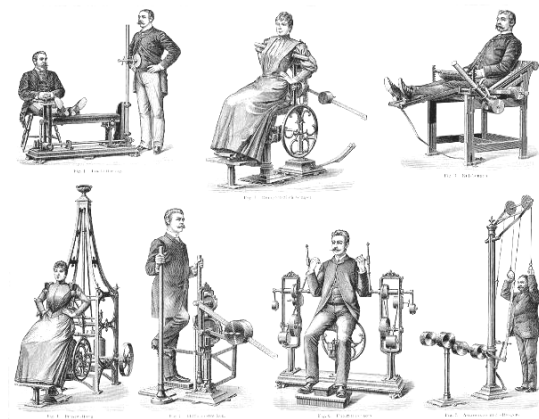


Fig. 5.09: Unknown author.. German physiotherapy machines. c.1850.

The new found interest in classical culture also re-introduced the Greco-Roman habits of collective bathing as a means for keeping the mind and body clean and healthy. This was also introduced thanks to the influence of many of the *dilletanti* who brought back descriptions of how Arabian countries kept the custom of bathing and massage as a healthcare routine. (Fig. 5.10)



Fig.5.10: Jean- Leon Gerome. *La grande piscine à Bursa*. 1885.

Inspired by these influences, Positivism brought facilities such as the spa, the hospital, the sanatorium but also the penitentiary, the orphanage, the asylum and the boarding school, places which were meant to educate and correct malfunctioning bodies and in some cases to keep them out of sight. These facilities were also used as fields of study and many of its occupants were used as experiment subjects. Of course this contributed to the evolution of medicine, but still there are many records of how ethics toward patient care were still far from a stable, humane development, mainly the asylums. The theories of the

time defended corporeal punishment and electroshock therapy as ways to treat and control patients who presented mental illness, or at least “abnormal behaviour”. One must also note that electricity was already being used in cities but still, for matters of body experimentation its calibre wasn’t probably the most refined. The invention of photography came to be of extreme importance in this case as the plates were used to register patient’s progress, the evolution of their conditions, and to report different steps of the experiments done. One example of great importance, especially regarding this thesis main topic, were the experiments done by Charcot, a neurologist who founded the neurology clinic at the Salpêtrière Hospital in Paris. (Fig. 5.11)



Fig. 5.11: Unknown author. Salpêtrière Hospital, Paris. c. 1881.

Charcot had a major importance in the development of neurology and psychology and was mentor of many highly influential researchers, for instance Freud who in turn would have Jung as disciple. Charcot

would also leave an artistic mark with his documentations, as the Salpêtrière patients were mostly women, one of them Jane Avril who was admitted for treatment of hysteria and after electroshock therapy would become famous for her spasmodic dance at the Moulin Rouge. (Figs. 5.12 to 5.14) Strangely, the Salpêtrière “muses” have also influenced novels and films, especially as their treatments consisted also of hypnosis or mesmerizing, techniques which were also seen by many people as magic “hocus-pocus” but also highly entertaining.

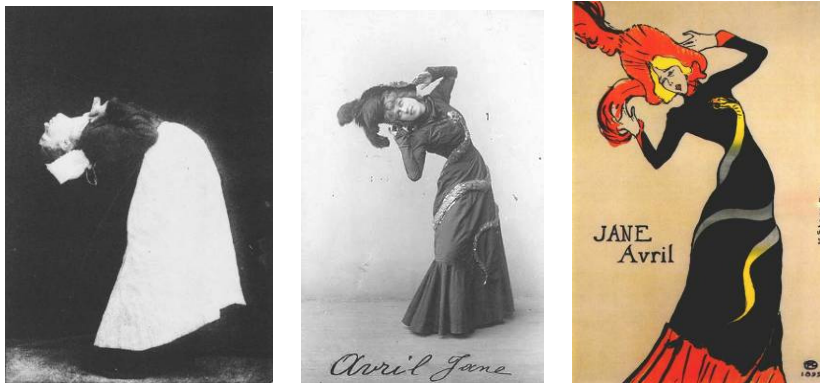


Fig. 5.12: Jean-Martin Charcôt. Catalepsy. 1881.

Fig. 5.13: Unknown author. Jane Avril. c. 1892.

Fig. 5.14: Henri Toulouse-Lautrec. Jane Avril. 1899.



Fig. 5.15: Guillaume-Benjamin-Amand Duchenne de Boulogne. Experiment with electrodes in a psychiatric patient. 1862.

Fig. 5.16: Jean-Martin Charcôt. Patient strapped to the hospital bed after hysteria attack. c.1881.

The 19th century's interest for science brought along, paradoxically, the curiosity on magic or illusionism and the occult sciences. Many people would go to theatres in the soirée just to see the new magic act which usually involved an implied risk for the performer himself or for the assistant. The most complex of these tricks were created with special machines or gadgets by engineers, a new profession which became of great importance in the 19th century. The public became more and more curious about the “invisible” aspects of the body, and demanded empirical proofs instead of metaphysical exploration. The greatest magician of all time, in these terms, was Harry Houdini (1879-1926). (Figs. 5.17 and 5.18)

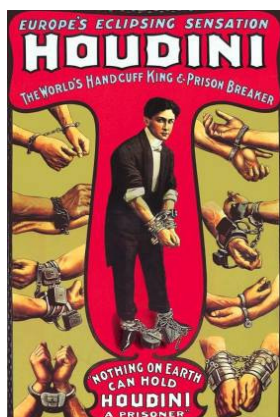


Fig. 5.17: Unknown author. Poster of Harry Houdini. c. 1906.



Fig. 5.18: Irvin Willat. Harry Houdini in “The Grim Game”. 1919.

Blessed with a very strong constitution, persistency and a knack for sports which included yoga, Houdini engineered, constructed and performed his escapist tricks himself, most of them based on real danger and not illusion. Having worked for a while for the movie industry as a stuntman, he adventured himself in the field of escapism challenging his own limits with each escape.

Houdini's physics were very impressive and posters representing his super-human abilities had broad circulation, influencing also the masculine ideals of the time. Houdini's tricks were also cleverly calculated as he used the positivist narrative and symbols of the time like chains, cuffs, straightjackets and cells to make the audience dream about a hero who can have no limits. One must also note that the 19th century's taste was, from the beginning, marked by romanticism, the interest for grime stories and a culture of escapism which was especially explored in German painting. Houdini was Hungarian-born and obviously exposed to this influence and interest for the "dark". He was also very interested in technology, especially photography and later in his life he would even organize evenings with so-called mediums to proof that they were charlatans taking advantage of technology just to impress and make profit of their naïve and craving for excitement audience. Speaking of excitement, this was also the time of the birth of new forms of entertainment, namely theme parks and dioramas, following the tradition of the 360° panoramas from the past century. (Fig. 5.19)

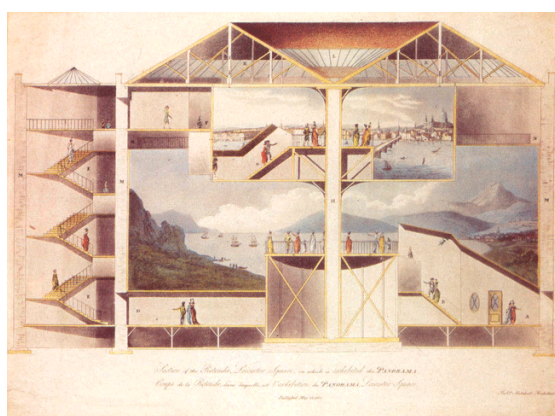


Fig. 5.19: Robert Mitchel. Cross section of Robert Barker's two-level panorama at Leicester Square. c. 1793.

Such places were to be found in the great big European cities such as London and Paris, signing their political and economical significance as highly “modern”, and also in America. It was especially in the area of Coney Island that it was possible to enjoy hours of tours through these fantastic worlds where carrousel dwelled next to circus acts, theatre performances, palm reading, caged wild animals, bearded women and people selling sexual favours. (Fig. 5.20 to 5.21) These were the places for the curious and eager for entertainment crowds who would visit to enjoy these intense experiences as a counterbalance for the toughness of life in the big cities. It was the beginnings of the entertainment industry which a few decades later would make its major success in another new immersive medium, cinema.



Fig. 5.20: Unknown author. New York, Coney Island. c.1890.

Fig. 5.21: Unknown author. Wonder Wheel. c. 1890.

The topic of immersion as escapism and the birth new architectural typologies focused on specific experiences will be addressed in detail on Chapter 10. In France the *Folies Bergères* also offered endless entertainment with women dancing acrobatically for the sights of champagne and absinth inebriated minds. Alongside there were also the *Maison Close's* which followed the positivist politics and kept sex

workers doing their job indoors and off the streets of Paris. Toulouse-Lautrec's paintings are a pristine historical depiction of the lives of these women whose bodies were routinely inspected by the local sanitary authorities to avoid the spread of venereal disease. Tuberculosis and syphilis were two of the major causes of death at the time. Gustave Courbet's painting, *L'Origine du Monde* would shock the bourgeoisie and its morals, exhibiting publicly what most men looked for in the houses of pleasure and also making a direct political threat. (Shusterman, 2008) Married women from the bourgeoisie would require architects to design and decorate their homes with all the necessities of a male-made entertaining environment such as smoke-rooms, personal dressing rooms, pool table and card/board tables, drinking rooms to display hunting trophies and studies. Women from the higher bourgeoisie had occasionally their own boudoirs where they could recollect away from men and the service of the house and enjoy comfort in their baths, salts and creams. (Figs. 5.22 and 5.23)



Fig. 5.22: Unknown author. Example of a typical office room in a bourgeois household. c. 1890.



Fig. 5.23: Mary Cassat. Antoinette at her dressing table. 1909.

Many ladies from the Belle Époque were mostly confined to their domestic environment, where lives of boredom, jealousy and sexual repression could lead them to diagnosed hysteria and eventually a forced holiday in a sanatorium. But also at this time some intellectuals who would become the first suffragists fighting for women's equal rights and emancipation from the patriarchal lifestyle. (Figs. 5.24 and 5.25)



Fig. 5.24: James McNeill Whistler. Whistler's Mother. 1871.



Fig. 5.25: Unknown author. Early suffragettes. c.1900.



Fig. 5.26: Unknown author. Advertisement for the "Sanatorium of Bilz" in Germany. c. 1912.

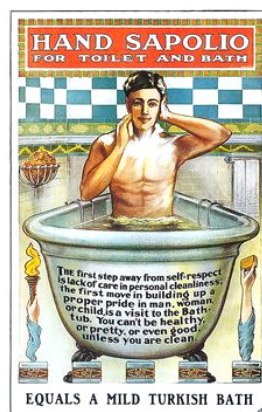


Fig. 5.27: Unknown author. Advertisement for the "Sapolio Soap". 1900.



Fig. 5.28: Unknown author. Medicine Bottle. c. 1900.

By the late 19th century the positivist ideas of hygiene had also transformed the cities, with their open boulevards and parks and also the bodies themselves. Big cities like Paris, London, Vienna, Barcelona and Chicago were particularly influenced by this. It was necessary to adapt the cities for the proper housing and development of hygienic conditions of life. Doctors would prescribe physical exercise as treatment, as well as contact with nature for mental rest. Magazines would bring drawings of exercising sequences for ladies to keep their shape, or mould it to the taste of the times who advised for slender and agile bodies, for both women and men. Also in the field of cosmetics and pharmacy the demand for health-care products grew and salesmen would travel selling machines engineered for sport, body conditioning and even as supports for education. (Figs. 5.26 to 5.28)

Scientific interest on the human body in movement grew particularly, as it was possible to use photography to register sequences of the body in time. In this regard, Muybridge and Marey were the most important pioneers as well as Darwin, who would also contribute with the publication of his “Origins of the Species” in 1859 with “The Expression of Emotions in Man and Animals”, for which he collaborated with psychiatrists, photographers and draftsmen. Darwin’s evolutionary sequence also has much to do with Muybridge’s studies on animal locomotion. (Fig. 5.29) Darwin’s point was to explore with the “Expression” the notion that expressions, meaning behaviour, may be genetically determined and not necessarily acquired. It was also part of the argument that expressions would come before language and that this one was mostly a reinforcement of the expressively transmitted thoughts.

Darwin had already opened a polemical field with this evolutionary theory and the society of the time wasn't very amused with the thought of being so close to apes. With his theory of Emotions Darwin had opened a door which was still unexplored. (Figs. 5.30 and 5.31)

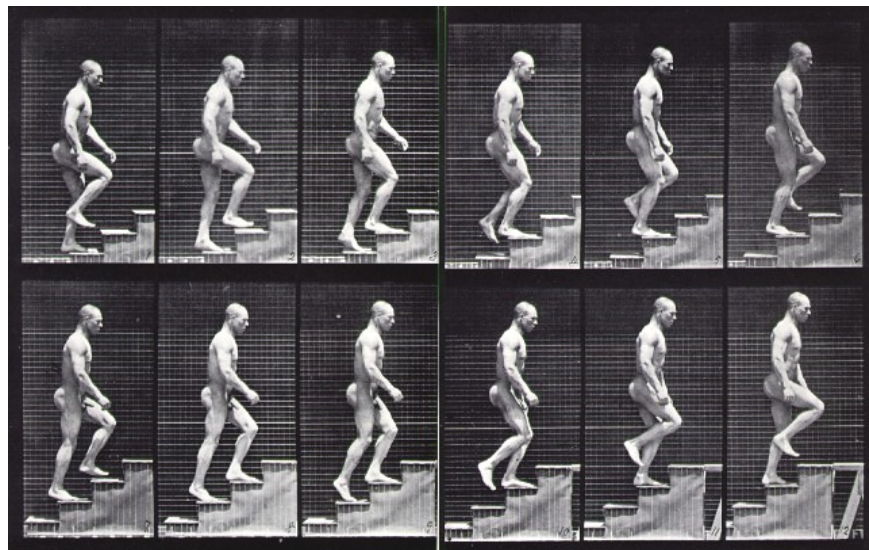


Fig. 5.29: Eadweard Muybridge. Human Locomotion studies. c.1887.

The biological influence of emotion in thought, a question which the philosophers of the Enlightenment weren't able to solve except for Kant who dared to transcend the borders of metaphysics but still without empirical evidence. Darwin, and some of his contemporaries like Charcot would pursue their studies and father the theories which neuroscientists like Damásio and Varela would demonstrate a century later and to which we will dedicate our attention on Chapter 10.

In the meantime, scientists in Germany and Austria were working with radiation to explore if it would be possible to look into the body by using a method similar to photography. There was a large interest for non-invasive methods, as these would allow to look inside the

body, while it is alive, to check the functions of the organs without the risks of infection involved in operation.



Fig. 5.30: Guillaume-Benjamin-Amand Duchenne de Boulogne. In Darwin's "The Expression of Emotions in Man and Animals". 1862.

Fig. 5.31: Guillaume-Benjamin-Amand Duchenne de Boulogne. *Ibid.*

At the time, microscopes were already used for diagnosis of certain diseases and thanks to Louis Pasteur vaccination also started to become a health-care routine. This means that medicine in the late 19th century was already much more refined than a century before and sensible in understanding the condition of an individual from the inside-out and not from the out-within, preserving the body's integrity and avoiding suffering as much as possible. It was taken in consideration that collective health depended on the maintenance of individual's health but also from the conditioning and maintenance of the surrounding environment. While the wealthy aristocracy could enjoy permanently the cares and nurtures of the countryside, middle class and lower were exposed and sharing unhealthy environments. Naturally, this presented challenges for architects and especially

urban planners, whose work grew immensely in importance. Architecture had naturally to follow these criteria as well. The end of the 19th century represented the end of a paradigm also in architecture, through photography, x-ray, vaccination, electricity, the agile trains and aircrafts and the crystal-like buildings of the world exhibitions, held together in their fragility through strong steel skeletons and renewed athletic bodies, and the interest for natural history. It was time for an architectural revolution, which would change radically the course of design theory and practice until today.



Fig. 5.32: Guillaume-Benjamin-Amand Duchenne de Boulogne. 1862.

Chapter 6

The Fragmented Body and The Unified Body

This Chapter presents Schinkel's proposal of architecture not just as construction but as material enhanced with aesthetic feeling. Bodies start to show signs of stress induced by the first era of industrialization. The entertainment industry feeds the public's need for stimulation and relaxation through immersive media - theme parks, panoramas, dioramas and early cinema. Wagner tries to achieve the total-artwork through Opera. Ludwig of Bavaria builds a castle as a total artwork. Embodied architecture evolves from the Penitentiary to the beginnings of the Theme Park, or architectural experience as entertainment.

The changes brought by the Industrial Revolution in the 19th century caused many intellectuals to rethink about the question of labour and especially manual work. Mechanization led to the end of many kinds of crafts and to many people to lose their jobs, as their bodies were required to perform other tasks. As Ruskin would probably say, their purpose in life was destroyed, as mechanized work brought a sense of alienation, didn't allow the same kinds of social interaction with co-workers and especially an output for creativity, expressed through natural and not systematic movement. Outside the factory only slums waited. Needless to say that engine steams fed by burning coal were responsible for lung damage and chronic health problems. (Fig. 6.01) Besides the high human cost, the objects produced in factories mostly tried to copy traditional designs and motives but without aesthetical or design quality. These issues contributed to many of the intense debates on architecture and aesthetics that would culminate with the Modern Movement in the 20th century.

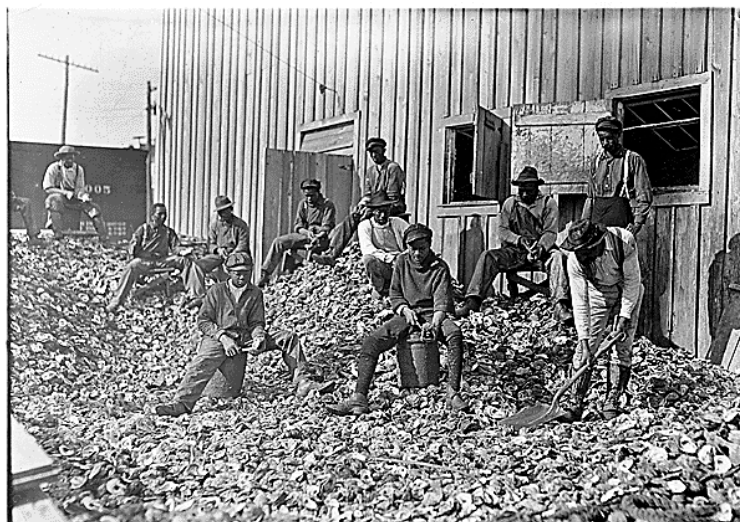


Fig. 6.01: Unknown author. Photograph of workers outside the factory.

Besides John Ruskin (1819-1900), architects, psychologists, philosophers, art historians and critics such as William Morris (1834-1896), Karl Friedrich Schinkel (1781-1841), Karl Bötticher (1806-1889) and Gottfried Semper (1803-1879) would make serious reflections on the questions of “style” and especially “ornament” trying to find the principles or the Order behind the fragments of classical architectural elements. (Fig. 6.02) They also reflected an early existential feeling of fragmentation, which would be a main topic of discussion in the arts of the beginning of the 20th century. What was surprisingly new about these theories was that they weren’t only based on the historical appreciation of architectural legacy or speculative, but they transported the inquisitive spirit of their philosophical predecessors, fundamentally Kant and Schopenhauer, to understand such questions through logical inquiry and evidence.

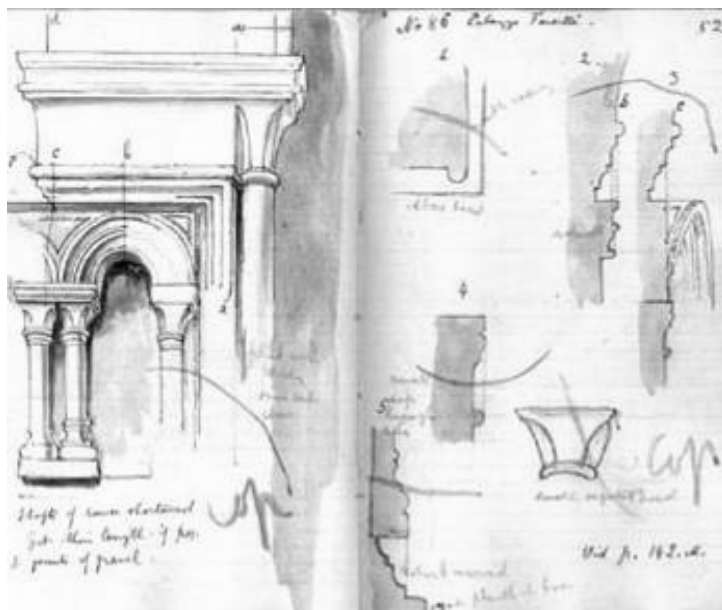


Fig. 6.02: John Ruskin. Drawing from notebook, study of the architecture of Venice. c. 1894.

In Germany, these theories would be of significant importance, since the debate on purposiveness, in Kantian sense, was still burning by the end of the 19th century, as referred to on Chapter 4. Bötticher, an architect and archaeologist who was mentored by Schinkel, began in 1839 to research on the symbolic language of Greek tectonics. Inspired by Schopenhauer, Schinkel had already tried an animistic reading of architecture, in which form was enriched by higher symbolic and emotional values. So for Schinkel architecture couldn't be read simply as construction but as material enhanced with aesthetic feeling, which would only be possible through the purposive construction of each part, relating the whole. Regarding the question of ornament, Schinkel recalled Alberti, referring that this endows form with a higher meaning and should leave all essential aspects of the construction visible, for a clear and honest perception by the senses. (Figs. 6.03 and 6.04)

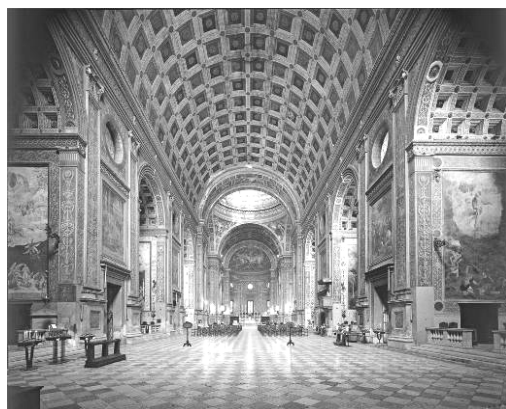


Fig. 6.03: Unknown author. Interior of Alberti's Basilica of St. Andrea, Mantua. c. 2010.

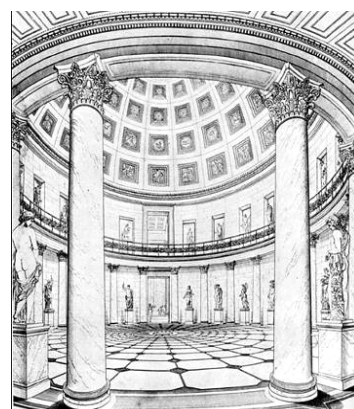


Fig. 6.04: Karl Friedrich Schinkel. *Altes Museum* Berlin. 1825-1830.

Regarding the question of proportion, Schinkel brings back the concept of *analogia*, which would also be explored by Semper, in the sense that they should only be meaningful through their direct relation

to human existence, in an embodied sense, or to an organized condition of nature which has a similar articulation.

Here, the role of “nature” proves of extreme importance, since already Vitruvius had referred to it as the most important source of architectural knowledge. Schinkel’s disciple Bötticher argues that all parts of classical Greek architecture artistically represent their mechanically-serving functions - specifically through their artistic forms. He further goes on saying that the principle of Greek tectonics, which he defines as the total form of an architectural body, is fully identical to the principle of creative nature. So in Greek architecture the sense of purposiveness was represented by all of its details and decorations, and none of them was left to chance. (Fig. 6.05)

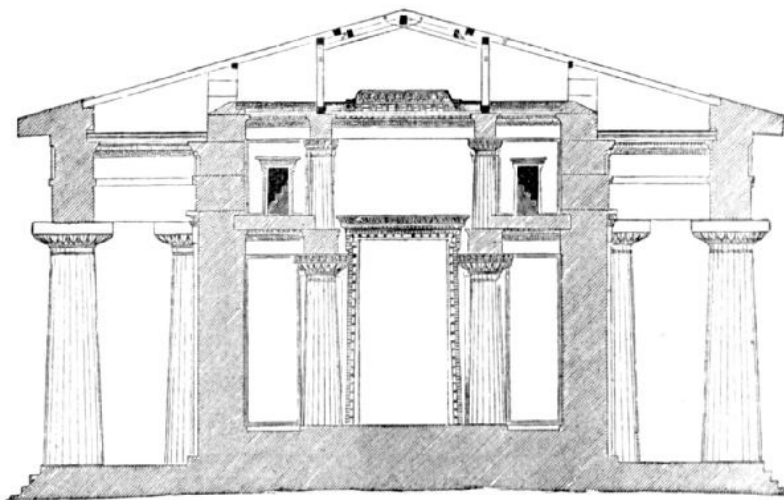


Fig. 6.05: Karl Bötticher. Section of the Greek Doric Temple at Paestum as restored by Bötticher. 1844-1852.

“The Greek building in its design and construction shows itself in every respect to be an ideal organism articulated for the production of the spatial need in an artistic way. This space-serving organism, for the whole to the smallest of its members (membra), is a conceptual creation; it is an invention of the human

mind and has no model in nature from which it could have been designed. Each one of its members proceeds only from the whole; for this reason, each is therefore an imperative and necessary part, an element integrated into the whole, which conveys and transfers its special function and place to the whole. From such a conception, the working hand of the architect [Tektonen] fashions each member into a corporeal scheme, which for the cultivation of space most perfectly fulfils each member's unique function and structural interaction with all other members. As one endows a form with an appropriate building material, and indeed with the form of an architectural member, as one arranges all of these members into a self-sufficient mechanism, the material's inherent life, which in a formless condition is resting and latent, is resolved into a dynamic expression. It is compelled into a structural function. It now gains a higher existence and is bestowed with an ideal being, because it functions as a member of an ideal organism."

The Albertian notion of *concinntas* or the Kantean notion of "purposiveness", one could say, would again be referred to by another German architect, Semper who attributed to architectural forms a rather evolutionist theory, comparing architecture to nature, and its simple set of ruling laws. Perhaps inspired by Laugier, since these were the times for gothic revival, Semper defined four principles which justify the origins of architecture and its relations to corporeal needs: hearth-making, mounding, roofing and walling. Semper developed these simple architectural archetypes to justify the human body's need for protection and also relating it to social rituals like sitting around a fire and weaving the walls for protection of the tribe. (Figs. 6.06 and 6.07)

The roof would protect the fire from the rain, and help to preserve the fire and the tribe together. The weaving or dressing of the walls was considered the most important element and here one can read a corporeal meaning for the primordial hut's walls as a protective skin. Semper related this to the question of ornament and how the weaving of the protective textiles was used in other cultures, such as the Egyptians and Assyrians, to communicate metaphors and symbols.

He was therefore interested in how these traditions were passed from one generation to the other, leading to the evolution of style and construction techniques, mainly manual crafts.

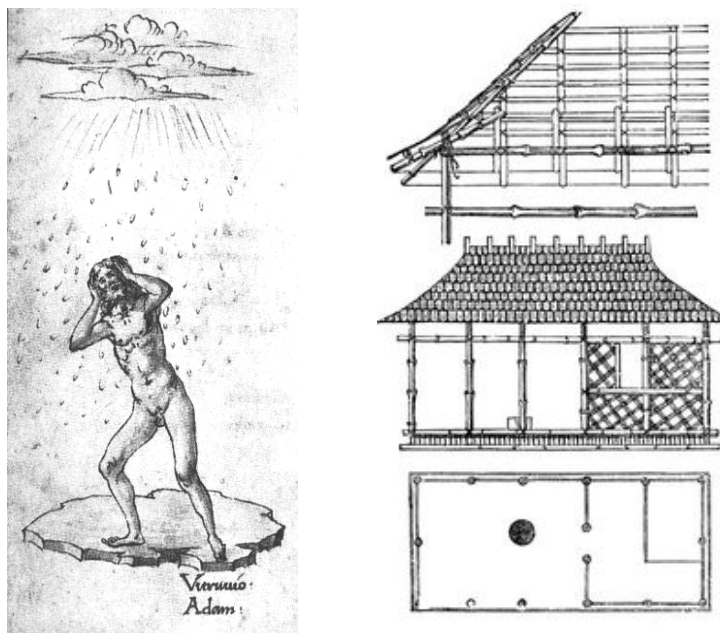


Fig. 6.06: Antonio Averlino Filarete. Adam in Vitruvius, on the origins of architecture. c. 1465.

Fig. 6.07: Gottfried Semper. Primitive Hut. 1851.

Semper also wasn't the only German with an interest for the question of Style. Following the contemporary obsession with historicism, the King Ludwig II of Bavaria would play a very important part, or in other words being highly involved from the original concept, to the spatial planning and the last decorative details, concerning the construction of castles in the historicism fashion, being the *Neuschwanstein* Castle the most famous. Ludwig was inspired by Richard Wagner's ideas on the *Gesamtkunstwerk*, or total artwork, which Wagner hoped to achieve through his music, especially in Opera.

Richard Wagner also had an important friendship with Semper who would be celebrated by his project for the Opera of Dresden. (Fig. 6.08)



Fig. 6.08: Gottfried Semper. Opera of Dresden. 1837 – 1841.

Ludwig II, sometimes called “The Moon King” for his emotional sensitiveness, would become one of the greatest symbols of Romanticism. His idea for the *Neuschwanstein* Castle came from his admiration of Wagner’s work since the age of 15, his fantasy filled imagination and his interest for the medieval past. Ludwig had visited 1867 the ruins of the Chateau de Pierrefonds which Eugène Viollet-le-Duc was adapting to a historicist palace. Viollet-le-Duc was a French architect famous for his Gothic Revival building restorations, most importantly his work on Notre-Dame de Paris, and his interpretative drawings on gothic sacral architecture which became object of study in the French Academy. Viollet-le-Duc also was responsible for implementing the ideas of conservation and restoration of the historical architectural heritage. This had a high impact on Ludwig who was an

extremely cultivated man but also a dreamer who wanted to preserve the true spirit of Bavarian identity in his castles. (Figs. 6.09 and 6.10)

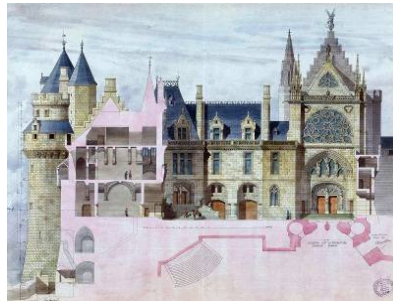


Fig. 6.09: Eugène Viollet-le-Duc. Chateaux de Pierrefonds. Façade drawing. 1858.

Fig. 6.10: Eugène Viollet-le-Duc Chateaux de Pierrefonds. Section. 1858.

The commission for the project of the castle of *Neuschwanstein* was given to a stage designer, Christian Jank and later to an architect, Eduard Riedel. Ludwig wanted to pay homage to the medieval legends, building a castle suitable for Kings in the Romanic style. The castle wasn't built to receive the court, but as a retreat for the King, where he could dwell as if immersed in a stage play. The castle's interior featured murals alluding to the operas of Wagner, the Holy Grail, an artificial *Grotto* equipped with a mechanical waterfall and a rainbow machine, a swan boat and other symbols. These elements contributed to create an atmosphere which recalled the German legend of *Lobengrin*, the Swan Knight. The swan would later become the symbol of the *Jugendstil* the German form of Art Nouveau. The servant's circulation areas were restricted, confining them to the service areas, leaving the rest of the rooms for the exclusive use of the King, securing his privacy.

It also included modern facilities of the time such as elevators, flushing-toilets, running warm water and central heating and the profuse interior decoration consisting of refined tapestry, furniture, pottery and other handcraft produced by the local artisans of Bavaria. (Figs. 6.11 to 6.14)



Fig. 6.11: Christian Jank. *Neuschwanstein* Castle. 1869.

Fig. 6.12: August von Heckel. Illustration of the *Lobengrin* at the *Neuschwanstein* Castle. 1886.



Fig. 6.13: Eduard Riedel. *Neuschwanstein* Castle, *Grotto*. 1869 - c.1892.

Fig. 6.14: Eduard Riedel. *Neuschwanstein* Castle, *Throne room*. 1869- c.1892.

Ludwig would only use his castle for 172 days and at the time of his arresting in 1886, the work was associated with scandal as the King's debt had grown extensively with the investment made in the projects of the other two famous castles, the *Linderhof* Palace in rococo style and the *Herrenchiemsee*, a baroque monument to absolutism. (Fig. 6.15) Still, many centuries after the King's death, his castles remain some of the most important symbols of the state of Bavaria and are considered among the best pieces of historicist architecture in Europe.



Fig. 6.15: Christian Jank. *Herrenchiemsee* Palace. 1878-1895.

It wasn't only in Germany that the interest on the Middle Ages and the work of craftsman would appear. In England in 1848, a small group of artists, architects and intellectuals called the Pre-Raphaelite Brotherhood, inspired by the legacy of the art of the Middle Ages and especially with a taste for the gothic and the sublime, created a significant revolution in art.

Subversive in nature, the Pre-Raphaelite Brotherhood, with the support of Morris and Ruskin, believed that industrialism was rendering mankind, and therefore contemporary aesthetics, to a devoid and soulless state. (Figs. 6.16 and 6.17) They took inspiration from the social order of the middle ages as well as its aesthetics and explored an utopian world where guilds of craftsmen would transmit their corporeal knowledge from master to apprentice, the same happening in other arts.

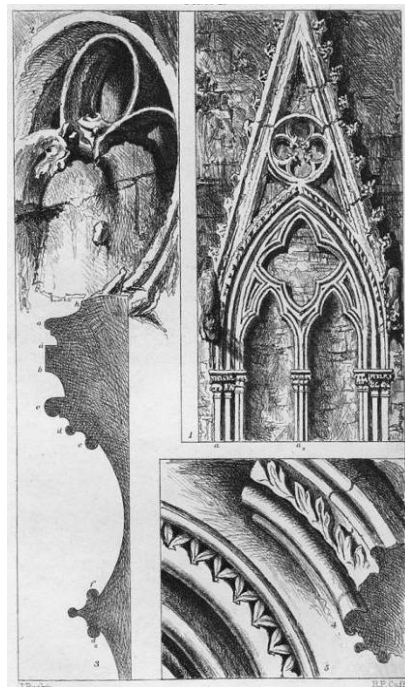


Fig. 6.16: John Ruskin. Plate VII, in “The Seven Lamps of Architecture”. 1855.



Fig. 6.17: John Ruskin. Watercolour in “The Stones of Venice”. 1845.

The Pre-Raphaelites also worked with the mythologies of Arthurian legends and other contextual narratives such as fables and folk stories, as they believed these were closer to the values that could redeem and inspire their contemporaries to look for a more dignified existence.

They also believed these were more appropriate in the British context, instead of taking inspiration from the Greco-roman past. Radical in spirit, the Brotherhood spread their values through painting, poetry, fiction, crafts, lectures and exhibitions and at their time they were considered, justly, highly subversive. The models chosen to pose for the paintings weren't classical beauties and their bodies were represented in a slightly un-naturalistic style which mixed corporeal, ornamental motives with flowing fabrics, suggesting sensuous, free bodies on the inside, the opposite of Victorian disciplinary morals. (Fig. 6.18) Still, the Brotherhood had a lot of support and important patrons.



Fig. 6.18: John William Waterhouse. *The Lady of Shalott*. 1888.

Besides painting, this was the beginning of the arts and crafts movement which was deeply encouraged by Morris (1834-1896), who implemented the principles of craftsmanship in his factory. (Figs. 6.19 to 6.20) Besides being an intellectual and social reformer, Morris was also a writer of fiction and it was through this medium that he transmitted his ideal vision of a harmonious society whose close contact to nature and manual work, rendered mankind happy, healthy and prosperous. Here were also encoded the ideals of socialism, which Morris endorsed through speeches in conferences but also by direct contact with workers waiting at factory doors.



Fig. 6.19: William Morris. Garden Tulip wallpaper. 1885.

Fig. 6.20: William Morris. Book illustration of one of Kelmscott Press's editions. c. 1891.

The arts and crafts movement and the interest for nature wasn't only a direct reaction to industrialization, but fundamentally a philosophical reflection on how to harmonize the use of new technologies without losing track of historical and cultural

heritage and eventually bringing industrial work closer to humanist values. This comes from the considerations taken on the role of repetitive mechanical actions in the human body/mind and the sense of non-fulfilment that can come from the absence of creative, manual work. Morris also had a fundamental role in affirming the notions of patrimony and monument, bringing to attention the importance of preserving the knowledge of the techniques used in the traditional construction-oriented crafts, in order to be able to continue the maintenance of historical buildings and preserving their integrity as much as possible.

It was in order to preserve the knowledge of old craftsmanship, usually transmitted from master to apprentice, that inspired by the arts and crafts movement in England, other countries in both Europe and America would develop their own interpretations and the philosophy of a new style which through the unification of all the arts would dignify human existence and celebrate it as a part of nature. (Figs. 6.21 and 6.22)



Fig. 6.21: Charles Rennie Mackintosh. Argyle Chair. 1898-1899.

Fig. 6.22: Charles Rennie Mackintosh. Stained Glass window in House for an Art Lover. 1901.

Of course one can immediately identify Rousseau's ideas regarding a return to nature, but the birth of art nouveau was mostly inspired by romanticism, the desire to get closer to nature and to use the new technological developments to achieve this in the search for a new style as an answer to the excesses of historicism. The concern with nature and the aesthetical quality of life of the inhabitants of the large cities where the style bloomed can be seen as an early manifestation of what in the 20th century would be addressed as sustainability.

The Art Nouveau defendants insisted on the use of local materials, techniques and craftsmanship in order to produce objects which were faithful to the organic yet geometrically simplified style of its creations. This had the direct influence of oriental art in its clear geometry and organicist themes. In the case of the art nouveau, mythology and folklore were recurrent and frequent topics, but also references from paganism can be traced, especially in the *Jugendstil*, the German variation of the style. (Figs. 6.23 and 6.24)



Fig. 6.23: Katsushika Hokusai. The Great Wave off Kanagawa. c. 1829–32.



Fig. 6.24: Unknown author. c. *Wohnhaus* Franz-Joseph-Str. 19, Munich. 1890.

The art nouveau was also present in the art of the poster, one of the highlights of the beginning of the 20th century, since its deliberate sensuousness was most appropriate to promote products such as wine, cigarettes, chocolates and other delicacies. (Fig. 6.25)



Fig. 6.25: Alphonse Mucha. The Four Seasons. c. 1895.

Figures of women appeared as naked or half-draped nymphs, celebrating the curves of their bodies and generally smiling joyfully, instead of the rather serene expression from classical sculpture. Apart from the eroticism of the extremely decorative style of art nouveau, its influence in architecture was manifested in the use of the curve also for spatial configuration. Gaudi's Casa Batló is an example of how the spatial configuration of the interiors through the use of curves and rooms with more than one door was revolutionary in the sense that it permitted different functions for each room, and different areas of circulation.



Fig. 6.26: Antoni Gaudí. Interior of Casa Milà. Barcelona. 1906 - 1910.

Fig. 6.27: Antoni Gaudí. Interior of Casa Batlló. Barcelona. 1904 - 1906.

It was the birth of a new kind of design, which could evolve according to the needs of the users and their more flexible habits. (Fig. 6.26 and 6.27) The curve theme was especially present in the work of the Belgian Architect Victor Horta, who is credited for designing the first architectural building in the new style. Horta's design for the Hôtel Tassel was completed in 1892, featured a semi open-plan floor design and incorporated curvilinear iron forms with stone in the outside walls. (Fig. 6.28) It would be through the prolific work of the also Belgian architect Henry van de Velde, who became exceptionally influential in Germany, that the architectural circles would be radically stirred, involuntarily leading towards Modernism, with Adolph Loos and his open attack to ornament.

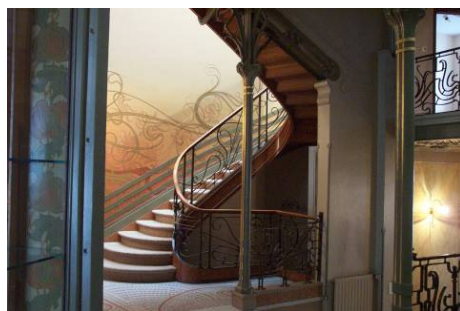


Fig. 6.28: Victor Horta. Hotel Tassel, interior with iconic stairway. 1893 - 1894.

Chapter 7

The Material Body and The Mechanical Body

This Chapter discusses how Freud proposes the notion of archetypes after psychoanalysis. Psychologists study aesthetics as a scientific problem related to "empathy." Vischer and Lipps propose "empathy" as a result of emotional bonding. Vischer proposes that empathy occurs as the human body engages with objects which arouse feelings of similarity, seeing the subject who experiences empathy as mirroring himself in the perceived objects. Wölflin proposes a psychology of architecture questioning "How is it that architecture forms are able to express an emotion or mood?" Henry van de Velde related "empathy" to the "total-artwork". Birth of Phenomenology and Taylorism takes place. The focus shifts from the Theme Park to the Assembly-Line.

An extremely important factor regarding the end of the 19th century is the influence of psychology and evolutionary theory which offered alternatives to the open questions of metaphysics and especially the growing awareness of the notions of the conscious, the unconscious and archetypes. The concept of archetype, especially its connection to psychoanalysis and Freud, was particularly interesting for architecture as it allowed the creation of a symbolic system of categorization of architecture, both in terms of spatial organization and of building elements, particularly through the use of architectural or spatial metaphors to describe emotional states and vice-versa. So, the question of “style” would also bring along the notion of “type” and its relation to “canon” and what this represents in terms of symbolic meaning.

The reader now might feel a little lost as we are in a new chapter and still discussing the 19th century. The reason for this lies in the necessity to explain the complex context from which a new theory on aesthetics would appear. Such theory is the notion of “empathy” or *Einfühlung*, in its German meaning and it is to Mallgrave’s lifelong interest in the questions of German aesthetics that the author owes much of this subchapter’s content, and most importantly, the theoretical justification of the historical background for some of this thesis main arguments, explored through practice as explained on Chapter 12. Besides making a vast collection on the topic of emotions and empathy in architecture, Mallgrave states that it was necessary to wait until the development and use of brain-scanning technologies in the areas of cognitive and neurosciences at end of the 20th century to bring these topics back into architectural discussion. The theoretical foundations of this research found its missing link precisely in the *Einfühlung* theory and its connection to the emotional experience of art, most specifically, in the architectural discussions of the beginnings of the 20th century.

The first step towards the foundation of a theory of “empathy” was taken by the German Friedrich Vischer (1807-1887) who was largely influenced by Semper (1803-1879), both refugees in Zurich by 1866. Already in 1851, Vischer had started to address the problem of “symbolic art” regarding architecture, having classified the task of the architect as the one who manipulates matter by infusing it with life through the linear and planar suspension of its parts. Thanks to Semper’s influence, Vischer started to approach the problem through a physiological basis that justified the tendency of the brain to connect emotionally and symbolically with art forms. He risked asserting that probably there were neurological modifications happening inside the brain as the result of the body’s exposure to certain objects that had a specific resonance in the sensory system. These, would allow the brain to create a particular symbolic representation, or an image, that represented the emotional moods of the viewer.

According to Mallgrave, Vischer further notices that “*vertical lines elevate the human spirit, horizontal lines broaden it, curves move more energetically than straight lines; the brain has an impulse to fashion this symbolic and emotional reconfiguration of the world as a unifying and contractive feeling, that is, as the “pantheistic” (animistic) urge to read our emotions and ourselves in the forms of the sensuous world*”. This was still a first theory on the subject, and it would be Vischer’s son Robert to follow his father’s steps and coin the concept of *Einfühlung* as an in-feeling or feeling-into which actually doesn’t have a perfect equivalent in the English language. More than just an emotional bond between the viewer and the object he perceives, it is rather a reading of these objects through collective (cultural and context related) and personal

experiences. Vischer was also highly influenced by Freud's archetypes and the idea that while we dream, our subconscious produces metaphorical or symbolic allusions to our body, for instance, represented through images of a house as a projection of our corporeality (meaning organism and soul) into the form of the conceived object. Still, Vischer wanted to prove that his theory had a physiological and neurological basis and here he adds the concept of "similarity" as the harmony between object and subject, instead of a property in the object itself. He went on further stating that we relate objects to our bodily form but also that the objects themselves might present certain features that excite our muscles, nerves or visual apparatus.

In a more complex level, if we understand these small perceptions in a whole, or feelings, we can relate them to certain psychological responses and conclude that our empathic relationship with an object is physiognomic (by relating to its appearance) or emotional. Mallgrave adds to Vischer's definition that we have a physiognomic understanding of the world because we have bodies and this relationship inspires empathy when we read our emotions and personalities into the objects of the world and the key to our experience in art lies in our ability to use our imagination, which means, our ability to transport ourselves into the object dedicating to them our vital energy. Vischer goes on giving the examples for "expansive feeling" and "contractive feeling" that one can feel while looking at a large object, for example a cathedral in the first case, or a small shell in the second which makes us transpose the feeling of our own bodily features into the scale or properties of the object.

Regarding the question of harmony, Vischer works over the Kantian notion of "purposiveness" adding that harmony does not result from certain mathematical proportions as attributes to the

objects themselves, but from our own bodily (mental) disposition to engage with certain objects, due to the feelings they produce in us. The same could be applied for feelings of harmony and balance or also by an object characterized by its complexity, as long as it arouses in the body neurological associations which trigger something in his equally complex neurological constitution or in which the viewer can mirror characteristics of himself, a “*strengthening or weakening of the general ‘vital sensation’.*”

This particular thought is of extreme importance since it was already a premise of the “mirror-neurons” theory that would be established by the end of the 20th century in the context of neurosciences. Regarding architecture, and apart from the theoretical writings of authors such as Pallasmaa or Mallgrave, there still is no established work about the influence of the mirror neurons and our empathic capability to read buildings through our bodies. The author also finds impressive that this knowledge is usually not incorporated in the teaching and practice of architecture either. Such issues were addressed specifically in the Experiments described on Chapter 12.

For now we continue with the beginnings of the *Einfühlung* theory and therefore advance to 1886 and Wölfflin’s proposal of a psychology of architecture. Wölfflin was an art historian who developed a doctoral thesis based on the question “how is it that architectural forms are able to express an emotion or mood?”, a question which is also asked with the present thesis along with “how is it that architectural forms are able to induce an emotion or mood?” The answer lies exactly in the concept of empathy and the properties of the mirror neurons, and the reciprocal relationship or transference that occurs between subject and object.

On the contrary of Vischer, who emphasised the role of imagination in such a process, Wölfflin concentrated his focus on the concept of “expression”. Thus, for him forms express a physical character only because we possess a human body, clearly an anthropomorphic view which basically means that we transfer our own form into the objects we perceive through our own bodily organization. For instance, if a building produces a sense of unease in a body it is because it disturbs the body’s own sense of balance. A strategy which would be consciously used in the late 20th century by Libeskind on his design for the Jewish Museum, with the specific purpose of expressing feelings of disorientation, disturbance and disquietude. (Fig. 7.01 and 7.02)



Fig. 7.01: Daniel Libeskind. Interior of the Jewish Museum in Berlin. 1992 - 2001.



Fig. 7.02: Daniel Libeskind. Detail of interior of the Jewish Museum in Berlin. 1992 - 2001.

Wölfflin would subscribe Semper's view of architecture as the result of a "conflict between matter and force of form (*Formkraft*), an energetic animation of the masses", so these masses would be animated by our moods, expressing the emotions that come from our own embodied condition. As Vischer relates architecture to the concepts of "regularity, symmetry, proportion and harmony", Wölfflin reduces architecture's expressive elements to "proportionality, horizontality, verticality and ornament." The question of ornament was of particular importance, for instance in the case of Art Nouveau. For Wölfflin, ornament was the expression of excessive force of form, responsible for experiencing architecture with every muscle in one's body, a view which was shared by Henry van de Velde, one of the architects at the time following closely the *Einfühlung* theory. (Fig. 7.03 and 7.04)



Fig. 7.03: Henri van de Velde. Interior of a dining room with decorative wall panels by Paul Elie-Ranson. 1895.



Fig. 7.04: Henri van de Velde. Reception Dress. c. 1902.

Van de Velde would adopt it for the creation of a new style, which advocated the avoidance of direct historical references, in order to ban banality and cheap, meaningless reproduction of objects from people's minds. He managed to take this concept far, being many of his works the best examples of the ideas of the *Gesamtkunstwerk* and would later be directly attacked by Loos for his appraisal of ornament. Van de Velde was also influenced by the philosopher Lipps (1851-1914), who in turn would also be interested in Vischer's concept of empathy, as aesthetic sympathy.

Lipps was greatly admired by Freud for his support on the theory of the unconscious and would later in his life become a disciple of Husserl (1859-1938), the founder of Phenomenology, or the study of essences, which we will refer to later in the text. Besides the question of empathy, which Wölfflin according to Mallgrave seems to have lost interest by the end of his thesis, we risk supposing that perhaps it was due to the lack of machinery to justify his theories empirically, with quantifiable data. His attention was also dedicated to the question of architectural "styles" and how they can be read as a direct translation into "form", of the collective "attitude and movement of people." This would explain why every period has a characteristic style and therefore "form" could be read "as an expression of a certain mood of the time." By the same time, in 1886, Goller who was a professor of architecture at the Stuttgart Polytechnikum, wrote an essay called "What is the Cause of Perpetual Style Change in Architecture" in which he excludes the questions of style or symbolic meaning and focuses primarily in the faculty of imagination as the main source for the aesthetic appreciation of architecture, therefore as a psychological act and discarding current theories on the role of physiology and corporeality in the experience of emotions.

According to Mallgrave, Goller defined architectural experience as “*an inherently pleasurable, meaningless play of lines or of light and shade.*” Regarding the question of “Style”, already approached by Semper, Goller defines it as the “*unconscious mental cause of the pleasure we take in that form*” that is generated in a collective “memory image”, which lasts as long as the individuals of this particular culture or time in history find pleasure in. Of course this leads inevitably to a point of saturation, in which the style finds itself exhausted, as the minds of the context had already gotten bored with it.

The spectators and the architects don't find anymore pleasure in the same old forms and it is up for the architects to create new solutions which usually lead to excess and to a “baroque” state of the style. Of course one must immediately think again about Art Nouveau and its excessive use of ornament. Goller himself, perhaps predicting a necessity for another change of Style in architecture, affirms that during this process of formal oversaturation, what he calls the law of “jading” or *Ermüdung* the architects last alternative is to “*simplify greatly the vocabulary and offer entirely new forms in order to generate a new memory image, which will then undergo a similar dialectic process of change*”, generally cyclical. We have already referred to Henry van de Velde and to Adolph Loos' open attack to his work (Loos, 1887-1930). Loos would describe the “appalling” ornamental style of van de Velde, starting from the architecture, to the furniture, decoration and even the dressing and accessorizing of his wife, all to match the style of the house. (Fig. 7.05)

Loos had cut his ties with the Viennese Secession, drawing parallels on “primitive” forms of ornamentation such as tattoos and making connections with them and the tendency for crime or social deviation. The comparison is transported to the field of architecture and Loos’ work is defined by a set of “organicist” principles which come closer to the classical vocabulary of architecture, such as purity of form and especially truth to the material, but assembled through a new spatial concept, the *Raumplan*, and the absence of excessive ornament.

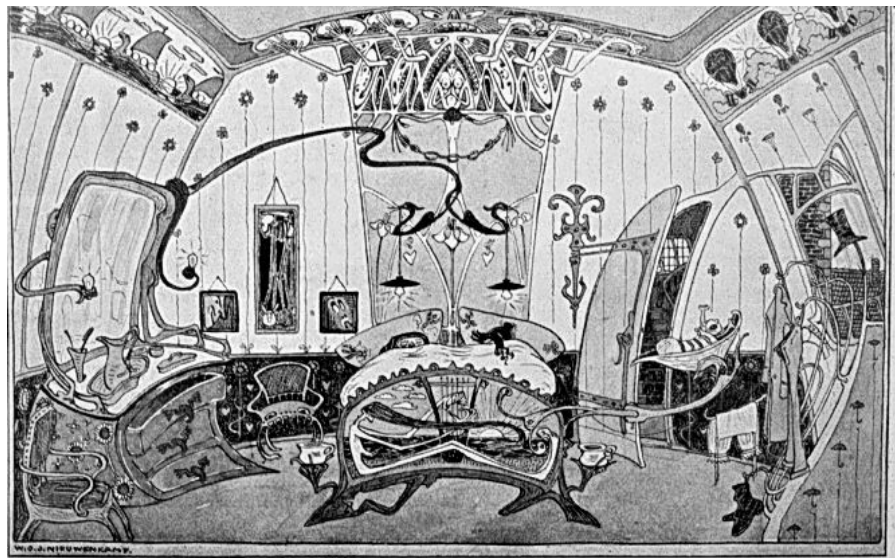


Fig. 7.05: Lustige Blätter, Berlin "Van der Blöde" Parody of van de Velde's designs. c.1905.

This doesn't mean that Loos was in favour of the extreme “purism” that later Le Corbusier would promote. His approach to “organicism” was meant by the use of refined or even luxurious materials such as marble stone, exotic woods and the finest leathers. Loos collected them along silver pieces and other fine goods. (Fig. 7.06)

Loos found that the simplicity and truth to the material would serve as decoration by itself, without creating too much visual noise.



Fig. 7.06: Adolf Loos. Interior of the American Bar, Vienna. 1903 - 1908.

Loos also was particularly interested in the spatial qualities of architecture, treating space as a material in itself and defining the designs' configuration not through plans, sections or facades, but through a spatial continuity between the rooms which is given by a cubic treatment of the space itself. For Loos there are no rooms or floors, but only space and the interconnections that this has with all the building elements to have a coherent reading of the design as a whole. (Fig.7.07)

Here it is easy to find references to Alberti, although Loos opted for designs with a rationalized and rather stripped appearance, and especially a new spatial vocabulary with the use of such “layered space.”



Fig. 7.07: Adolf Loos. House in Michaelerplatz, “Looshouse”. 1910.

It is still possible to trace some connections with the architecture of other members of the Viennese Secession such as Jože Plečnik (Fig. 7.08), who would be responsible for much of the architectural identity of the city of Ljubljana in Slovenia and was commissioned for the renovation of the Castle of Prague in 1920. Although a member of the Secession, Plečnik introduced abstracted forms in the classical repertoire, being one of the main influences on the polygonal

architecture of Czech Cubism (Fig. 7.09), a very specific case in the history of architecture which developed between both world wars.



Fig. 7.08: Jože Plečnik Church of the Most Sacred Heart of Our Lord, Prague. 1929-1932.

Fig. 7.09: Josef Chochol. Residential building in the Czech Cubist style, Prague. 1913.

Thus, it is possible to conclude that even within the Secession there were already signs of saturation of the Art Nouveau style. Also, as Loos pointed out, the question of ornament was indeed a corporeal problem since, besides its symbolic interpretations, it was also related to the positivist approach to the body as a material which can only be rendered “efficient” and “decent” through hard discipline. It is interesting also to note that in his private life, Loos had a rather bizarre tendency to be interested in very young girls, from which one could draw a parallel between the youthful and slim forms and their simple attire, and the difference to the usually plump and ornamental body of the full grown bourgeois woman. *Ornament and Crime* is full of corporeal examples, and Loos uses them in a rather moralist tone, to show that for him these questions weren’t only a matter of aesthetics but mostly ethics. Modern man should rely on ornament to expose his individuality as simplicity showed he was spiritually superior.

From the beginning of the text one understand the direct influence of Darwinism, at least in what concerns the evolution of the human being both in terms of culture and in personal's maturity. For Loos, the primitive man had to rely on ornament to fill his time as a source of joy, taking it away from him would be as equal as telling him there was no God to put his faith into. Instead, Modern man didn't need this, being only a waste of time and energy. Loos defended that this "childish" behaviour was a sign of degeneracy and that industrial society shouldn't allow mankind to waste time with this primitive kind of work, leaving their minds free to indulge in higher subjects. But in fact, Loos had been even more influenced by American construction logic or rationalization that he was exposed to during his visits to New York and Chicago. (Figs. 7.10 and 7.11)



Fig. 7.10: Charles C. Abbotts. Rockefeller Beam Workers Lunch. c. 1900.



Fig. 7.11: Louis Sullivan. Prudential Building in Chicago. 1896.

Sullivan's work made such a strong impression that Loos immediately transposed the values of scientific management for architecture and life itself, defending a strict abidance to the laws of the market. Following this logic, even meals should be simple and done as quick and efficiently as possible, without the burden of hours of work.

The same would be applied to the fabrication of objects, which shouldn't be ornamental at all representing only a waste of vital energy of the workers. (Fig. 7.12)

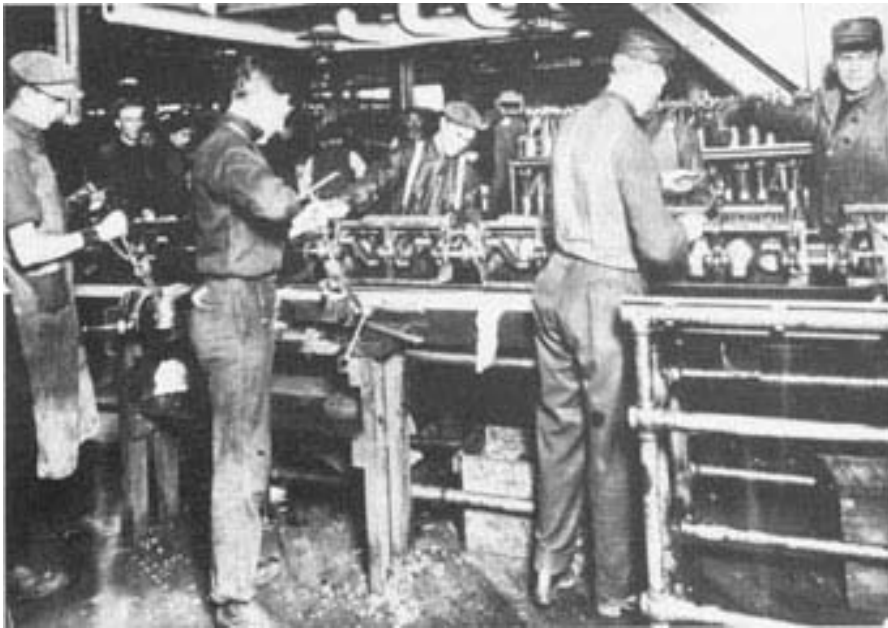


Fig. 7.12: Unknown author. Factory workers. c. 1900.

Sullivan was already largely influenced by a certain logic of “market”, which considered construction sites as assembly lines and therefore, workers actions were already coordinated in such manner to avoid waste of time and resources. The new large buildings of Chicago were proof that the rationalization of the design would be transferred directly into the economic efficiency of the investment, saving both time and money. This logic of work was characteristic of Taylorism, a set of philosophical principles which had the purpose to manage factory workers production through scientific management.

Naturally this was meant with the logic of profit and so the notion of standardization also came to being. It was necessary to reduce the diversity of design options in order to optimize the production process as much as possible, saving time and resources. Regarding the labour conditions, this also meant that there would be no need for special skills or craftsmanship since each member of the assembly line was generally confined to a single task, all day everyday of his work time at the factory. (Fig. 7.13) This could be something as simple as screwing the heads of a doll, a seemingly repeated action which led to both tedium and specific injuries related with the overstrain of the body in a single task for a long time, and also to a sense of alienation as the kind of work itself didn't allow any kind of interaction or creative output.



Fig. 7.13: Unknown author. Henry Ford Assembly Line. 1913.

Taylorism wasn't the only set of ideas with the purpose of implementing efficiency in the production line. In fact, there were competitor theories such as Fordism which applied similar principles to the evaluation of efficiency, including time and movement studies. (Fig. 7.14)

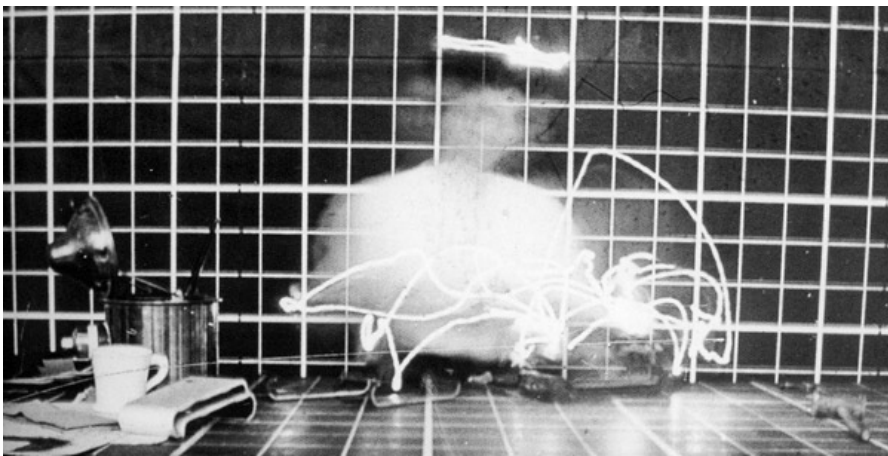


Fig. 7.14: Frank Gilbreth. Chronocyclograph. Efficiency Studies. 1908 - 1924.

These were particularly important since it didn't take much time to realize that workers efficiency and productivity levels also depended on factors such as levels of strain, speed of other colleagues in the production, possibilities or not to take breaks and so on. In the end the major difference between Taylorism and Fordism specifically was that the second already relied on strategies of incentive to make workers feel that their actions were part of concrete goals which they would eventually also enjoy and take part – mass production in such assembly lines would allow a worker to get one of the products himself. This had double advantages for the producer who could extend the range of clients and second it would give workers the rewarding feeling that they belonged to a certain group and shared the same values.

In a way, the traditional spirit of the craftsmen's work in guilds had been transposed to the production line. The human factor was mostly illusory, as knowledge in the assembly lines wasn't transmitted from master to apprentice, but registered also through mechanical means, to be served in the optimization process, over and over again. Photography had taken a major part in this process, as it allowed the study of the motions of the workers in detail, at different times of their performance. The purpose was to reduce "inefficient movement" to make the workers concentrate only in the ones strictly necessary to the accomplishment of the task at hand, also making the monitoring of their performance easier, making it possible to correct assembly flaws and optimize results as much as possible. Video was also used, as the end of the 19th century also brought along the expansion of the moving image, which would be fundamental in shifting the perception of space and time in the next century. The mechanistic view of the human body, and of course the technological developments brought by standardization and the optimization of the assembly line allowed for another jump which made time run even faster than at the beginning of the 20th century. The next years would bring the death of the material body of labour and the birth of the virtual body, which would make it appear omnipresent and immortal. At the same time, philosophy was also starting to address the question of essences and the beginning years of the 20th century saw the birth of phenomenology, a discipline dedicated to the study of modes of consciousness, as the result from embodied experience, pinning down the importance of new concepts such as empathy and intersubjectivity in the psychological constitution of mankind.

Husserl would be the first to approach this problem but soon his disciples such as Edith Stein who dedicated her thesis to the topic of “empathy”, would spread it through Europe, especially Germany, where the matter had already been addressed on the aesthetic field.

Chapter 8

The Essential Body and The Performative Body

This Chapter relates how the Baby-boom generation recovers from WWII with the exponential growth of cities, mass construction, and a progressive dependency on technology and natural resources. It describes how Bodies become a commodity, pacified. Increased mediatisation of culture and life through television, film, computer, and internet occurs. Man lands on the Moon, the body beats gravity through the aid of technology. The Body becomes a cyborg. First successful cloning of organs and animals is achieved. Embodied architecture evolves from the Labour Camp to the Suburban House.

As referred to before, phenomenology appeared in the twenties in Germany and was established mainly by the philosopher Husserl (1859-1938) as the study of essences and modes of consciousness, although also developed by Hegel (1770-1831) who was more interested in exploring “phenomena” as connected to the Spirit since in the German language the same word, Geist, is applied to mind. These two main branches of phenomenology, respectively “transcendental phenomenology” and “dialectical phenomenology” would be developed mostly by two philosophers, the first by Merleau-Ponty (1908-1961) and the second by Heidegger. (1889-1976) These would become in the second half of the 20th century the source of inspiration for some of the most significant approaches to architecture revealed in both theory, with the writings of Norberg-Schulz (1926-2000), Pallasmaa (1936-), Pérez-Gómez (1949-), Rykwert (1926-) and Thiis-Evensen (1946-) and in practice, Steven Holl (1947-) and Zumthor. (1943-) These authors defend a phenomenological approach to architectural design, trying to express in their work the sensorial experience of the body in architectural space, “*a unique way of being that speaks to all my senses at the same time*”, as stated by Maurice Merleau-Ponty in his “Phenomenology of Perception.”

Husserl would also have as a disciple the already referred to Edith Stein, who did her doctoral dissertation under Husserl’s orientation. To the author’s knowledge her ideas on “empathy” haven’t been considered yet in the field of architecture, remaining an open door for discussion. Stein followed the phenomenological reduction to approach the topic of empathy and her text is an example of how this method is based on the conscious direction of one’s attention to the body in an effort to understand the process that constructs interpretation and meaning. It also reveals an unexplored reflection on the performance of the human body in space, as experienced by oneself.

Here one sees the indirect influence of Vischer, whose ideas on empathy had been adopted by Lipps, who would incorporate later in his life some of Husserl's ideas on phenomenology, who in turn was very critical of Lipps' psychologism, defending experience as the source of all knowledge and breaking with the pure empiricism advocated by positivism in philosophy and science. It was through Husserl's influence that the generally accepted Cartesian division between body and mind was finally broken and phenomenology would reflect and influence the aesthetic that generated many of the artistic avant-garde manifestations of the first half of the 20th century. Phenomenology brought attention to the matter of consciousness and along with it the importance of the concepts of space and time, matter and memory, the real and virtual potentialities of the mind. Most importantly, phenomenology tried to solve such old dichotomies, by adopting a unified approach considering both elements as simultaneous parts of a whole. An interesting detail which is usually disregarded is Husserl's early years' relationship to mathematics. In fact, Husserl did his PhD in mathematics, which explains the importance he would give to logic and justifies his disliking for psychologism. Therefore, since its foundation phenomenology seeks to be scientific, defending an objective analysis of topics such as consciousness, perception, emotion, intuition and judgement which are usually regarded as subjective.

This came from a growing awareness of the importance of keeping the health of the bodies in the city, but also as a reaction first to the enthusiasm, then to the excesses of Positivism. *Koerperkultur* represented at first liberation and this meant from traditional gastronomy habits, to women's and men's attire, to their social roles as individuals or couples and of course their relation to society and the city.

“Garden cities,” followed a method of urban planning initiated by Sir Ebenezer Howard in England in 1898 and where idealized as places where self-sustaining communities, on a rather small scale, could enjoy the closeness of nature and support their inhabitants with locally produced goods. Some of these communities didn’t have exactly the best reputation among the most “common citizens,” as they did attract most of the *avant-garde* and their interest in exploring Vegetarianism, Naturism, yoga or *eurhythmics*. It was near the city of Dessau that such a community was founded, referred to by Mallgrave as the “Hellerau experiment.”



Fig. 8.01: Unknown author. Sanatorium Monte Verità. c. 1907.

Fig. 8.02: Unknown author. The School of Art, managed by Rudolph von Laban. c. 1914.

Many of the Bauhaus Masters had spent time at Hellerau in the Dalcroze institute or even living in the commune at *Monte Verità* in Switzerland, where Rudolph von Laban planted the seeds for the breakthrough of expressionist dance, following Isadora Duncan’s legacy and, particularly, the interest in Greek culture and the pagan traditions of ritual, performance and collective catharsis. (Figs. 8.01 and 8.02) Literature on the subject abounds in the German language, but English publications remain rather scarce. So for the purpose of this literature review, Mallgrave’s work functions as the main source for

reference. According to him, the brain behind the Hellerau experiment was Karl Schmidt, (1873-1948) an ecologist and social reformer who had the goal of producing well-designed furniture for German middle-class and so founded the German Workshops for Handcrafted Art, a predecessor of the *Deutsche Werkbund*. With the success of this first step, noting that the workshops were producing furniture designed by names such as Behrens and Olbrich, Schmidt, his brother in law Riemerschmid (1868-1957) and Tessenow (1876-1950) founded the Deutsche Werkbund, an alliance of more than a hundred artists and industrialists, to be based in Hellerau. (Fig.8.03)



Fig. 8.03: Unknown author. Dalcroze Institute at Hellerau. c. 1913.

Besides Schmidt, the other generative force behind the project for the city of Hellerau was Wolf Dohrn (1878-1914), an intellectual and artistic collector, who made his doctoral degree with Lipps, on the topic of empathy, therefore well versed on the most recent theories in psycho-physiology. Dohrn also happened to be the son of a wealthy maritime biologist and an advocate protector of the German rural landscape.

The idea of Hellerau matured from 1906 to 1910, beginning with the founding of the *Deutsche Werkbund* till the appointment of the swiss educator Emile Jacques Dalcroze (1865-1950) as the director of what would become “The Institute for Rhythmic Dance.” Dalcroze was a professor of Harmony in Geneva Conservatory and viewed music not as an end in itself but as a vehicle for individuals to expand their happiness and creativity, harmonizing body and mind. A rather progressive holistic thinking, that searched for “*a coordination between the mind that conceives, the brain which orders, the nerve which transmits and the muscle which executes.*”

Dalcroze viewed the body as a marvellous instrument of beauty and harmony when it vibrates in tune with artistic imagination and collaborates with creative thought. Dalcroze developed a system of rhythmic gymnastics which he called *eurhythmics*, with the purpose of developing corporeal awareness in young music students, as a way to enhance individual potential with the ultimate goal of a social reform, which would lead for a harmonious working of the whole. Dalcroze’s method was already quite popular even before the foundation of the Institute of Rhythmic Dance in Hellerau. It was during one of Dalcroze’s tours with his students that Dorhn came to know him and become passionate about this project. Dalcroze had also made a very strong impression in Adolphe Appia (1862-1928), a choreographer who was also affirming himself as one of the main promises of the avant guard in the field of choreography and stage design. (Fig. 8.04)

Appia had been influenced by Wagner’s ideas on the Gesamtkunstwerk and believed that theatre should be explored by the director through artistic unity, through the synchrony of dynamic and three dimensional movements by actors, perpendicular scenery and the use of depth and the horizontal dynamics of the performance space.

Appia would influence greatly the world of performing arts, leading towards a reading of the human body in motion, as the embodiment of the virtual potentialities of the mind and imagination in space and time. For this he used a calculated play of light and shadow, which became the signature mark of his stage design style. Appia also influenced greatly the theatre of Meyerhold and his systematic approach to the task of the director.

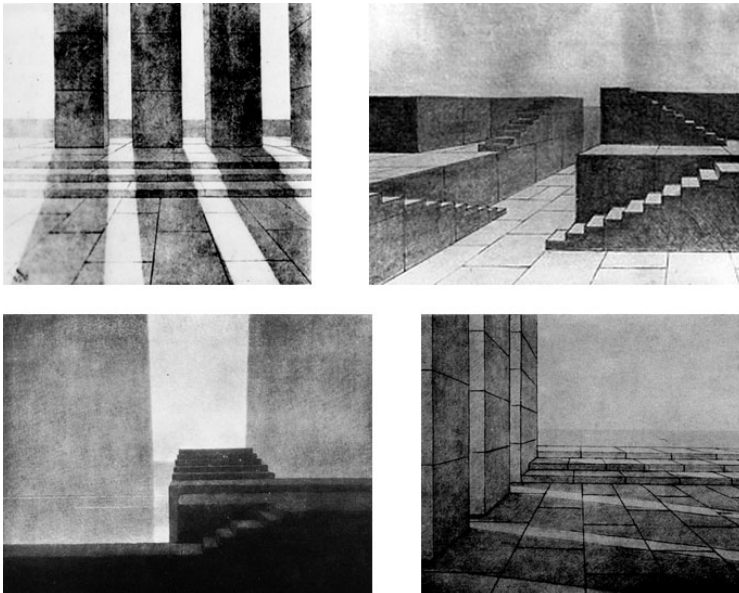


Fig. 8.04: Adolphe Appia. Rhythmic Spaces. c. 1913.

The merging of the actor with the scenography was also one of the intentions of the Futurists, who wanted to make a synthesis of sound, scene and gesture to create a psychological synchronism in the soul of the spectator, compressing in a few minutes of improvisation innumerable situations, sensibilities, ideas, sensations, facts and symbols¹.

¹ GOLDBERG, RoseLee. 2006. *Performance Art, from Futurism to the Present*. (1988). "word of art". London. Thames & Hudson. pp 26.

The Futurists have also outlined rules for the movement of human bodies on stage advising the actor to gesticulate geometrically, in a draughtsman like topological manner, synthetically creating in mid-air, cubes, cones, spirals and ellipses. To explore these concepts, many futurist artists have built and performed with *Übermarionetten*. or life size puppets that would allow exploring with their geometry the idea of a dynamic sensation made eternal through mechanization. Already in the year of 1909, Marinetti's first Futurist manifesto had been published in Russia, providing Russian artists a strong weapon against the art forms of the past.

Futurist ideals were adapted to support a cultural revolution that started with Mayakovsky's 1912 quasi-futurist manifesto "A Slap in the Face of Public Taste" and generated many artistic movements that would grow in the twenties such as Suprematism, Rayonism and Constructivism, this one seen as an ethical proclamation of a social and political revolution that would have a major influence in the development of the aesthetics of the Modern Movement. Constructivist artists believed that to surpass the academism in arts, speculative activities such as painting should be abandoned and artists should use real space and real materials in performances in what they called production art.

This kind of non conventional theatre joined many kinds of performance arts such as circus, puppetry or music hall, and the movement of the human body was being studied with actors on stage, through methods and practices such as the eurhythmics of Emile Jacques-Dalcroze, the *eukinetics* of Rudolf von Laban (1879-1958) and Meyerhold's (1874-1940) Bio-Mechanics. (Fig. 8.05) Meyerhold would become in 1921 the Director of the State Higher Theatre Workshop in Moscow, where he developed bio-mechanics as a system of rules for

actors, based in physical discipline and self-awareness. *“Since the art of the actor is the art of plastic forms in the space of a stage, he must study the mechanics of his body [...] and train this material so that it is capable of executing instantaneously those tasks which are dictated externally”*²

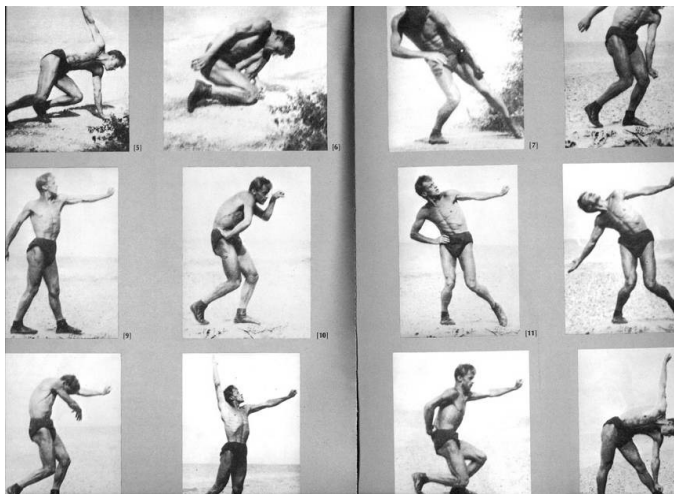


Fig. 8.05: Vzevolod Meyerhold. c. Bio-Mechanics Exercises. 1920 - 1930.

This allowed for a new dynamic style of theatre and, in the words of Meyerhold, the actor could base his art in scientific principles, transforming the entire creative act in a conscious process and this would help him utilize correctly his body’s means of expression to rouse the emotions of the spectator, inducing him to share his performance³. “The Magnanimous Cuckold”, 1922, was Meyerhold’s first staged Constructivist performance, in which the actors were carefully placed and conducted by the director in a rhythmic production. (Fig. 8.06)

² CAMPBELL, Robin; LYNTON, Norbert; *et. al.* 1971. *Art in Revolution: Soviet Art and Design since 1917*. Catalogue from the exhibition in the New York Cultural Center. 9 September to 31 October 1971. New York. pp: 80.

³ _____ *Ibid.* pp: 60-81

The stage set was designed by Popova (1889-1924) and consisted of a series of apparatus that were assembled to each other, working as dynamic extensions of the actor's movements in space.

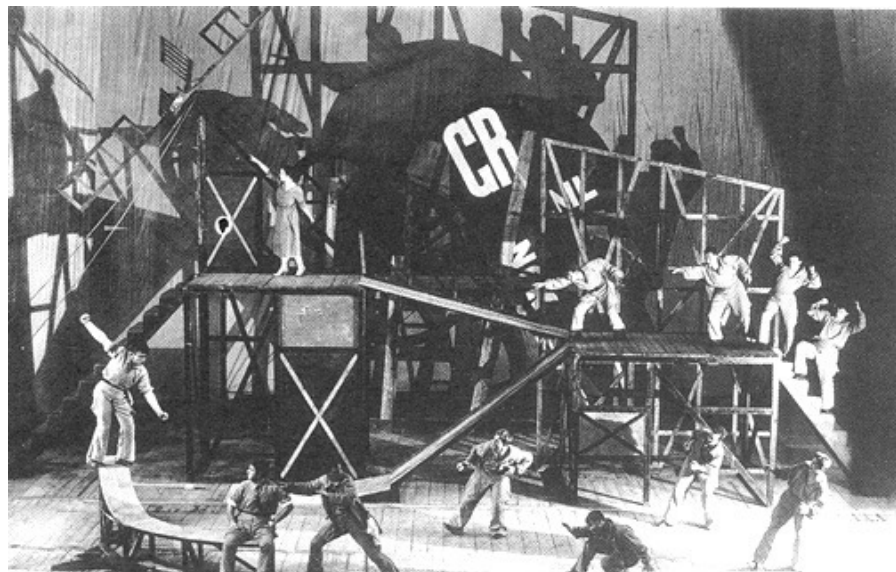


Fig. 8.06: Liubov Popova. *The Magnanimous Cuckold*. 1922.

The Bauhaus would also be under the influence from such Constructivist approach, since both the Ballet Russes and other artist from Eastern Europe were frequently touring through Germany. Performance art was a very important part of the Bauhaus curriculum, and especially in the pedagogy of Oskar Schlemmer. (1888-1943) His course on “Man” (1926/27) was based in the study of Durer’s system of proportion, Leonardo’s “Canon of Proportions” and the golden section. He also included in the course curriculum the study of human biology and chemistry, of the growing steps since gestation to maturity and also notions of psychology and philosophy.

Schlemmer developed systems to study the mechanics and kinetics of the human body through notation and staged diagrams of movement in space. These studies were the basis for his choreographies reaching its peak in the *Triadiches Ballet*, his most famous piece. In his diary of July 5th 1926, Schlemmer explains why his ballet was given the name Triadic,

“Because three is a dominant number, in which the unitary ‘self’ and his opposed dualist are suppressed, starting the collective [...] After that comes five, then seven and so on. The ballet should be understood as a dance of the triad, the switch from one with two, then three. [...] Further, the triad is shape, colour, space; the three dimensions of space, height, width and depth; the fundamental shapes, sphere, cube and pyramid; the fundamental colours, red, blue and yellow. A triad of dance, costume and music.”⁴

According to Pythagorean thinking, the number tree was the number that “embraced the totality of existence” and mathematically originated the possibility of palpable extent. For Plato three was the number of the soul and for Aristotle, it was “*a beginning, middle and an end.*” (Figs. 8.07 and 8.08)

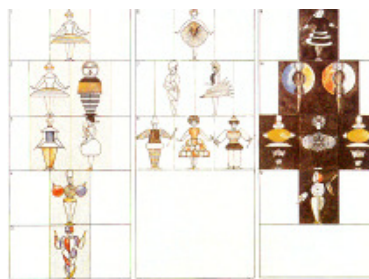


Fig. 8.07: Lux Feininger. Oskar Schlemmer and the Bauhaus' theatre crew at the school's stage. 1922.

Fig. 8.08: Oskar Schlemmer. Designs for the Triadic Ballet. 1922 and 1926.

⁴ SCHLEMMER, Oskar.. 1987. *Escritos sobre Arte: Pintura, Teatro, Danza, Cartas y Diarios Oskar Schlemmer*. Ribalta, Ramón, trans. Barcelona. Paidós Estética. pp: 92-95, free translation.

To Schlemmer, space was the unifying element in architecture and the common denominator of the many interests amongst the Bauhaus staff. According to Goldberg, “to the 20’s notion of “felt volume”, the *Raumempfindung*, Schlemmer’s view added the idea of “sensation of space”, and this was the origin of his dance productions.” (Figs. 8.09 and 8.10)

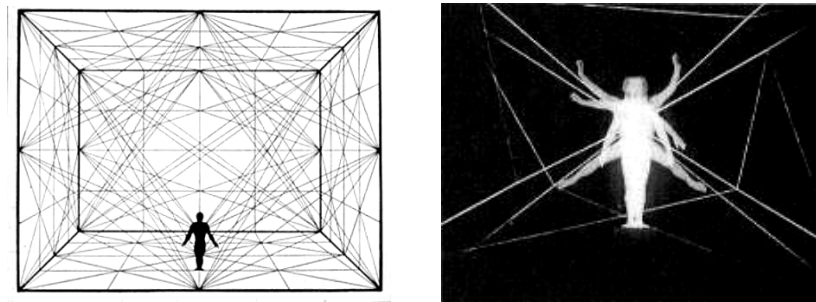


Fig. 8.09: Oskar Schlemmer. Drawing for “Figure in Space with Plane Geometry and spatial Delineations.” 1924.

Fig. 8.10: Lux Feininger. “Dance in Space (Delineation of Space with Figure),” multiple exposure photograph, Bauhaus Stage demonstration. 1927.

Schlemmer’s system was based on plane geometry, coordinating simple elements such as the straight line, the diagonal, the circle and the curve and according to this theory; “a *stereometry of space evolves, by moving the vertical line of the dancing figure in space. This stereometry could be ‘felt’ if “one were to imagine a space filled with a soft pliable substance, in which the figures of the sequence of the dancer’s movements were to harden as negative form⁵”*

These abstract theories were illustrated in 1927 by Schlemmer and his students, at the Bauhaus stage in a dance called ‘*Dance in space*

⁵ GOLDBERG, RoseLee. 2006. *Performance Art, from Futurism to the Present*. (1988).“word of art.” London. Thames & Hudson.pp 103-105

(Delineation of Space with Figure)'. The square surface of the stage floor was divided into bisecting axes and diagonals, completed by a circumscribing circle and afterwards taut wired was crossed through the empty stage, defining the 'felt volume' diagram of the cubic stage space. A multiple exposure photograph of this performance by Lux Feininger gives us an image that resembles to a living performance of a standing Vitruvian man, in motion, generating volumes with his body in the void of space. (Figs. 8.11 and 8.12)

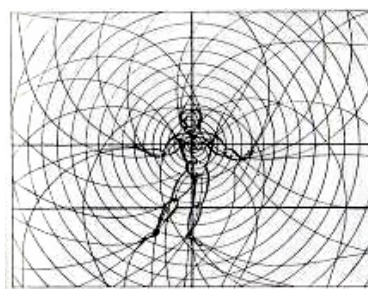
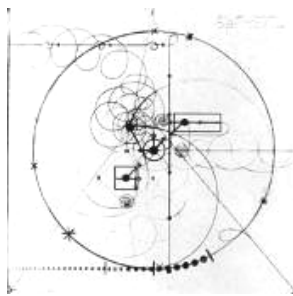


Fig. 8.11: Oskar Schlemmer. Diagram for "Gesture Dance." 1926.

Fig. 8.12: Oskar Schlemmer. Drawing from "*Mensch und Kunstfigur*." 1925.

As confessed admirer of classical philosophy, where he sustained his aesthetics and ethics according to the mythological opposition between Dionysus and Apollo, it is most likely that Schlemmer has devised his "Mathematical Gesture Dance" by this phenomenological approach to Vitruvius' canonic tradition. Interestingly, besides Gropius (1883-1969) as Behrens' (1868-1940) assistants and students, were also Mies van de Rohe (1886-1969) and Le Corbusier (1887-1965), whose works would also be remarkably influenced by the same factory values of efficiency. Mies's work was initially closer to Behrens' corporate logic and Le Corbusier would surf somewhere between the factory efficiency and the phenomenological approach of expressionist architecture, while Mies quoted classical

architecture, but was also highly influenced by Russian Constructivism's aesthetics and ideology. This may have led to Mies' forced departing from Germany, soon after he took over the role of director of the Bauhaus in 1930 after Gropius. What seemed like a forced departure from his homeland would later prove to be Mies's chance for developing his architectural ideas, becoming a pioneer of the International Style in the United States. Gropius' exile in the US led to the transmission of his experience as an architect but mostly as a director of the Bauhaus in the pedagogical development of universities like Harvard and the MIT. It might be interesting to remember that Gropius, under the pseudonym "Mass" had also been a member of the "Glass Chain." This was an utopian chain correspondence which appeared as a reaction to first world war and the consequent economic crisis. The Glass Chain and was founded in 1919 by Taut, whose pseudonym was "Glass", and included also Scharoun as "Hannes" among others.

The correspondence would last about a year but its influence brought expressionism to architecture, blooming especially through Mendelssohn's (1887-1953) and Scharoun's (1893-1972) work, but also being a very important inspiration for the idiosyncratic architecture of Rudolph Steiner (1861-1925). (Figs. 8.13 and 8.14)

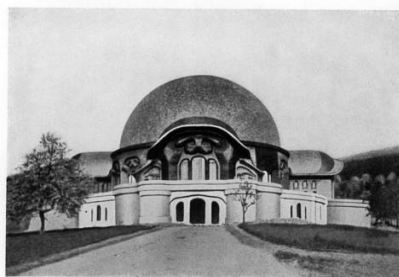


Fig. 8.13: Rudolph Steiner. First Goetheanum, Dornach. 1921.

Fig. 8.14: Rudolph Steiner. Second Goetheanum, Dornach. 1928.

The leader of the Anthroposophic movement would take up Goethe's principles on spiritual science and apply them to an ecological approach that was embodied in his own approach to *eurhythmics*, to agriculture, medicine, education and even architecture. According to Cabral de Mello, "*expressionist architecture was always considered out of the "norm" and therefore relegated to a second place in the architectural scene, as a consequence of its direct approach to the sensitive topic of emotion as transmitted through space.*" Modernist architects, obsessed with finding the appropriate measurement and scale for all objects, from a spoon to the city, could not accept with ease that which couldn't be justified through logic and, most importantly, scientific value, in the Cartesian sense.

Still, as Rykwert puts it, "*the Bauhaus, the school which would explore and lead design towards the essential values of abstraction as transmitted by the pure essence of form and colour, had also a "dark side", which made it interesting.*" This came from the direct influence of each of the school's masters and their interest in corporeal practices and spirituality. (Figs. 8.15-8.16)

"The geometrical proposition of the human body had much focus in the German and the Russian avant-gardes of the twenties, especially at the Bauhaus, where according to the Bauhaus archive, life drawing had always been part of the school's curriculum. Feininger, Itten, Klee, Schlemmer, Kubr, and later on, Joost Schmidt held the course successively, [setting] individual focuses. In expressive studies, Itten concentrated on the rhythmical coordination of the body limbs and on the body structure as a whole [and] Klee was interested in the representation of the tectonics of the human body through linear drawings, whereby the articulations necessary to movement were emphasized as dots⁶."

⁶ <http://www.bauhaus-archiv> museum of design - bauhaus 1919 - 1933 - classes - oskar schlemmer

According to Mallgrave, referring to Hellerau,

“Among thousands of prewar visitors who made pilgrimage to see the town [of Hellerau] and its activities at first hand were Ebenezer Howard, Martin Buben, George Barnard Shaw, Max Reinhardt, Serge Diaghilev, Thomas Mann, Stefan Zweig, Oskar Kokosbka, Emil Nolde, Hugo Ball, Heinrich Wofflin, Max Klinger, Wilhem Worringer, Julius Meier-Graefe, Franz Kafka and Upton Sinclair. Alma Mahler, the composer’s widow and the future wife of Walter Gropius, was a visitor. Ada Bruhn, shortly to become the wife of Mies van der Rohe, was a student at the institute in 1912-13, and Mies himself visited the town on several occasions. Albert Jeanneret, the brother of Charles-Edouard Jeanneret (later Le Corbusier), was an instructor under Dalcroze, and Le Corbusier visited Hellerau no fewer than four occasions. Other notable architects to visit Hellerau included Peter Behrens, Henry van de Velde and Hans Poelzig.”

As a consequence of these influences, the rebellious spirit of the Bauhaus made the students tolerantly intolerable and according to Itten’s principles, even the school’s cantina was offering an exclusive macrobiotic diet. This would lead to Schlemmer’s criticism believing that there were more important things to explore with the students besides concentrating on what they were putting on their stomachs.



Fig. 8.15: Unknown author. Group of dancers at the Dalcroze Institute, Hellerau. c. 1912.

Fig. 8.16: Unknown author. Dance production at the Dalcroze Institute, Hellerau. c.1913.



Fig. 8.17: Paula Stockmar. Portrait of Johannes Itten. 1921.

Itten's pedagogy also included gymnastics exercises for his students in order to "*experience, feel and release to body through movement, followed by harmonization exercises after which students stood at their easels and freely drew lines and swirls with both hands.*" (Fig. 8.17) Mallgrave continues to refer to Itten's practice further by stating that the point of such activities was to tap into the body's natural biological rhythm, which were generally followed by other exercises, focuses on material and texture and which were intended to awaken the haptic senses. It is interesting to note that most of Itten's work at the Bauhaus is generally referring to his studies on colour, but in fact it was a holistic approach which explored the senses as media and perception and the creation of art as an embodied, multimodal understanding which involved the entire body.

For this he included in his classes the exploration with closed eyes of material samples such as wood shaving, steel, wool, sheep's wool, glass. This interest in multisensory perception was also explored by Kandinsky (1866-1944) who was also a synaesthetic, as it

is nowadays scientifically accepted, although at the time Kandinsky would base his theory on the simultaneous perceptions of colour and sound on Lipps and Worringer's studies on perfection.

Although current theories explain that such phenomena happens only in some people who happen to have this particular biological disposition in the brain, Kandinsky was deeply familiar with the psychological theories of empathy, as proposed by Lipps and Worringer and in his writing. Both in "Concerning the Spiritual in Art" and "Point, Line, Plane" he argues that colours and lines have not only a psychological effect on the retinal nerves but also a deeper "psychic effect", which he described as a biologically centred "spiritual vibration". Kandinsky like later Le Corbusier, would call for an "art-scientific" analysis of lines in architecture, following Wölfflin's theory, in order to determine "*the relationships of graphic formulae to the spiritual atmosphere of the given time.*" Kandinsky would later be fascinated by the theories of Gestalt, which explored the dynamic aspects of perception.

Chapter 9

The Performative Body and The Totalitarian Mind

This Chapter presents how Virtual Reality leaves science-fiction and becomes a part of daily life. Scientific studies report an increased growth in mental illness and other pathologies such as diabetes and hypertension due to over-use of passive means of work, such as the standard office unite of computer, desk and chair. Material body starts showing signs of neglect, of imbalance between somatic experience in real life (movement, non-artificial stimulation) and experience in virtual life. Artists regain interest in the body and sensory perception. Pallasmaa proposes a "corporeal architecture" to address collective sensory deprivation. Embodied architecture moves from the Suburban House to the Wellness-centre.

In his book “The Architecture of Image: existential space in cinema” (2001) Pallasmaa quotes author’s such as Alfred Hitchcock (1899-1980) who consciously manipulated the viewer’s gaze through a very well calculated placement of elements in the setting, choice of camera shots and, of course, acting. Pallasmaa in his book “The eyes of the skin: Architecture and the Senses” cites Henri Bergson (1859-1941) on the same subject to state that “*what separates architecture of the other arts, while configuring man’s existential space, is the possibility of corporeal action and reaction.*” Likewise, one is forced to acknowledge that such techniques were applied especially in the field of propaganda, namely during the Nazi regime which expressed its narrative through film but also through the intense and highly emotional manipulation of the masses through speech and of course the manifestation of the greatness of the *Reich* through its grandiose architecture in stark contrast to the humble human scale.



Fig. 9.01: Simon Müller. *Haus der Kunst*, München. 1953.

The architecture of the III Reich plays consciously with human proportions, manipulating simple elements mostly through scale, exaggerating the height of steps, the height and width of door frames and even the effort necessary to turn a door knob. Munich's Haus der Kunst by Paul Ludwig Troost, (1878-1934) built in 1937 is a live example of how a building can express through its use the fragility of the human body and a specific narrative which glorifies bodily strength, endurance and even immortality (Figs. 9.01 and 9.02) -- an architecture made for Gods and not for humans. An interesting detail lies in the fact that Troost happened to be known for his extreme tallness which brings back thoughts about Loos affinities in the aesthetical appreciation of art, architecture and women, as referred to before in the text. Although seemingly farfetched, it is not illogical to assume that an author's own embodied condition plays an important role in his aesthetical choices and of course, influences his mind's construction of a world view. A strong tall man doesn't have the same perception of space as a child or an aged person.



Fig. 9.02: Unknown author. P.L. Troost, *Haus der Kunst*, München. c. 1937.

Troost had come exactly from the same school of thought as Behrens and Gropius, who all reacted against the ornamental style of the *Jugendstil*, defending an essential architectural approach that targeted the values of genuine simplicity and a return to the essence of architecture. Although, while Behrens would evolve from a first architectural approach that is closer to the values of the *Gesamtkunstwerk*, through his connections with the *Deutsche Werkbund*, to the simplicity and efficiency necessary for the design of a factory and the corporate identity of a brand like AEG, (Fig. 9.03) Behrens eventually converted to the Nazi ideology, as Gropius followed an opposite route. After replacing van de Velde in the School of Arts and Crafts of Weimar, Gropius transformed it into the Bauhaus, which later lead to his exile in the United States, due to his left wing influence in the ideological management of the school and his interest in designing buildings which were concerned with the health of the working class.

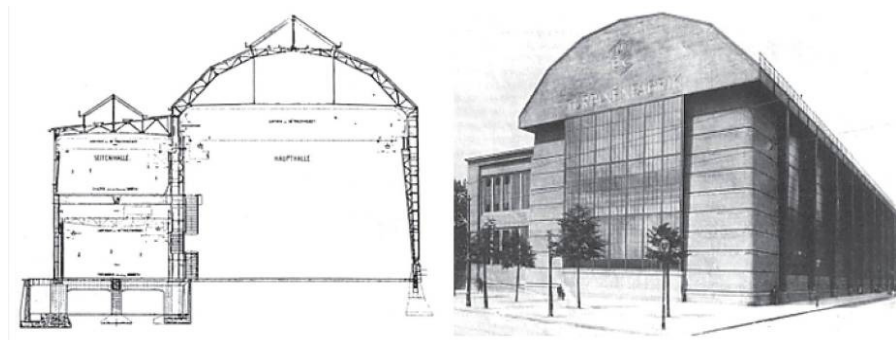


Fig. 9.03: Peter Behrens. AEG Turbine Factory. 1909.

The praise of the Pythagorean tradition was continued by Le Corbusier with the Modulor, (1948-1955) who considered Mathematics as “*the majestic substructure conceived by Man to grant him comprehension of the universe.*” The Modulor was devised as a measuring tool that systematizes the mathematical wisdom of the Pythagorean Triad and Duality and the Fibonacci sequence, and its creator hoped that it could relocate architecture in relation to the human scale, as it was based on the systems of proportions of the human body, the Golden section and the Vitruvian man. To Le Corbusier, it would be a tuned measuring instrument that, together with the technical means of his time, “*could make the good easy and the bad difficult*” facing the challenges and the growing complexity of the machine age¹.

Le Corbusier wanted to express in his work the belief that, “*only the architect can strike the balance between man and his environment: man [as] psycho-physiology and his environment [as] nature and cosmos,*” a rather holistic view that also recalls humanist thinking and a concern for ecological values. Paradoxically, being the creator of a system of rules that recalls many Renaissance’s authors such as Alberti, who considered the eye as the supreme organ of perception, Le Corbusier states in his final considerations in the Modulor that “*I have only stayed within the realm of concrete things, [...] the field of human psycho-physiology; I have concerned myself only with objects falling under the jurisdiction of the eye, avoiding the sorcery of the Renaissance.*”²

¹ LE CORBUSIER. 1968. *The Modulor I*. (1954). Peter de Francia, Anna Bostock, trans. Massachusetts Institute of Technology. Cambridge, Massachusetts, and London, England. USA. The MIT Press. pp: 58.

² _____ *Ibid.* pp: 184.

Le Corbusier's suspicion of the Renaissance's architects was based on the understanding of their architecture as more a product of subjective and individual spiritual quests than a commitment to a social or universal philosophy. Ironically, his generic understanding of the "Universal Man", as an inflexible *tabula rasa* standard that despised cultural, genre and emotional differences, would be the cause of the Modulor's decline, seen as a static, closed and abstract representation of Man. In Pallasmaa's words, "*The modernist idiom has not generally been able to penetrate the surface of popular taste and values, [it] has housed the intellect and the eye, but it has left the body and the other senses, as well as our memories, imagination and dreams, homeless.*"³

The metaphor of the well-tuned Swiss clock could be applied to Le Corbusier's idealization of the Modulor and architecture, as his father happened to be a craftsman, specialized in the manufacturing of glass for clock screens, a craft the young Jeanneret would also learn in his youth. Le Corbusier refers many times about aesthetics as "well tuned instruments", and to a certain extent the zeitgeist applied this notion to an increasingly growing "body culture", what in Germany, specifically in the Weimar Republic, would be defined as *Koerperkultur*. Le Corbusier would take this interest in the human body as a source of spiritual transformation and self improvement being interested in primitivism, nudism and the direct contact with nature. Eventually, this stubbornness would lead to his tragic death, by drowning at the age of 65 in result of going for a swim, despite his doctor's advice. Le Corbusier's interest in body culture was also a vital part of his architectural and urban agenda.

³ PALLASMAA, Juhani. 2005. *The Eyes of the Skin: Architecture and the Senses*. Academy Press. pp : 16-19.

Both kinds of designs display specific areas planned as stations for exercise and to allow the body to be kept fit, healthy and self sufficient. This matched the ideology of the time, the empowerment of the individual through the knowledge and maintenance of his body. Of course this would be taken to extremes after the economic crisis which led to the II World War, where such corporeal practices were induced in education and propaganda, leading to mass movements and the suppression of individual will through the submission of the collective of totalitarian regimes. Here emotion played a key part, as nations would tend to follow apparently strong leaders whose political agenda staged and incorporated a sense of regained strength, structure and order. Such display of power had lead to the disastrous consequences of the II World War and would again strike with the energetic crisis of the 70ies and the first collapse of the social system as governed by pure capitalism.

If one recalls Le Corbusier's Modulor and specifically its application in works such as the *Cabanon* (1951-1956) or, most importantly, in the design of the apartments of his *Unités d'Habitation*, (1947-1965) one is surprised to find out through direct experience that although these works are usually depicted in photography as just as grandiose in scale as the architectural contributions of the III Reich, or not less remarkably the Soviet's, Le Corbusier's architecture reveals through the manipulation of scale that in fact he was not a tall man. In Pallasmaa's writings, Le Corbusier's architecture is usually criticized for its disregard for the human scale or even a certain sterile atmosphere.

Anyhow, one must note that before designing the Modulor (1954) Le Corbusier expresses in L'Esprit Nouveau (1925) the need for rules in architecture based both in scientific knowledge and also art and experiment, a “*Scientific Aesthetics*” that joined reason and intuition. (Fig. 9.04)

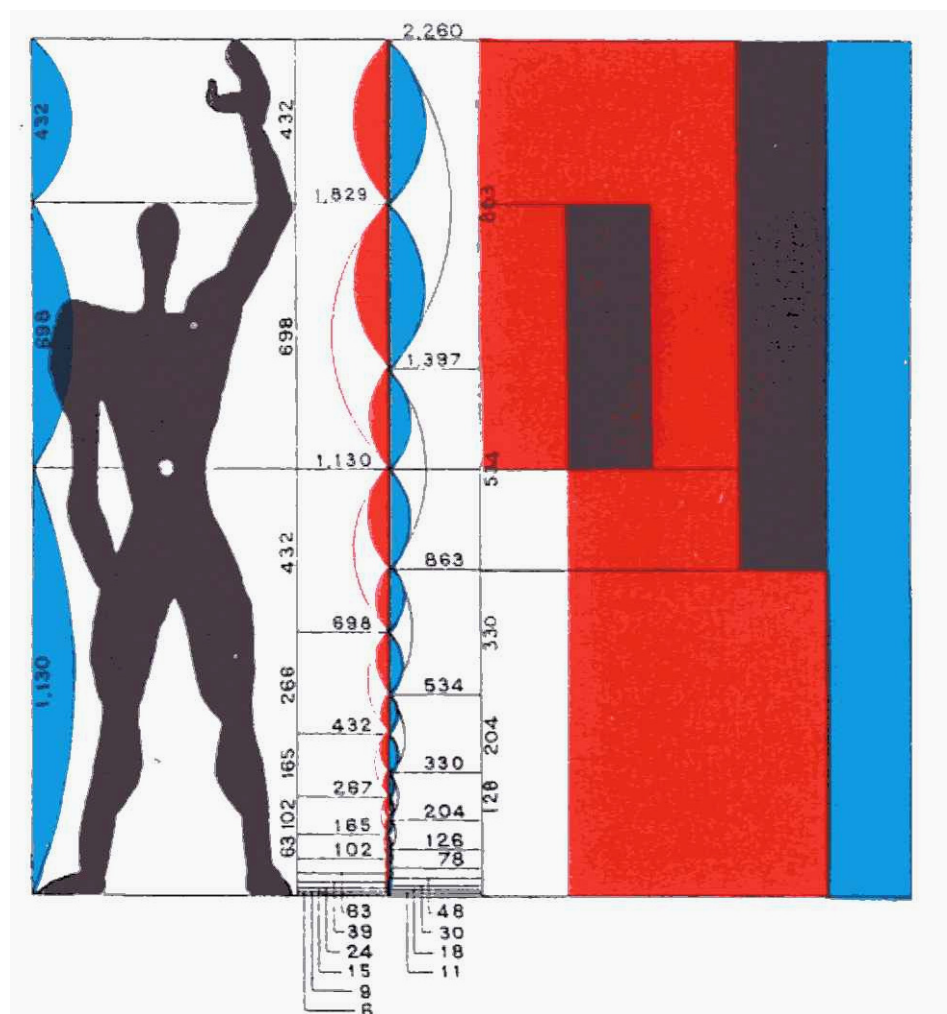


Fig. 9.04: Le Corbusier. The Modulor. 1948-1955.

This would be based on his studies in cubist painting and sculpture and the musical concepts of harmony, applied to architecture, in the pursuit of the “*fourth dimension, the moment of boundless freedom brought about by an exceptionally happy consonance of the plastic means applied in a work of art*”, being the key to aesthetic emotion a function of the architectural space. This interest in the topic of harmony makes sense, since Le Corbusier’s brother was a practitioner and teacher of the Dalcroze Method and their mother was a musician herself. Even though the Modulor, as a system of rules, wasn’t complex enough to deal with the challenges of its time, reducing them exclusively to a problem of measurement and efficiency, and also being a tailor-made tool conceived to the uses of its maker’s body and desires, its use was intended to open the path for the architect to work with more assurance, letting intuition flow and make art easier. It was also Le Corbusier’s belief that as an architect he had the ethical and professional duty to teach people how to live better lives, which led to failures in some specific cases like Chandigarh where the context and cultural habits would clash dramatically with the creator’s idealism.

In the text, "The World as Design" (1991) Otl Aicher states, "*The world we live in is the world we made*" makes us reflect on the consequences of human intervention in the built environment in the direct lives of its inhabitants, revealing the world as the result of good and bad interventions in confrontation. Aicher points the finger at what Man recognizes a conditioning of a whole way of life and not simply a design. The complexity of design in architecture has to do with the difficulty of combining a number of factors that determine the success or failure of the production of objects that will constitute reality.

Each design is subject to conditions that do not depend only on the proposal of the architect but mainly to solve more or less concrete problems and demands of society. In this context, there is often a large distance in the way a designer interprets such problems and the definition of a solution in the design itself. Many times we as designers are forced to confront ourselves with interventions that are inappropriate, both from an urban point of view and in terms of their social implications. The problem of the architect as a creator, according to the Modernist paradigm, is addressed as a central theme in "The Fountainhead" (1949) a film by American director King Vidor, based on the novel by Ayn Rand. (1943) The main character, Howard Roark, is an idealistic young architect who prefers to fight in anonymity to compromise his artistic and personal vision. (Fig. 9.05) Here one can identify clear traces of modernist principles and the role of the architect at such time, finding parallels in the personal idiosyncrasies and architecture of Mies van der Rohe, Frank Lloyd Wright or Le Corbusier.



Fig. 9.05: King Vidor. The Fountainhead, Screenshots. 1949.



Fig. 9.06: King Vidor. *The Fountainhead*, Screenshots. 1949.

In the film, at one point Roark is confronted with changes that were introduced in one of his main designs without his authorization. In retaliation to the theft of the integrity of his work, Roark decides to destroy it, by blasting it. Roark goes on trial for destroying public property and refutes by claiming the importance of the value of the self and the individual's need to remain true to one's beliefs. (Figs. 9.06 and 9.07)



Fig. 9.07: King Vidor. *The Fountainhead*, Screenshots. 1949.

The problem that arises in the film still has great relevance today in the sense that explores the confrontation that always exists between the creative act of the project, the collective taste and the fulfilment of requirements. However, the apology of the architect as a "God", which both has the power to create and destroy, may be symptomatic of some arrogance that eventually contaminated the good intentions of the main authors of the Modern Movement. Such beliefs in ones absolute knowledge let to an attitude which subdues a collective imposition of an idealized model of life, which relied on the blind faith in technology and the abundance of energy and natural resources. According to authors like Aicher, Pallasmaa and Cabral de Mello, this attitude may have led to a dehumanization of architecture.

The way of life that modernism aimed to establish, was intended to organize all human activity, as an individual was understood as a part of a greater machine. Taylorization and the factory-logic, set existence at all scales and types of activity in a systematic way, based on tasks in serial production, characteristic of industrialization. Charlie Chaplin has addressed such issues, as performed in 1936 movie "Modern Times" in which, through his characteristic humour, he warns against the standardization and mechanization of life, which may steal one's individuality. The sketch in which a factory worker emerges as a guinea pig to test a "machine for feeding workers" is probably one of the most serious in the history of cinema, comic but at the same time frightening, uncannily contemporary since still nowadays not only work but almost every aspect of daily life, such as food, is seen as dependent on technology. Even more strangely, many people would actually desire to be able to rely on such technologies, in order to save as much physical effort as possible. (Fig. 9.08)



Fig. 9.08: Charlie Chaplin. Screenshot from “Modern Times” with Operary Feeding Machine. 1936.

It is almost unthinkable to live in the "civilized" world without objects such as the refrigerator, stove or a tap with running water. However, the energy and economic crisis have brought attention to the value of sustainability and raised the issue that perhaps one day such gestures of acquired comfort may disappear, if solutions and concrete action are not taken. One can even ponder if contemporary culture is prepared to accept that such notions of comfort could be, in the long term, compromising the human body as healthy organism. Nowadays, it is possible to see the consequences that such a passive way of life, based on monotonous repetition of tasks, has in what regards quality of life. According to statistics, a series of physical and psychological disorders (obesity, musculoskeletal disorders, and depression) are reaching large numbers of the world population with increasing incidence in younger generations.

Similarly to the effects of the Industrial Revolution, with the introduction of the digital technologies in daily life, both work-related and for leisure, the human body is being rendered docile and the increasing interest in the topic of “zombies” in pop culture might be seen as a manifestation of a collective feeling of numbness. Such effects can also be directly seen in the profession of the architect and also in the implications that the excessive, most times exclusive, use of digital tools are having in the creator’s bodies.

The current digital tools offer many possibilities, but they are still far from the speed and ambiguity that analogical means allow in the creative process. Also, in what regards the contemporary culture of architecture and urbanism, one can realize that although highly criticised in the 70ies and 80ies, Modernism left the strong ghosts of its gods, whose works are copied and transmitted by a mimetic academic attitude, not so different from the Beaux-arts model criticized in the beginning of the last century. Such a perpetuation of Modernist style is supported by a generalized mediatised attention that is given to the architect as a *persona* and a sort of worship of visual images, which according to Pallasmaa is characteristic of contemporary media. Architecture then is more focused on the creation visual images rather than experiences, playing along with the demands of the market, as architectural offices sometimes can’t afford to make a stand which would imply compromising the economic stability of the managers and workers.

Contemporary clients also wish to invest in building architectural objects that fit to a particular “modern” image, which has been embedded in culture and a symbol of social status and luxury, perhaps even without fitting their true desires and needs.

Clients and investors wish to see such images come true, later coming to the confrontation that such designs sometimes are not flexible enough to accommodate change or simply pass the challenge of time. Just like a tailor-made suit won't most likely fit forever to its owner's body and needs, a tailor-made architecture can become closer to an architectural corset, instead of the embodiment of a private space of flexibility, change and freedom. Attributes which perhaps help to turn a house into a home, and differentiate architecture from mere construction.

The work of artist Nuno Cera about the *Unité d'Habitation* of Berlin by Le Corbusier and created within the exhibition "Ghosts" is a testament to the coolness and aggressiveness of a building which was crystallized as architectural icon of Modernism, and a specific way of life. Paradoxically, with such designs as the *Unité d'Habitation* Le Corbusier had the intention of uniting Man to the Cosmos, therefore the building's proportions were based on the proportions of the human body, according to the Modulor. The problem of such a simplified reading of the human body purely metric and mechanical aspects, as well as the purely visual understanding of the experience of architecture, is revealed in Cera's work through the coldness and impersonality of the spaces the artist explores, emphasizing the confrontation between such spaces and the fragility of the human body. Cera uses photographs and videos that show corridors that remember morgues in which the body wanders like a ghost, or through the contrast between the blood of a mutilated or perhaps suicidal body and whiteness of the ground, humanizing tragically an intentionally aseptic space. (Fig. 9.09)

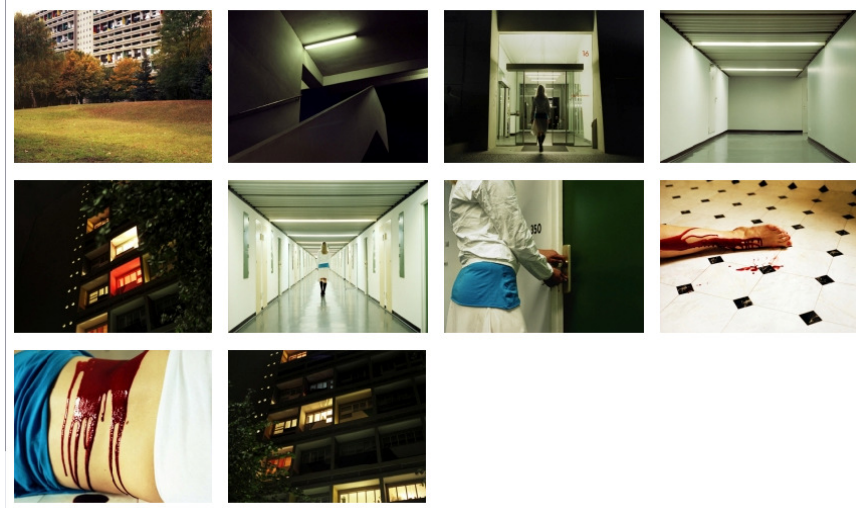


Fig. 9.09: Nuno Cera. “Unité d’Habitation” within the exhibition “Ghosts”, Centro Cultural de Belém. Lisbon, curator Nuno Crespo. 2006.

Christopher Alexander in the text "A city is not a Tree" (1965) presents a theory based on ecology and cybernetics, which explains the failure of cities he calls "artificial", including Columbia, Tokyo or Brasilia as examples. Alexander states that *"another concept preferred by the theoretical proposals of the CLAM is the separation between leisure and the rest from other activities. This attitude was crystallized in our cities (artificial) for example in the typology of the "playground", paved and fenced, coming from inflexible and rather dualistic ideas that "play" exists as an isolated concept in mind [...]."* Alexander continues to argue that such places *"have nothing to do with what is the nature of playing, which can happen both inside and outside the home, in an abandoned building, or by the river [...] these are activities which form systems with objects and other systems of the city, therefore there is an interference between one and other. This is what happens in a "natural" city, where a child can take ownership of their surroundings and where the complexity necessary to life is generated."* (Figs. 9.10 and 9.11)



Fig. 9.10: Le Corbusier, Children at the “Unité d’Habitation” of Marseille. 1945-52.

Fig. 9.11: *ibid.*

The theory developed by Alexander finds its most obvious representation in the films of Jacques Tati, especially in "*Mon Oncle*" and "*Playtime*" where the clash between ancient and modern city, as well as unsuitability to a systematized way of life is always present. By analyzing the work of Le Corbusier, in particular through the photographs showing the child ownership of the proposed spaces "to play" at the inauguration of the “Unité d’Habitation” in Marseille we can remember the work of director Jacques Tati, especially in "*Mon Oncle*" in which children, as Mr. Hulôt, Tati's most remarkable character and a kind of child-adult, emerge as unsuited to the rigidity of modern architecture. (Figs. 9.12 and 9.13)



Fig. 9.12: Jacques Tati. Screenshot from “*Mon Oncle*”. 1958.

Fig. 9.13: *ibid.*

It would take almost a century to develop technologies that would allow us to make better simulations, instead of experimenting new theories in the field of architecture directly with the dwellers. Still, although now we possess such tools which allow us to simulate virtually, to see what happens in the minds of the dwellers and analyse their behaviour from the inside-out, the temptation of returning to the modernist view of the totalitarian architect who can teach people how to lead their lives may need to be carefully pondered as well as the ethical implications that might come from this. Le Corbusier himself had stated in the text of the Modulor, *“having a tuned instrument isn’t enough to generate harmony, it is necessary to use it with rules, the product of analysis and painstaking study; they are evolved on the basis of a problem well stated. In the final analysis, a rule is established by experimentation.”* It is to such experiments that Chapter 12 of this thesis is dedicated.

Chapter 10

From the Body without Organs to Organs without Bodies

This Chapter relates how the Baby-boom generation recovers from WWII with the exponential growth of cities, mass construction, and a progressive dependency on technology and natural resources. It describes how Bodies become a commodity, pacified. Increased mediatisation of culture and life through television, film, computer, and internet occurs. Man lands on the Moon, the body beats gravity through the aid of technology. The Body becomes a cyborg. First successful cloning of organs and animals is achieved. Embodied architecture evolves from the Labour Camp to the Suburban House.

The human body has become a field of intense reflection with the turn of the millennium and the mystification of the role of digital technology in the future. The prophecy announced by Stanley Kubrick and Arthur C. Clark in “*2001, a Space Odyssey*” that humans would be at the verge of a new evolutionary step while conquering space travel through the use of Artificial Intelligence didn’t take shape exactly as they stated, as it still isn’t available as a common means of transportation due to the extreme cost of the technology and also to travel risks. Anyhow, cyberspace gave another body to Kubrick’s idea, as today anyone can space travel without moving, just by using software and connecting through the Web to one of the many satellites around the Earth. As Neil Spiller states, “*in cyberspace, old modernist rules are defeated, gravity, enclosed space, circulation and many others things loose significance.*¹” (Fig. 10.01 and 10.02)



Fig. 10.01: Stanley Kubrick. Screenshot from “A Space Odyssey”. 1968.

Fig. 10.02: *ibid.*

¹ SPILLER, Neil “*Corpos, espaços e reflexividade*” in AFONSO, Rui Braz, FURTADO, Gonçalo (coord), *Arquitetura – máquina e corpo: notas sobre as novas tecnologias na Arquitetura*, FAUP Publicações. 2006

An increasing number of people spend their leisure time using the same tools they use for work, namely the computer and the internet. As stated in the previous chapter, this leads us to consider what impact in terms of physical and mental health of the body this type of passive experience will have in a short or medium term. There is an increased use of virtual communication platforms, beyond the essential email with the introduction of social networks like Facebook, where people can communicate with an indefinite number of users globally. The interaction in virtual spaces begins to gain a large role in the social life of individuals, especially among teenagers, but also in professional terms, through the communication of enterprises and organizations, or even to political campaigns.

Another phenomenon that is growing exponentially is the massively multiplayer online role-playing games (MMORPG), which act as "simulated reality". In these, users run multiple virtual worlds through an avatar, interacting with other users and virtual entities. An example of this type of game is World of Warcraft (WoW). The popularity of WoW has to do with the kind of experience such space offers, by allowing the exploration of worlds that constitute a utopian world of legends and myths and is an allusion to the memory of medieval imaginary spaces with dungeons, castles and walls. These idealized spaces, by their complexity, have a very important role in our collective unconscious, as spaces of mystery, dream and sensorial richness. Another fact that might justify WoW's success is that the game allows the expression of fantasy, like flying, or casting magic spells. Therefore, and although the experience in such simulations happens mostly through visual stimuli, the gamer has a strong sense of involvement, as he controls the action of his avatar and eventually influences through his actions the events that occur in the game.

So although the body of the user is only using specific parts of his body (including brain) to participate in the experience, he is at some level immersed, therefore, the more immersed he is, the more “real” is the experience. Pallasmaa, (2001) about the existential space in cinema, says that *"the architecture designed by artists is a direct reflection of mental, memories and dreams images; the artist creates an architecture of the mind [...] art offers us alternative identities and situations of life and this is [his] great work, [...] offer us the opportunity to experience our own existence through the existential experience of [another]."*

Regarding the affinity in terms of existential space between architecture and cinema, Walter Benjamin (1892-1940), in his essay "The Work of Art in the Age of Mechanical Reproduction", (1936) states that *"although the situation of watching a film transforms the viewer in a "disembodied" observer, the kinematic space of illusion returns to the spectator his body, as the experience "haptic" and the moving space provide powerful synesthesia, [so] a movie is seen by both eyes as by muscles and skin, [...] the images stored in our memory are both visual images and incorporated as "haptic."* We can infer, regarding experience of the worlds offered in cyberspace or virtual reality, the same conclusions as Pallasmaa and Benjamin take on the experience in the theatre as immersive systems, however, we can ask ourselves about the impact that excessive use of such mechanisms of reality simulators may have physical and psychological terms the individual or even in terms of society as a collective supported by complex systems of relationships. Although it might be enriching to share the experience of another through such mediums, how far does this deny oneself to be conscious of the experience of one's own life. Pallasmaa in "The eyes of the skin" (2005) also points out that *"beyond architecture, contemporary culture [while forgetting the carnal and sensory dimension*

of existence] is heading towards a terrifying de-sensualisation and de--sexualisation of human relations with reality."

David Cronenberg directed in 1999 the film *eXistenZ*, reflecting precisely on the impact that the use of technology, particularly virtual reality and simulated reality computer games, have in the body, therefore in mind. Cronenberg uses an aesthetic which is itself rooted in the “body horror” genre, using sexual analogies to reinforce in a hyperbolic way the strange relationships that man is developing with technology, understanding it as a part of body. (Figs. 10.03 to 10.08)



Figs. 10.03 to 10.08: David Cronenberg. Screenshots from “*eXistenZ*”. 1999.

Cronenberg presents us a universe in which a sense of alienation and a growing dissatisfaction with the real world, the environment, leads to an increasing interest in experience more and more sensually arousing experiences in virtual worlds. In the movie, such games experience is made by direct connection of the gaming device to the nervous system. It is a fully immersive game which is controlled by the users brain wave frequencies and the reality experienced by the characters is described in the film as *"more real than reality"*, where everything is much more erotic, and where the appropriation of the world is made much more through the skin, touch and smell than by vision, expressing a lurking desire for sensuous and primal haptic experiences. (Figs. 10.09 and 10.10)



Fig. 10.09: David Cronenberg. Screenshots from “eXistenZ”. 1999.

Fig. 10.10: *ibid.*

With eXistenZ, Cronenberg also alerts us to the fact that, eventually, this kind of experience will make us forget our real body, preferring a "disembodied" existence and leading to an increasing distortion of reality, reaching the limit of not being able to distinguish between this and the game. In the film, the repression of the physical body for this more seductive, virtual reality, leads to phenomena of violence.

This is alluded to by the surprising ending of the film in which the two main characters, or players in the game, condemn its creator to death for "*severe distortion of reality*", killing him with extreme violence, what Cronenberg proposes as an allegorical criticism of the violence induced by videogames. (Fig. 10.11)



Fig. 10.11: *ibid.*

Although it does not seem possible to live the reality described by Cronenberg, the technological potential exists and is scientifically plausible. The Sony Company has a patent for a non-invasive method of implanting sensations in the brain via ultrasound, stating that this was a "prophetic invention" and not something they are currently experiencing. Some experts warn against the dangers of promoting the concept, since any application of the technology needs research in terms of its impact, which will take a possible use for the next century. Consequently, what can we think about role of architecture, as total immersion medium *par excellence*, given this reality?

Are we on the threshold of arriving to a schizophrenic society, with a multiple existence in the real and the virtual or embodying the "body without organs" announced by Gilles Deleuze (1925-1995)²? The concept was invented by the playwright Antonin Artaud (1896-1948), in its radio broadcast "*Pour en finir avec le jugement de Dieu*" ("To end the judgment of God," 1947). For Artaud the theatre is the place where life is re-enacted, through the body. The "body without organs" is the name of the body redone and reorganized, and once freed through corporeal training from its automatisms, opens to "dance in reverse." In the work of Deleuze and Felix Guattari (1930-1992), the term BwO refers initially to the "virtual" body, a body of latency through which the "real" body can express itself through a set of gestures, habits, movements but also "virtual" dimensions, a vast reservoir of potential gestures, movements and connections. The potential that this collection Deleuze calls "body without organs" becomes active with the interaction between the various bodies, real and virtual, in what he called the "plane of immanence".

The expression of motions as emotions was explored in action painting in the 50ies, especially in the work of Jackson Pollock, (1912-1952) who registered his emotions in apparently random choreographies of movements that were executed in large scale canvas lying on the floor, allowing as much freedom of movements as possible, and to paint he used non conventional objects such as holed tin cans suspended by wires or broomsticks as flexible extensions of his body. Pollock stated that this allowed him to move freely around the painting, letting the painting process flow and the painting itself acquire a life of its own. (Fig. 10.12)

² Deleuze, Gilles and Guattari, Felix; 1972. "Anti-Oedipus, Capitalism and Schizophrenia".



Fig. 10.12: Unknown author. Jackson Pollock, dripping. 1950.

The potential of the human body in movement was already vastly explored in the performance arts of the 60's and 70's, in order to understand the mechanisms that generate actions, especially those that occur in a subconscious or involuntary way. The work developed in this field has produced impressive results and many performances of "body art" exploited limit states of the human body, such as the works by Gina Pane (1939-1990), Marina Abramović (1946 -) and Rebeca Horn (1944 -). (Fig. 10.12)



Fig. 10.12: Rebecca Horn. The Feathered Prison Fan. 1978.

The body in movement and its relationship towards space was also widely explored in postmodern dance of the United States. New means of the time, mainly video, to capture and explore the movement of the human body and its expression, without breaking the *continuum*. Choreographers such as Anna Halprin (1920 -) have also explored the haptic dimensions of the body while moving in space, and many of them provide us reflections on the fragility and potentials of the body and some embodiment of its “*hidden dimensions*”³ that manifest through actions that express subconscious thoughts. In the 60’s, choreographer Halprin used improvised dance and the nudity of the human body as a means to generate cultural and political revolution. In her “Parades and Changes” 1965 performance, the concept was to disaggregate simple gestures of everyday life, like dressing and undressing, executing them in a very slow and repetitive way in order to break its meaning. (Figs. 10.13 and 10.14)



Fig. 10.13: Anna Halprin, Anne Collot & Guests. Parades & Changes, Replay. 2009.

³ HALL, Edward T., “*A Dimensão Oculta.*” (1966) col. Antropos. Relógio D’Água Editores. Lisboa. 1986.

These actions acquired a corporeal materiality on stage as the performers interacted naked with the setting, made with giant roles of craft paper that were lying on the floor. The performers would dress themselves by merging with the paper and then undress again by ripping the paper. This generated a collective body in movement, made with the performer's nude body and the fragments of the ripped paper, remind us of Duchamp's "Nude descending the stairs".



Fig. 10.14: Marcel Duchamp. "Nude Descending a Staircase, No. 2". 1912.

Choreographer Merce Cunningham, (1919-2009) developed since the 50's a process in dance that explored indeterminacy as a means of arriving at a new dance practice, the same John Cage (1912-1992) did with his music. Just as Cage found music in the everyday sounds of the environment, Cunningham proposed that walking, standing, leaping and the full range of natural movement possibilities could be considered as dance and each movement was something in itself.

Such theories in music and dance were largely influenced by Zen philosophy as both Cunningham and Cage, who were also life partners, felt deep sympathy for Buddhism and yoga. Merce Cunningham was pioneer in realizing the potential of applying motion capture to his choreographies. In the late 90's he used such technology to register the movement of the human body, through the use of sensors placed in strategic points of the dancer's body. (Figs. 10.15 and 10.16)



Fig. 10.15: Merce Cunningham. Biped. 1999.

Fig. 10.16: *ibid.*

Fig. 10.18: *ibid.*

“Motion capture” allowed for a series of recordings of the movement of the human body that were projected on stage as linear diagrams of the body, or a second shadow that interacted with the dancers. This technology has since been further developed for computer animation in the last years and is nowadays used in the animation of parametric models for character animation in digital movies, computer games or virtual simulations.

Portuguese artist Helena Almeida in the video “A Experiência do Lugar II⁴” explores the metaphysical dimensions of the body, its relationship towards space and movement as a continuous flow that is influenced by a series of parameters such as gravity or aging. (Figs. 10.19 and 10.20)



Fig. 10.19: Helena Almeida. A Experiência do Lugar. 2009.

Fig. 10.20: *ibid.*

The relationship between the human body and technology has generated an intense debate especially in philosophy and in the arts, in which the work of Australian performance artist Stelarc has a huge importance as one of the most radical and provocative manifestations. The artist assumes himself as a “cyborg” and his body as canvas or a “*work in progress.*” Stelarc has successfully implanted an artificially created third ear in his arm, where he is going to install a microphone and Bluetooth system to make it “hear.”

⁴ ALMEIDA, Helena; “A Experiência do Lugar II,” exhibition “Pés na terra, cabeça no céu”. Centro Cultural de Belém. 2004.

To Stelarc, “*we have always been prosthetic bodies*” and “*obsolete*”, so it is technology that allows the preservation and evolution of the human body, in other words, he suggests that man is “*artificial by nature*” and that to extend the body is a natural instinct. (Figs. 10.20 and 10.21)

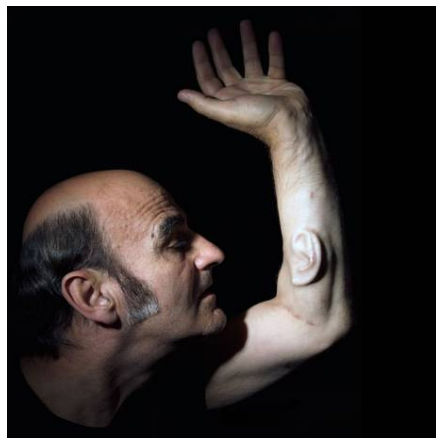


Fig. 10.20: Stelarc. Ear on Arm. 2008.

Fig. 10.21: Stelarc. Installation of “Ear on Arm” through surgery. 2006.

Architecture, after having ignored the body during decades, with the decline of the Modulor and its limited and simplified view on man as mainly a system of proportions, saw the importance of the body again with the appearance of cyberspace and the expansion of virtual reality.

Marcos Novak, in his seminal work, “*Transvergence, Allogenesi: Noted on the Production of the Alien*” (2002) points the digital era as the “*era of the production of the, Allo,*” in Greek the Alien or the “*Other,*” in which cyberspace allows the possibility for the expansion of human consciousness and the construction of the Self. Novak compares the digital age to the era of the production of Man in the Renaissance and his transdisciplinary approach to architecture, science and arts recalls humanist thinking.

A radical view on the relationship of the human body and architecture was also proclaimed by Marcos Cruz in his RIBA rewarded PhD Thesis, “*The Inhabitable Flesh of Architecture.*” (Fig. 10.22) Cruz explores architectural space as the field for the expression of “the Uncanny”, an allegorical reference to Freud’s concept of *das Unheimliche* as what is familiar but at the same time strange.



Fig. 10.22: Marcos Cruz. *The Inhabitable Flesh of Architecture.* 2007.

His fleshy architecture is made of synthetic “neoplasms” inspired by the game pods in Cronenberg’s “*eXistenZ*” and feelings such as abjection and disgust are exploited as an opposition to the hygienic body of modernism. Cruz wishes that this architecture made of responsive flesh can purge through its pores and sphincters the modernist ghosts of an architecture he considers obsolete. After Le Corbusier’s failed attempt to definitely fill the gap between the human body and architecture, there has been a lot of criticism but there hasn’t been much more work done to solve the same problem, in an operative manner.

In industrial design, especially in human machine interfaces or in prosthetics there are some considerable developments that open the path to a kind of “body tailored” design, in which flexibility, responsiveness and intuitive using are the fundamental concepts developed. This is possible due to the recent developments in mind and brain theory and also to the new digital technologies that allow the translation of all sorts of information to a mathematical or programming language, for instance biomechanical processes such as movement.

In the field of Artificial Intelligence there have been developed many studies that simulate behaviour phenomena through this type of approach. One example is “boids”, a kind of simulation that reflects emergent behaviour resulting of the interaction between individual agents, according to a simple set of rules programmed, such as cohesion, separation or alignment. The motions of this kind of agents can be described as chaotic or ordered and unexpected behaviour can be considered emergent. The algorithms that generate these simulations are used, for example for the representation in virtual reality of the behaviour of flocks. These have been applied mostly in cinema in CGI, computer generated images or animations, in which the characters are animated as digital puppets and the actor’s job is to inflate them with life, using his emotions, with the whole expression of his body being transposed remotely to the puppet using the motion capture hardware interfaces connected to his body in specific places. This information is interpreted by software that translates the information and generates algorithms that animate the puppet, character or “avatar”. Such algorithms are increasing in complexity and getting more accurate to reality at an astonishing speed.

Computer generated animations can mimic body language so faithfully that they can already establish the same kind of empathy or “attunement” that a good actor can create with his public, using his own body. Digital animation also allows the creation of all sorts of objects and geometries, due to parametric design and the use of topological geometries, surpassing Euclidian limitations. (Fig. 10.23)



Fig. 10.23: James Cameron. Screenshot from “Avatar”. 2010.

This allows the simulation and rendering of extreme situations such as zero gravity and underwater environments and also different weather or lighting conditions. Recent technological development has also enlarged the knowledge on the body, mostly in what concerns its interior. Nowadays it is possible to observe the interior of a human body without invading or harming its integrity, for example using “Magnetic Resonance Imaging,” MRI. (Fig. 10.24)

Because these systems use digital information, this kind of image can be easily processed, for example in parametric 3d modelling and animation, such as in Marcos Novak's project, the "AlloBrain", in which the architect used the MRI scan of his own brain to develop a 4d interactive environment. In this simulation, it is possible experience the movement of the synaptic flow inside a human brain, allowing the demonstration of its role in the process of cognition. (Fig. 10.25)

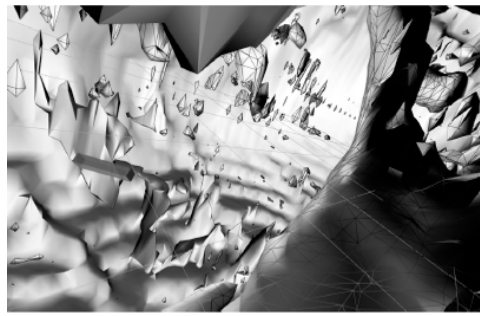
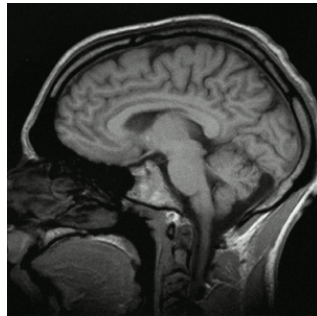


Fig. 10.24: MRI, digital section of a human brain.

Fig. 10.25: Marcus Novak. "Allobrain". 2009.

In architectural design, digital modelling and rapid prototyping tools are replacing analogical design systems progressively, but there still isn't a single tool that joins the psychophysiological characteristics of the dwellers and architectural space together as parameters or rules in the generation/simulation of personalised designs, body tailored, empathic and corporeal. Dweller performance and behaviour in space is usually the ultimate architectural test, possible only after construction and most of the times with a great amount of uncertainty. Although the use of such tools won't allow by itself a bigger individuation of the user's in space dwelling or generation, it can certainly help to increase the level of complexity and surpass the generic limitations of other systems, such as the Modulor, by encompassing rules and parameters

that simulate complex bodies and situations. Portuguese architect Domingos Tavares, on the urgency of broadening the knowledge in architecture, states that “*architecture is also built in the spirit of architects, whose ambition is to understand the usefulness of their work in the configuration of ordinary life, considering the instruments that are available that better serve this purpose [...] it is particularly this the right time to create a set of tools for thought and action that may give a positive contribution to a change and a life more tailored to our lives.*”⁵

It would take until the second half of the 20th century for architecture to keep up with phenomenology’s interest in experience and the role of the human body as medium and for the technological developments of the 80’s for phenomenology to be rediscovered by science, specifically neuroscience and biology, namely through the work of Varela and the general establishment of the concept of “embodiment” in the 90ies. Varela, influenced by his mentor Maturana who had a strong interest in philosophy, allies’ phenomenology to biology, proposing a neurophenomenology that is based on the study of the subjective, or first-person science, in which subjects observe and study their own perceptions and conscious experience through the use of scientifically accepted methods. Varela is also credited for introducing the concept of *autopoiesis* to biological theory and introduced the revolutionary concept of the body as both a biological system that is governed personally or through subjective experience.

⁵ TAVARES, Domingos. in AFONSO, Rui Braz, FURTADO, Gonçalo (coord); (2006) *Arquitetura – máquina e corpo: notas sobre as novas tecnologias na Arquitetura*, FAUP Publicações.

This brought about the revolutionary notion of emotions as biological reactions and still is to day the most important change in paradigm since Kant's outrageous proposal.

The Portuguese-American neuro-phenomenologist Damásio would develop Varela's concept of *autopoiesis* even further by suggesting the role of emotions in the regulation of a body's *homeostasis*, and feelings as somatically constructed "images" that allow the body to regulate itself. Damásio's notion of image overtakes the usual definition of eye-related perceptions. Instead, image is a mentally constructed array of perceptions that the body makes as a whole (visual, haptic, aural, kinaesthetic) to attribute meaning to certain experiences and situations. Through such images, the mind constructs memories and the body relies on these to construct experience and knowledge of the self and the world, evolving gradually from "protoself", to "self" and to "extended self", in other words, from "consciousness" to "extended consciousness."

Damásio proposes that extended consciousness is responsible for conscience and that this is a condition of higher developed neurological systems, hence, exclusively human. Damásio bases his theory on the Critique of Descartes' dualism, on the method of phenomenological reduction, on the philosophical writings of Spinoza, and also on practical experiments in the field of biology and medical sciences, which are only possible through the use of the recently discovered technologies of neuroimaging used in neuroanatomy. Damásio and his team's experimental work, which includes Hanna, his life partner who is responsible for the practical part, is focused mostly on the application of such technologies in the study and treatment of certain brain pathologies responsible for behavior, movement and cognition disorders.

In his book “Looking for Spinoza: Joy, sorrow and the feeling brain,” Damásio (2003) reports an experiment with a woman who suffered a stroke which inhibited a part of her brain from experiencing emotions such as sadness, anger or pain. Although in a first reading this may seem like an advantage, the fact was that at the same time, the patient had difficulties in experiencing other strong emotions, namely joy. This was reflected mostly through a very sudden change of attitude towards her closest ones, such as family members and old friends, hence the reason for her treatment. In this case study, Damásio and his team applied electrodes in very specific points of the patient’s body (not necessarily in the head) in an effort to understand if the stimulation of these through a very small voltage of electrical current would make the nervous system transmit the information to the part of the brain that seemed not to be working properly. The experiment revealed to be a success, as through this the woman, who in the beginning was calm and in a general good mood, started to feel unexplainable feelings of sadness and despair, crying involuntarily and being unable to control these overtaking feelings. Damásio and his team concluded that the problem was in the transmission of neurological information and in the capacity of the patient’s brain to interpret it.

The reader might be confused about the reasons why this episode is referred to so extensively in the context of this thesis. The reason for this lies in what the author has considered to be a breakthrough in science which should no longer be ignored in the field of architecture. Transposing Damásio’s experiments in the stimulation of certain body parts to the field of architectural experience, one can question if a user’s mind can be aroused by applying the same principles in a design project.

Chapter 11

The Embodied Mind and the Mind by Numbers

This Chapter presents how Virtual Reality leaves science-fiction and becomes a part of daily life. Scientific studies report an increased growth in mental illness and other pathologies such as diabetes and hypertension due to over-use of passive means of work, such as the standard office unite of computer, desk and chair. Material body starts showing signs of neglect, of imbalance between somatic experience in real life (movement, non-artificial stimulation) and experience in virtual life. Artists regain interest in the body and sensory perception. Pallasmaa proposes a "corporeal architecture" to address collective sensory deprivation. Embodied architecture moves from the Suburban House to the Wellness-centre.

According to Stanford Encyclopaedia, Embodiment means that an agent's cognition is dependent upon its physical characteristics, meaning its body or corporeal¹ properties. These include its physical arrangement, as well as its sensory system, which are understood as a whole sentient entity. The concept of Embodiment implies that such properties play a significant role in that agent's cognitive processing or reading of the environment. By cognition (in Latin *cogito*: to think) the author is referring to the term that defines the mental processes that are involved in gaining knowledge and understanding. As examples of cognitive activities that are higher-level functions of the brain, we can refer to internal actions (or "movements") such as thinking, knowing, remembering, judging, and problem solving, keeping in mind that they are responsible for perception, imagination, language, and planning.

Contemporary science, specifically with authors such as Varela and Damásio, acknowledges that the body of an agent operates on three distinct cognitive levels. The body can operate: as a "constraint" on cognition, meaning that it can restrict the system; as a distributor for cognitive processing, meaning that it can extend cognition, and as a regulator of cognitive activity, meaning that it can support processes needed for the system's *homeostasis*².

¹ By "corporeal," we mean the Oxford's English definition of "*relating to the body; existing or manifesting in bodily form, of a material nature*". By "corporeality", we are referring to the same meaning.

² The concepts of restriction and extension were directly addressed in the Experiment #1 – "*Raummetaphern*," which explored changes in sensorial perception by introducing a body extension in the corporeal schema, and in Experiment #2 – "*Corporeal Architecture*," which explored the concepts of body extensions and body restrictions through the design of objects that extended or restrained the corporeal schema. The description of such experiments and the discussion of the results follow in Chapter 12.

By *homeostasis* the author means Damásio's notion of the process that maintains the stability of the human body's internal workings in response to changes in its surrounding environment, being a property that assures that the different variables responsible for keeping the system (body/agent) balanced are regulated, keeping internal conditions stable and relatively constant, while responding to changes in the external environment.

Cognitive Linguist George Lakoff, author of the influential book "Metaphors we live by" argues that all cognition is based on knowledge that comes from the body and that other domains are mapped onto our embodied knowledge using a combination of conceptual metaphors, image schemas, and prototypes. Researchers like Lakoff have developed work that suggests that humans use their understanding of known physical objects, actions and situations, which include architectural and urban spaces, to understand other more complex domains. Examples of these domains are more disciplines, such as mathematics, but also general emotional processes, such as social relationships and death. The contemporary understanding of the term "embodied mind," therefore, refers to the intrinsic unity that exists between a body's various sensorimotor capacities and cognition, regarding that such sensorimotor capacities are themselves embedded in integral wider context that includes biological, psychological, and cultural aspects.

As already discussed in the Introduction, interest on the topic of emotional experience of architectural space has re-appeared, in the field of Architecture, especially through the recent work of Juhani Pallasmaa, as a consequence of the influence of the embodied mind theory on diverse areas of knowledge.

The 2012 ETSAB's conference of the Architectonics Network promoted a debate between Pallasmaa and Prof. David Kirsh, who is a researcher in the field of Cognitive Sciences at UCSD, known for his studies on Situated and Embodied Cognition.

Kirsh's research explores the use of digital technologies and sensory design as an approach to the issues of assisted living of Alzheimer's patients. By "sensory design," we are referring to the contemporary approach to design as "experience" and it is a blooming area of practice and research. Sensory design includes the calculated choice and arrangement of design elements taking in consideration the psychophysiological effect of parameters such as colour, light, scent and sound on the human body. Sensory designed spaces usually are conceived around a specific narrative and are generally chosen for the customization of environments in which the physical experience of space plays an important part. Examples of its use in architectural settings include health-care facilities such as hospitals, spas and wellness centres, large retail areas such as shopping centres or cultural venues /entertainment areas, such as museums, cinemas or theme parks.

It is important to refer that sensorial design, in contemporary terms, usually relies on the use of the latest technologies and is nowadays intrinsically connected to new media, being augmented reality installations one of the most common examples of its application. Therefore, it is also common that such environments are designed not necessarily by architects but by Information Technologies (IT) specialists, although it also is frequent that such projects are developed within teams that include both designers and IT specialists. According to Kirsh, who also is not formally trained as a designer, laboratory experiments undertaken in his department at UCSD, which have used augmented reality and emotion measurement methodologies to assess

the user's sensory experience of specific architectural settings, have demonstrated that these methodologies can be extremely helpful to understand how design solutions are perceived by patients.

The debate at the ETSAB 2012 conference mentioned above, which was long and heated, with a strong reaction by Pallasmaa's against Kirsh's technological approach on sensory design, raised many important questions, and revealed a certain resistance on the behalf the architectural community to accept a direct involvement with methodologies that are perceived as belonging to "conventional sciences." Still, one has to recall that until the 19th century, some of the most important developments in the field of Architecture, both in theory and in practice, have taken place through the work of authors who were directly involved with other areas of knowledge, such as psychology and medicine, as discussed in the previous chapters.

Although it may seem that the topic of emotions and sensory experience of architecture might be a new source of concern for the architectural community, they were already addressed in the 19th century by Heinrich Wölfflin, specifically in his work "Prolegomena for a Psychology of Architecture," as previously discussed on Chapter 7. Interestingly enough, essays such as Wölfflin's were produced in the last three decades of the 19th century, at a time when technological developments caused social and economic changes that led to a paradigm shift in culture. A similar process can be observed now in contemporary culture since the proposal of the "embodied mind" theory by Varela, (1992) and its rippling effect on many areas of knowledge, ranging from social sciences to marketing or economics. New terms have since then been established such as neuromarketing, neuroeconomics and even neuroarchitecture, although with few consequences in the latter case.

Wölfflin's work is part of a collection of essays called "Empathy, Form, and Space: Problems in German Aesthetics: 1873-1893," which was translated from German into English by Mallgrave only in 1994. This may explain why the topics of Empathy, Emotions, and Architecture remained a rather hidden concern that stayed in the German-speaking intellectual landscape for quite a long time. Mallgrave also is, not surprisingly, a founding member of the ANFA (Academy of Neuroscience for Architecture), and author of "Architecture and Embodiment," (2014) where he writes concisely but with precision on the implications of contemporary knowledge on the relation of body and the mind and how such knowledge can help us to better understand the role of Architecture in human emotions, and vice versa. Mallgrave also is one of the main reviewers of the "Arquitectonics Network Journal," which was responsible for the organization of the ETSAB conference mentioned above.

Already in the late 19th century Germany, answers to the aesthetic problem of how we might appreciate and exploit architectural space, as well as other aesthetical manifestations, have been proposed, but not verified within the Positivist definition of "science." This was due to the unavailability of methodologies to measure emotions. This has caused discussions on architecture and emotions to remain silent and confined to the aesthetical field and to phenomenological studies. The progressive specialization and establishment of Architecture as an area of knowledge in itself may have also contributed to disregard the evolution of such methodologies or even the importance of emotional experience in architectural space. Such concepts would even be deemed as ridiculous or disregarded as romantic idealizations that had more in common with the Beaux-Arts tradition than with the Functionalist approach brought by early 19th century's Avant-Gard that, regardless

of many Post-Modern efforts to desacralize it, remains established in the referential pantheon of Modernist architecture titans. Still, one also has to recall Le Corbusier's concern with the topic when he states that "*construction is made to hold things together, architecture is for stirring emotion.*"

Emotions are not easy to define or classify and one has to consider the etymology of the word. According to the Oxford Dictionary, the modern meaning of emotion is surprisingly recent and very different from its original sense. In the 16th century the word first meant 'a public disturbance or commotion,' the root of the word coming from the Latin *movere*, 'to move,' and the second sense represented 'a movement or migration.' The main current meaning of emotion as 'a strong feeling such as joy or anger' was not used in writing until the early 1800s. It wouldn't take too long until emotions were examined with greater rigor in the scientific field, first in Biology with Darwin and later in Psychology with Freud, Lipps, and Jung. Nowadays, and here we take Damásio's work as reference, a scientific definition of emotion consists of "*physiological changes, cognitions, behaviour and feelings which occur in the body of an agent, as an effect of the particular context/environment in which she/he is embedded in.*" The biological purpose of emotions is to inform the agent about their interaction with the world. The core aspects of emotions reside in their expression, which is done in great part, but not only, through facial communication, and in their recognition. In 1872 Darwin had already defined in his book "The Expression of Emotions in Man and Animals" what could be called a lexicon of basic emotions, including anxiety/fear, sadness, anger, happiness/joy and disgust, among others.

These emotions are basic in the sense that they biologically grounded and important to the evolutionary survival of the individual, After Darwin, this lexicon was extended and refined. In 1962 Robert Plutchik created a wheel of emotions consisting of 8 basic emotions and 8 advanced ones, in which each advanced emotion was composed of 2 basic ones. Plutchik's wheel relates colours to emotions and seems to have drawn inspiration from some of Itten's notions on Colour and Gestalt, simplifying them. (Fig. 11.01)

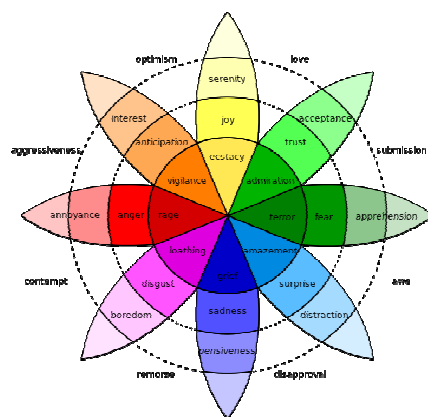


Fig. 11.01: Plutchik's wheel of Emotions.

According to the wheel system, primary emotions, like primary colours, can be expressed with different intensities and mixed with each other to form additional emotions. The wheel includes 8 primary bipolar emotions, namely: joy versus sadness; anger versus fear; trust versus disgust; and surprise versus anticipation. The socially constructed and self-conscious or self-referent emotions are: pride, shyness, embarrassment, guilt and shame. Some of these emotions, in addition to provide information about the individual, function as mechanisms of social control. In human beings, emotional behaviour has been studied mainly in relation to facial expression.

The expressions for the various emotions seem to be universal, although rules for when and how much emotion to express vary from culture to culture. Physiological arousal is thought to be a necessary aspect of emotion, but this has not been proved so far. Both the autonomic and the central nervous systems are implicated in emotion, but there is scarce evidence to support the idea that each emotion has its own particular pattern of physiological expression. The major form of cognition involved in emotion is the appraisal of the significance of stimuli for the individual.

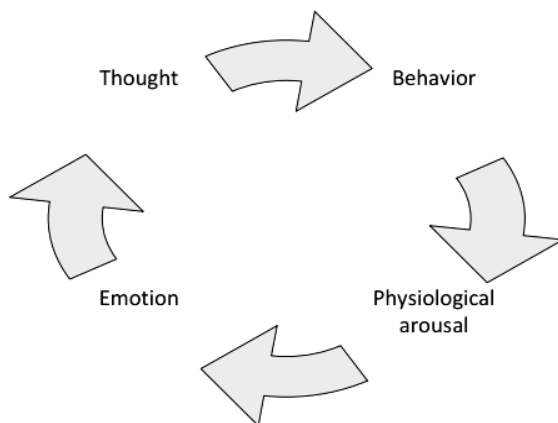


Fig. 11.02: Schema of the thinking process.

Emotion and cognition are intimately intertwined and emotion and motivation are also connected. It is difficult to understand emotion without considering cognition. The main way in which cognitions and emotions are linked is through appraisal. When anything happens, we evaluate what it means for us, its significance to us – this is an emotional appraisal, or an appraisal that leads to an emotional reaction. These appraisals are believed to help us in making fine distinctions about our emotional experiences or in determining the extent or the intensity of the emotion. (Fig. 11.02)

Since the 1970s there is a great variety of affective report measures available and used in fields of knowledge other than Architecture, including Psychology, Cognitive Sciences, and Human-Computer Interaction. This has raised difficulties in defining what to assess when measuring people's reports of internal feeling states. According to Lang, (1969) choosing a physiological or behavioural measure can be surprisingly easy, to the extent that available technology and methodological procedures determine the choice, most of the time.

Emotional response can be measured considering at least three different systems - affective reports, physiological reactivity, and behavioural acts. To Bradley and Lang, (1994) the differences in affective meaning among stimuli, such as people, objects, places or events, can be summarized using three basic parameters. Such parameters have been coined by Wundt (1896) who defined them originally as *lust*, (pleasure), *spannung* (tension) and *beruhigung* (inhibition). Later on, these parameters were settled as "pleasure, arousal and dominance," respectively. It is interesting to note that Wundt's work is mentioned repeatedly in Wölfflin's "Prolegomena for a Psychology of Architecture."

Wundt's theoretical categories have been consistently used since his contribution to the field of psychology and, according to Bradley and Lang, empirical work in the field has confirmed consistently that the parameters of "pleasure, arousal, and dominance" are pervasive in organizing human judgements for a varied range of perceptual and symbolic stimuli. Judgments of nonverbal stimuli, such as sonar signal and aesthetic pieces of art have often been measured using the "Semantic Differential Scale" developed by Osgood *et al.* (1975) and Mehrabian and Russell. (1974; 1908)

This scale is largely used to assess human perception of the three-dimensional structure of objects, events and situations. It consists of 18 bipolar adjective pairs, each rated along a 9-point scale. The analysis of the resulting ratings in the 18 parameters generates scores in the dimensions of "pleasure, arousal and dominance," according to Wundt's categories. The 18 pairs are "unhappy-happy," "annoyed-pleased," "unsatisfied-satisfied," "melancholic-contented," "despairing-hopeful," "bored-relaxed," "relaxed-stimulated," "calm-excited," "sluggish-frenzied," "dull-jittery," "sleepy-wide-awake," "unaroused-aroused," "controlled-controlling," "influenced-influential," "cared for - in control," "awed-important," "submissive-dominant," and "guided-autonomous." As said above, these pairs are evaluated usually on a 1-9 rating scale for the three Wundt parameters of pleasure, arousal, dominance. According to Bradley and Lang, although the Semantic Differential Scale is shown to be informative of the perceiver's emotional response to the exposure of certain stimuli, there are a number of difficulties related to its use. The first of these difficulties lies on the fact that it is not practical to come up with 18 different ratings for each stimulus presented during an experiment.

It requires significant investments in time and effort and results in a relatively large database that requires statistical expertise for analysis. The second difficulty in using the semantic differential scale, which also turns it an inefficient method for emotion measurement, is that it relies on an exclusively "verbal" rating system that is difficult to use with people who are not fluent in the English language. Translating the words is not desirable as the semantic/cultural layers of meaning can be lost or altered with the translation.

The third difficulty was acknowledged in the field of psychology, and is that subjects, who are not linguistically sophisticated, such as children or sufferers of certain brain conditions such as aphasia or dementia, seem to have difficulties in evaluating their perceptions using such a scale. In order to overcome such difficulties, Lang (1980) and Hodes, Cook & Lang (1985) devised an image-based instrument called the Self-Assessment Manikin (SAM). SAM consists in a graphical representation of different emotional states, organized into the same three categories established by Wundt, that is intended to directly assess the response of a subject to an object or event. (Fig. 11.03)

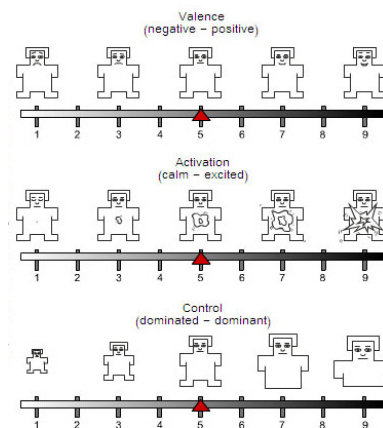


Fig. 11.03: Self-Assessment Manikin (SAM).

Initially SAM was implemented as an interactive computer program but since this version wasn't flexible enough and required both knowledge of the technology, at least on a basic level, it was adapted to a paper-and-pencil version that illustrates in a graphic way, various points along each of the three major affective dimensions. Bradley and Lang's SAM chart uses graphic scales that range from a smiling happy figure to a frowning, unhappy one, in the pleasure parameter, and from an excited, wide-eyed figure to a relaxed, sleepy one in the arousal parameter.

The dominance parameter represents changes in the feelings of control and it is rated through variations in the size of the SAM Manikin: a small figure indicates minimum control and a large figure indicates maximum control of the situation. In this paper-and-pen version, subject in the experiment can place their choice by placing a cross over any of the five figures or between any two of them. Subjects can also make a circle around the 9-point rating scale for each parameter.

SAM has been used with reliable results to measure emotional responses in a variety of experimental settings, including reactions to pictures (Greenwald, Cook, Lang, 1989; Lang, Greenwald, Bradley & Hamm, 1993), images (Miller, Levin, Kozak, Cook, McLean & Lang, 1987), sounds (Bradley, 1994), advertisements (Morris, Bradley, Waine & Lang, in press), painful stimuli (McNeil & Brunetti, 1992) among others. SAM has also been used with children (Greenbaum, Turner, Cook & Melamed, 1990), anxiety patients (Cook, Melamed, Cuthbert, McNeil & Lang, 1988) and other clinical populations. (Bradley and Lang, 1994).

Therefore, SAM has been widely accepted by the scientific community as an easy, nonverbal and reliable method for quickly assessing people's reports of affective experiences. To the author's knowledge, there is no work referring to the use of SAM to evaluate a subject's perception of an architectural space. There seems to be no empirical final solution to the debate on which components are sufficient or necessary to measure emotions. However, since the late 90s, and specifically with the rapid development in the area of Human-Computer-Interaction systems, emotions and human experience have been taken in consideration as more important factors, specifically to determine interface design solutions.

Desmet (2004) treated emotion as a multifaceted phenomenon consisting of the following components: behavioural reactions, expressive reactions, physiological reactions, and subjective feelings. Such definition of emotion illustrates the breadth of the phenomenon, and reflects the complexity of emotions as responses including many of these elements. Mauss and Robinson (2009) divided emotional response into emotional experience, physiology, and behaviour, whereas Lang had categorized it into affective evaluation, facial expressiveness, visceral reactivity, and behavioural responses that maintain or terminate stimulation. Such view that considers all facets of emotional response is useful to organize the measurement techniques available to Human Computer Interaction, an established reality. To the author's knowledge, these concepts and methodologies have not been sufficiently explored in the analysis of design processes, particularly in the field of Architecture, but in Industrial or Interface Design, they are already common practice.

Donald Norman, a specialist in design, usability engineering, and cognitive science and director of the Design Lab at UCSD defines in his seminal work "Emotional Design" (2004) three dimensions regarding usability, which differ slightly from Wundt's parameters and are defined as "visceral, behavioural, and reflective." Norman, whose *alma mater* is the MIT, claims that emotions shouldn't be disregarded in design as they have a crucial role in humans' understanding of the environment, taking a very important part also in the learning process, not only in childhood but also in other stages of life.

Nowadays, we also know from neurosciences that neuroplasticity allows the continued capacity of humans to learn and be creative in the course of a lifetime. Norman affirms, based on his research on usability in design that aesthetically pleasing objects seem to be more effective than purely functional ones, because of their sensual appeal.

The user feels an affinity (or empathy) for an object that is appealing to her/him because an emotional bond is established with the object. (Fig. 11.04)



Fig. 11.04: Phillip Stark, Citrus Squeezer, used by Norman as an example of Emotional Design.

This represents a shift from widely accepted values of performativity purely based on target values of efficiency, speed, and cost. Plain usability does not account for and does not evaluate the range of emotions linked to human experience. Although some studies on user satisfaction have been conducted, they are limited to the assessment of satisfaction associated with efficiency and error rates. They have been regarded as ill-suited to measure emotion. Alternatively, a Multi-Componential Response approach, (Kim, Cho and Tim, 2015) consisting of not just one component, but of a variety of components can provide a comprehensive way of measuring emotions. According to Kim *et al.*, whose research represents the state of the art on the subject, “*three main components of emotional response are currently accepted in Human-Computer-Interaction: experiential response, physiological response, and behavioural response.*”

It was precisely this methodology that was applied in the experiments of this thesis, as described in Chapter 12, through the combined use of SAM charts (experiential response), measuring of physiology response (e-health platform) and evaluation of behaviour response (Presence Questionnaire). The “e-Health Sensor Shield V2.0” (Fig. 11.05) was the machinery used in the experiments to measure the participants’ physiological response. The “e-Health Sensor” allows “Arduino” and “Raspberry Pi” users to perform biometric and medical applications where body monitoring is needed, by using 10 different sensors: pulse, oxygen in blood (SPO2), airflow (breathing), body temperature, electrocardiogram (ECG), glucometer, galvanic skin response (GSR - sweating), blood pressure (sphygmomanometer), subjects’ position (accelerometer), and muscle/electromyography (EMG) sensors.

This information was used to monitor the emotional and physiological state of each subject in real time and obtain data on such states to be subsequently analysed. Using Wi-Fi technology, the biometric information gathered was sent to a “cloud” to store it permanently and to a laptop to visualize it in real time.



Fig. 11.05: e-Health Platform with Arduino board and sensors.

The third means to gather information used in the Experiments was a Presence Questionnaire (PQ). PQ was created by Witmer and Singer (1994) for military purposes to evaluate how immersed and present a person can feel in a virtual simulation. Witmer and Singer considered PQ important to understand how realistic simulations were, when training subjects to act in virtual environments that simulated specific real-world situation, like in the remote control of drones in a war field. According to Witmer and Singer, a simulated environment should allow the subject to feel that the experience is as “real” as possible and that this depends on a number of factors, evaluated in the PQ, but also on the subject’s capability to focus. Also according to Witmer and Singer, subjects who reported a deep level of immersion in the simulation also felt more accurately present, which shows that the correlation between immersion and presence is important. The PQ taken as a reference for the experiments in this thesis consists of 27 questions that subjects must answer on a 1-9 scale, the same used in the SAM chart, although for assessing different aspects. Instead of “pleasure,” “arousal,” and “dominance”, the PQ 1-9 point scale evaluates the experience of the subject in a range that goes from “less compelling” to “more compelling.” By “compelling” the author means feeling a sense of being present in the experience, or being moved (emotionally or physically) in the simulation.

According to the authors of the PQ, its questions address a number of factors considered important to evaluate Presence. These factors are “Control Factors” (CF), “Sensory Factors” (SF), “Distraction Factors” (DF), and “Realism Factors” (RF).

Other questions address aspects that are categorized as “Subscales” and are generally attributed to the characteristics of the interface that allowed the experience to take place.³ The “Subscales” questions address respectively the parameters of “Involvement Control” (Inv/Ctrl), “Nature” (NAT), “Auditory” (AUD), “Haptic” (HAPT), “Resolution” (RES) and “Interface Quality” (ItfQual). The PQ used in the first two experiments, “Experiment # 1 – *Raummetaphern*” and “Experiment # 2 – Feel your Design”, was based on the original one by Witmer and Singer. For the other two experiments, “Experiment #3 – Corporeal Architecture” and “Experiment #4 – *De Humani Corporis Fabrica.*” a shorter, more optimized version was developed. A detailed explanation of each experiment and the discussion of their results can be found in Chapter 12.

³ For a more detailed description of the Factors and Subscales used in a PQ, please consult the work of Witmer and Singer (1994).

Chapter 12

From the Inside-Out:

Experiments in Architecture and Corporeality

This Chapter presents the final steps of the research process, in which the knowledge summarized in the previous chapters was applied in devising a set of the experiments to test and verify this thesis' hypothesis under different conditions:

- The Grammar of Movement: proposes a compositional system of somatic self-awareness to be used as a tool for designers;
- Experiment #1 - *Raummetaphern*: evaluates changes in sensory perception in the experience of body extensions that simulate a spatial situation;
- Experiment #2 - Feel your Design: evaluates changes in sensory perception in the experience of atmospheric architecture models enhanced with sound and smell;
- Experiment #3 - Corporeal Architecture - evaluates changes in sensory perception in the experience of body extensions, body restrictions, and when the body performs as an architectural element;
- Experiment #4 - *De Humani Corporis Fabrica*: Fabricating emotions through architecture: evaluates changes in sensory perception in the experience of 1:1 scale architecture settings.

Introductory Note

As mentioned in the Introduction, the initial research plan foresaw the combined use of the Grammar of Movement and simulations in virtual environments to verify the thesis hypothesis. However, the literature review led to the conclusion that for assessing the emotional experience of architecture, especially involving movement in space, it was necessary to work in real space. Also, it seemed more appropriate to work with objects and settings that had real properties of weight, scale, scent and texture, as these aspects cannot be simulated so accurately in a virtual environment. For these reasons, the experiments weren't meant to evaluate the effectiveness of computer simulated virtual environments to influence the subjects' emotional experience, although this is still a possibility for future work. Instead they were designed to evaluate the ability of "real" environments and objects to create specific changes in the sensorial and emotional landscape of the subjects. Therefore, the situations explored in the experiments were simulated through architecture models, through objects that functioned as body extensions or restrictions – "props" as one would call in performance, and through 1:1 scale models of architectural settings -- interior spaces as defined, for example by Neufert, like a kitchen unit.

It was also important to understand how such material properties interfere directly with the emotional experience of a subject, specifically as they address sensory modalities that are still hard to explore in virtual simulations due to technological constraints. Although conceived to evaluate the sense of Presence, that is, the feeling of being "more or less compelled" by a virtual environment, the Presence Questionnaire was considered a valuable tool for the research to qualify

a subjects' experience of a real environment, as it used a methodology that helped finding answers for the thesis main question: *“how is it that a designed object/architecture space affects the emotions (or is able to move) of a user?”*

The importance of the combined use of the PQ and the SAM chart also was re-enforced by difficulties encountered in the course of the Experiments with students. Sensors of the e-Health platform didn't function consistently throughout the experiment and performances with objects that demanded more movement interfered with the calibration of the sensors. For this reason, it was important to cross-reference data collected also with the SAM charts and the Presence Questionnaires, to assess the emotions experienced by each subject/performer as accurately as possible. Even though the e-Health platform sensors presented such difficulties, the data collected were consistent with the results evaluated through the SAM charts and Presence Questionnaires in most cases. This suggests that for measuring emotions it may be desirable to use biometric machinery, but it is not mandatory. Therefore, experiments with similar goals may be developed without sophisticated technological means, as the information collected with SAM charts and the Presence Questionnaires may be sufficient to measure rather comprehensively the emotions experienced by the subjects.

This presents interesting opportunities as it allows performers to explore wider ranges of movements in the performances without being concerned with disconnecting sensors, and suggests that experimental setting can be flexible, that is, not dependent on conditions built specifically for the experiment.

Experiments with the goal of evaluating the emotional experience of a user in an architectural space can, therefore, take place in existing environments and virtual simulations, facilitating the study of how subjects feel in such spaces, without compromising accuracy.

As such, it would be possible and advantageous to integrate such a methodology in the design process, to evaluate the effectiveness of designed objects and architectural spaces in producing specific emotions or moods in a subject and, most interestingly, in analysing how existing built environment actually affects our bodies and, therefore, our minds. Such an analysis would not be focussed on ergonomic factors in the strict sense, but mainly on the psychophysiological effects of designed objects and spaces on the body and mind of the user. Hence, it would permit one to understand what could be improved in order to respond to both contemporary living requirements and basic biological demands. Architecture and design objects can, therefore, be used to truly protect and nurture the emotional needs of the human body, by consciously providing meaningful experiences to users. The next sections describe and discuss in detail the Grammar of Movement and the Experiments with students at TUK, which applied the knowledge acquired with the literature review presented in the previous chapters and tested the thesis hypothesis.

Pilot Project - The Grammar of Movement

Introduction

This pilot project was the first practical reflection on the topic of the human body undertaken in the course of the CDA. At the time, it was necessary to produce an assignment for the chair of “Programming and Computation for Architecture.” This assignment required the development of an AutoLisp code and the author chose to represent a parametric human body. It was decided to expand the universe of human body types to include different genders, sizes and other variations, instead of just a single canonical body, as this would allow the simulation of a larger number of actions and, consequently, of spatial relationships and situations. In the program developed, it is possible to choose from different body types - Male, Female, Child, OverAveragePerson and UnderAveragePerson – – because different ranges of values for certain parameters were foreseen in the development of the code. (Figs. 12.01 and 12.02)

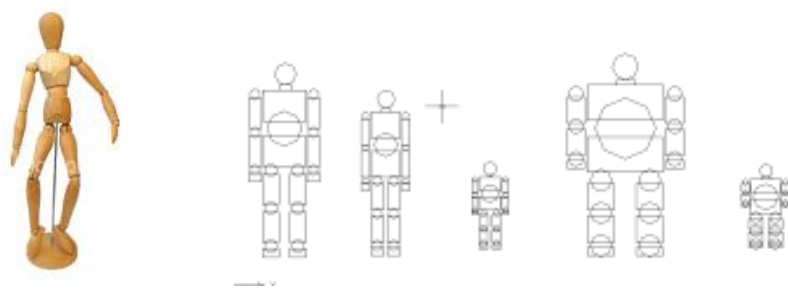


Fig. 12.01: Humanoid scale model used as a reference in the development of a digital parametric puppet. Image by author.

Fig. 12.02: Output of “Genera(c)tiveHumanoidLifeForm”, the AutoLISP code for generating: Male, Female, Child, OverAveragePerson and UnderAveragePerson. Image by author.

While writing the code for the digital parametric puppet that simulated the human body character – the “Genera(c)tiveHumanoidLifeForm” – it was necessary to abstract human form but in a way that guaranteed that human motion could be simulated adequately. The model is a replica of the articulated scale models usually used in drawing classes. Its simple “body” is sectioned in various main segments, followed by an anatomical simplification of the members, so that each section corresponds to a drawing function written in AutoLISP. A brief description of the code is provided below and a detailed one in Appendix II.

Description

The geometry used in the Humanoid puppet is composed by a set of elemental shapes, including circles representing body joints and head and rectangles representing straight body parts. The former are responsible for the rotation of the latter, like in the functioning of the mechanisms of a real human body. Each one of these body parts corresponds to a drawing function defined by a set of three parameters: insertion point, given by coordinates x e y ; width of the shoulders (width); and height of the body (height). Restrictions imposed on the relative values of some parameters ensure that the generated body character conforms to the real proportions of human bodies, while allowing for variation so as to generate as many variations as possible of “body types.” Restrictions also are imposed on the relative position of body parts, defining acceptable spatial relations, so that they simulate real movements of human bodies. Body movements between adjacent body parts are encoded as shape rules. Coordinated body movements can be simulated by sequential application of various rules.

The developed grammar is a literal interpretation of human body and movements and it can generate animations, or choreographies. To keep track of movement, the program has a feature that copies the body onto its new position while leaving the previous in its place. This overlapping of the program's successive output was created by analogy with the Futurist synthesis used to study movement and simultaneity, a technique that also led to the development of cinematic experiences by Italian Futurists, such as Balla. (Fig. 12.03 and 12.04)

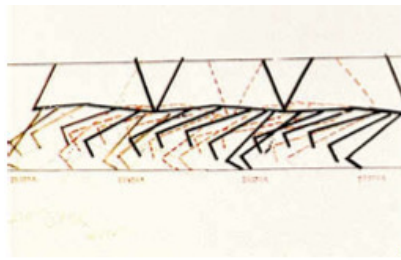


Fig. 12.03: Giacomo Balla's technical study for "Girl Running on a Balcony". 1912.

Fig. 12.04: Balla's Dynamism of a Dog on a Leash. 1912.

Muybridge's "Animal Locomotion Plate 99" was used as a reference in defining the output of the desired program, because he is considered by many as the father of cinema, and a pioneer in the study of animal locomotion, using a self-developed photographic multiple exposure system called the "Zoopraxiscope"¹, which allowed the sequential projection of images on a screen, thereby generating animations. (Fig. 12.05)

¹ "Zoopraxiscope", [Zoo- + Gr. a doing, an acting (from to do) + -scope.]

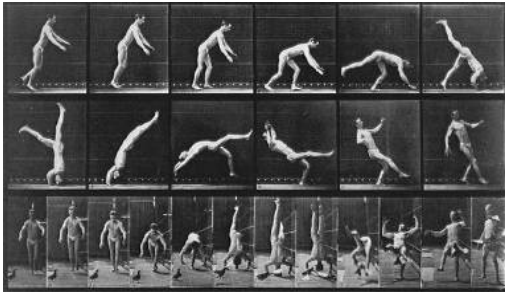
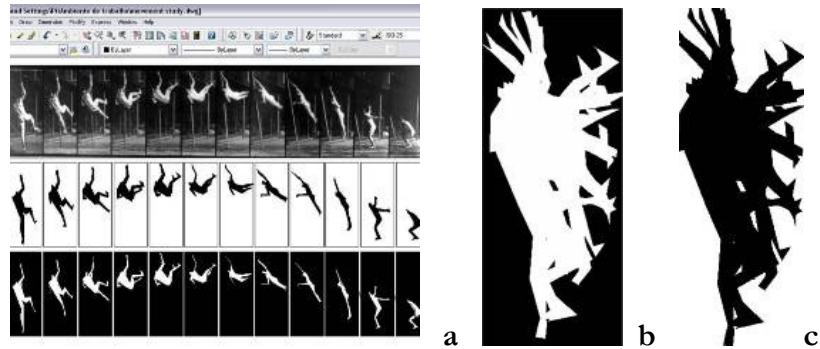


Fig. 12.05: Edward Muybridge. “Animal Locomotion Plate 99”. 1887.

This concept was the basis for the conception of the Grammar of Movement, which was written afterwards. This grammar functions as a human movement simulation tool, which can be defined according to the rules and parameters codified by the grammar. Each rule corresponds to a transformation in the relative position of part of the body, defined as a set of shapes. The application of the rules represents a movement executed by body after changing the position of some of all of its shapes in space. (Fig. 12.06 to 12.08) The initial set of shapes represents the standing position of a human body and the rules developed so far allow for a series of variations that can be used to generate choreographies. This language can grow in complexity as more rules can be applied successively to represent a larger set of motions. Then, it could be possible to define various sub-languages, for example one for dance, another for yoga, another for daily tasks and so on, having in mind that these languages will always descend from the “mother” language of the movement. More information on this subject can be found in Laban’s work as he is credited as having organized such a detailed collection of actions into a coherent vocabulary.



Figs.12.06, 12.07 and 12.08: Interpretation of Muybridge's movement sequences (a) and two overlapping outputs of the program "Genera(c)tiveHumanoidLifeForm" (b and c)

Results

Following Duarte's Malagueira Grammar definition, the Grammar of Movement is a parametric shape grammar defined in the Cartesian product of the algebras represented by the following matrix:

<U₀₃V₀₃>

<W₀₃V₀₃>

<U₁₂V₀₂>

<U₁₂V₀₂>

<U₁₂V₀₂>

The body's envelope was defined in the Cartesian product of the algebras U₀₃ and V₀₃. The elements in the algebra V₀₃ are all labelled dots that indicate the origin of the referential system in which designs are described, the insertion points of body parts in space, the body's centre of gravity, the name of each body part, and the centre and name of joints. The generation of designs (or choreographies) is controlled by cross-referencing the frontal view (elevation), the sagittal section and the horizontal section (plan).

These views were defined in the Cartesian product of the algebras U12 and V02, providing two-dimensional representations of a human body in a certain position. Three-dimensional representations could be used for visualization purposes or eventually in animation. As an example of the use of the Grammar of Movement for analysing and notating movement, it is presented here a sequence of yoga postures. They have been chosen for their symbolic elemental geometry and capacity to illustrate the grammar's ability to generate complex choreographies after various rule application sequences. Here is presented a simple rule description, and given some examples of generated designs, or choreographies, with different levels of complexity. A more detailed account of the grammar can be obtained in Appendix II. Each rule has two views, a front view on the left-hand side and a side view on the right-hand side. (Fig. 12.09)

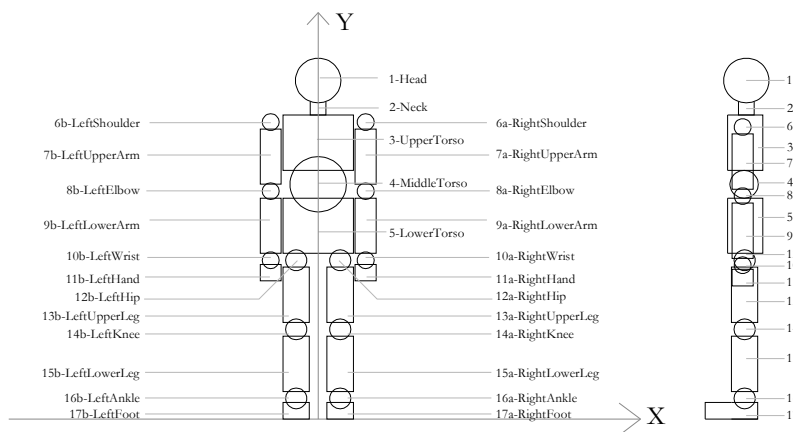
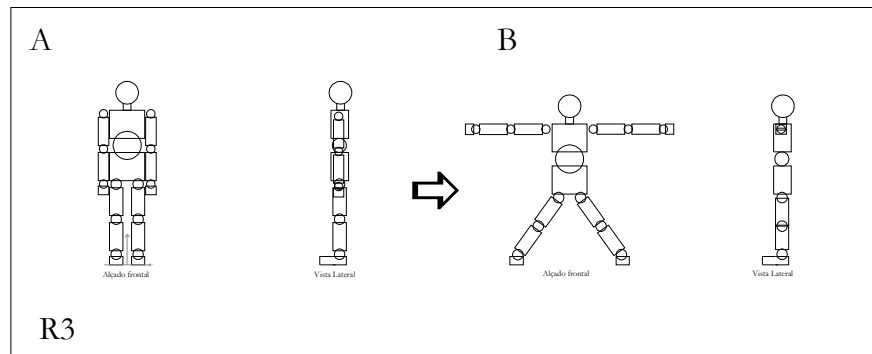


Fig. 12.09: Grammar of Movement's Initial Shape. Image by author.

The initial shape is an output of the Genera(c)tiveHumanoidLifeForm program, a parametric humanoid, based on the human body's system of proportions.

Each of such shapes, or body parts, is identified with a number, as shown in the schemes on Figs. 12.10 through 12.13. This numbering was intended to make the application of rules to each geometrical shape that composes the “body” easier. For example, the rule to rotate the right arm, with the centre in the shoulder would be:

- With center on 6a, rotate until an 120° angle with the X axis is achieved: 11a; 12a; 9a; 8a; 7a ; 6a ;



Figs. 12.10 and 12.11: Examples of Rule R3, before and after rotation of the limbs.

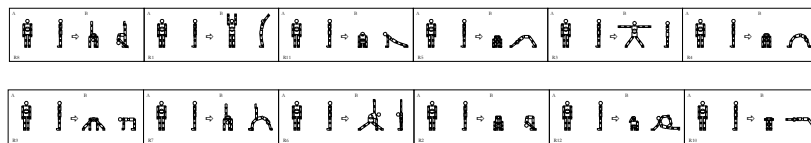
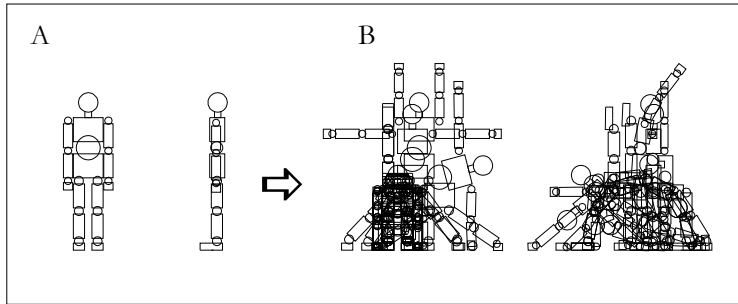


Fig. 12.12: Choreography generated by a random application of rules. Images by author.



R8 ⇨ R1 ⇨ R11 ⇨ R5 ⇨ R3 ⇨ R4 ⇨ R9 ⇨ R7 ⇨ R6 ⇨ R2 ⇨ R12 ⇨ R10

Fig. 12.13: Final choreographic result. Image by author.

Discussion and Conclusions

The Grammar of Movement was initially conceived as an aiding tool for the notation of the human body movement regarding its relationship to space and it was useful for the author to discern and plan the fundamental aspects to approach in the sensorial training of students participating in the practical experiments that would follow. Nevertheless, it presented some limitations that prevented its deeper use in the study. It was defined in a Cartesian representation of space according to Stiny's paradigm by articulating 2-dimensional line representations. This level of abstraction brought it closer to Cubist representations of space, but made it difficult to visualize topological relationships in the three-dimensional space. It would be possible to redevelop the grammar in the three-dimensional space, but the effort involved would not compensate for the outcome, as the study became more focused on the effect architectural space on emotion and, as a result, experiments with real subjects seemed crucial.

In the course of the preparation for the experiments, the Grammar was shown to be too abstract to be used by students and university colleagues who are not used to work within the shape grammar framework or have trouble understanding its algebraic formulation. This posed difficulties, since the experimental part of the thesis involved the direct participation of students and members of the teaching staff of the Fachbereich Architektur TU Kaiserslautern, who participated both as subjects and as evaluators of students' work in the experiments. In addition, after the comprehensive study on the work of Laban and Schlemmer and, specifically, after having knowledge concerning the possibility of using contemporary technology such as motion capture devices for the notation of movement, the author realized that there was no real necessity to create a new system of movement notation. Also, Laban's system is still widely accepted, although Labanotation as it is called continues to pose problems to dancers who find it too abstract. The Grammar of Movement can be used for the purpose of movement notation, being less abstract than Laban's system and is one of the original contributions of this thesis.

For a detailed development of the Grammar and its possibilities please see Appendix II where its rules and lowest-level-constituents are presented, together with a thorough examination of the kinetic possibilities of the human body according to the shape grammar framework.

Experiment #1 – *Raummetaphern*

Introduction

This experiment was developed as the last stage of a required course with students of Vocational Teaching in Media and Communication Technology. The goal of the course was to teach these students how to work with digital tools of design and fabrication. The goal of the experiment was the evaluation of the emotional reaction to changes in users sensory perception when using body extensions designed and fabricated with CAD/CAM tools. The course was attended by 34 students and 29 participated in the experiment as subjects on the final class, dedicated to the performance with the objects designed and developed during the semester. The course took place from April 15th through July 24th 2013, the date of the performance, and it was hosted by the Fachbereich Architektur, Digitale Werkzeuge, TU Kaiserslautern, Germany.

Description

This course dealt with the practical application of various digital tools for the collection, processing, and production of objects on the theme of *Raummetaphern*, i.e. spatial metaphors. *Raummetaphern* refers to expressions existing in the German language, which relate the body to a spatial situation.²

² For a complete list of the metaphors chosen by the students please see Appendix II where they appear both in the original German language and in English.

Each of the students was assigned on the first day of the course a metaphor that described a spatial situation. In the course of the semester the students had to conceive, develop and finally build an object that would interpret the *Raummetaphern* as an extension of the human body and its action spectrum. The objects that the students were assigned to design and fabricate should function as mediators between the body and the spatial metaphor. As an example, for the spatial metaphor *Alle Brücken hinter sich abbrechen* – (destroying all bridges behind) the student created an object which resembled a large scale hammer and for the performance the student devised a choreography of actions which simulated that he was destroying (imaginary) bridges behind with the designed object. (Fig. 12.14)



Fig. 12.14: *Raummetaphern*. Student performing “*Alle Brücken hinter sich abbrechen*”.

The goal of the experiment is related directly with this thesis main hypothesis that *it is possible to consciously influence a user's emotional reaction through a design object that conditions hers/his movements*. The goal was to explore through a performance the interaction between body, movement and space. Namely, the idea was to evaluate the subject's emotional experience while performing with an object that extended the body's usual range of action, therefore, conditioning the performer's emotional reaction by changing hers/his usual sensory perception. The emotional experience of each subject performing with the object was evaluated through the use of a Presence Questionnaire and a SAM chart³. During the course of the semester, the students who would participate in the performance of *Raummetaphern* were introduced to the use of selected software for representation and digital production of designs. They also were introduced to basic concepts and techniques of performance art in order to prepare for the experiment that would take place on the last day of the course. For the experiment, each student was instructed to prepare a performance that explored the spatial relationship between the body, the space and the object conceived under the motto of the spatial metaphor. (Fig. 12.15) Students were advised to wear comfortable black clothing for the performance, since they would be moving in a setting prepared for the experiment. In addition to the original, required performance, they also were expected to improvise further uses and meanings for the object created. Each student performed with hers/his own design.

³ It was originally planned to include biometric and eye tracking machinery in the experiment, according to the methodology explained on Chapter 11, but this wasn't possible as Experiment #1 and Experiment #2 were undertaken before the Digitale Werkzeuge teamed up with the DFKI. Such a partnership would be effective in time for Experiment #3 and Experiment #4, which are described further below

This was intended as it was important to understand through the performance the emotional connection to the object that each student developed during the whole process of design. The experimental setting was conceived having in mind Muybridge's studies on human locomotion, referred to in the previous section, dedicated to the Grammar of Movement, and in Chapter 5. It consisted of a black background and a black floor, obtained by a continuous piece of black fabric. (Fig. 12.16)

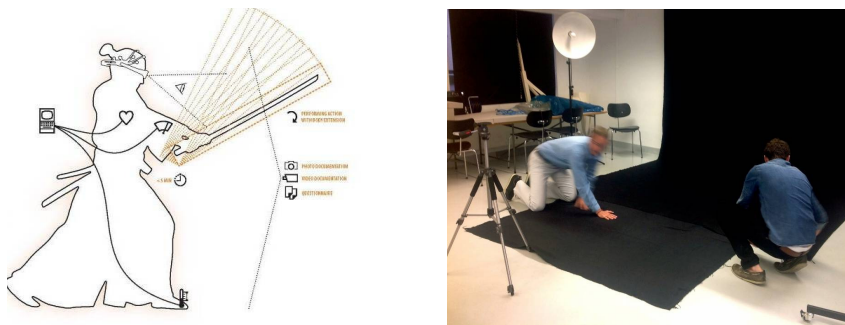


Fig. 12.15: *Raummetaphern*: experimental setting scheme.

Fig. 12.16: *Raummetaphern*: preparation of the setting at the Digitale Werkzeuge, Fachbereich Architektur, TU Kaiserslautern.

It was considered important for documenting the experiments that performers were dressed in a similar way so as to guarantee visual coherence between the photographs of each performance, given that that these could be displayed in an exhibition in the future. As such, students wore tight black clothing underneath and then white sheer overalls, which permitted to see-through their black silhouette. The sheer overalls were meant to enhance the feeling of “Presence” and to emphasise the movements of the performers with the objects, not necessarily the shape of their body.

This way, students would feel more comfortable and not too exposed and perform their idea of the spatial metaphor before the camera without feeling too inhibited. The neutral mask, a standard fabric mask used for cosmetic purposes, was chosen following the pedagogy of theatre director Jacques Lecoq, who follows some of the principles of corporeal training devised by Laban and Meyerhold, described in Chapter 8.



Fig. 12.17-18: *Raummetaphern* neutral Masks and Questionnaires used during student's performance (left) and student being prepared for performance (right).

Lecoq developed ideas on the use of the neutral mask as a liberating tool that allowed the performer to transmit through hers/his body the spatial idea s/he had in the mind, without the constraints of the everyday *persona*, which usually is expressed mainly through the face. It also was considered important that in the Experiments each student would have the privacy to perform only in presence of the camera and the jury.⁴

⁴ The jury who evaluated the students work consisted of the author of this work, as well as Prof. Andreas Kretzer, chair of the Digitale Werkzeuge, and Franziska Wilken, art historian lecturing also at the Fachbereich Architektur.

Therefore, students weren't allowed to see each other while performing, so that each performer/subject could be totally focused on the experiment and answer mindfully to the Presence Questionnaire and SAM chart afterwards.

Recall that the main goal of this experiment was to classify users' response to corporeal stimuli, by analysing sensory data, having in mind that our main hypothesis was:

H1 - a user's emotional response to design objects as "compelled or not compelled", "positive or negative", "aroused or not aroused" and "dominant or dominated" can be evaluated through objective measurements of emotion using a Presence Questionnaire (PQ) and a SAM chart.

Two secondary hypotheses were then formulated:

H2 – the somatic techniques of "performance art" and "emotional design" are an effective strategy to develop corporeal awareness and stimulate the creativity of students and designers;

H3 – the illusion of presence and emotional activation of the body of a user can be intentionally induced through the performance with analogical models, in this case, body extensions;

To verify these hypotheses, the experiment was developed considering the following four stages:

1. Identify the design elements that are more suitable to induce sensations in the user such as "positive, aroused, dominant, compelled" or "negative, not aroused, dominated, not compelled;"

2. Design an object so that those elements are the most important aspects of the design;
3. Perform experiments with users interacting with these objects, while being monitored by camera, and assess their emotional experience through the use of a PQ and a SAM chart after the performance;
4. Process and analyse the sensory data collected to understand if significant differences can be found in the classification and differentiation between a “compelling-positive” experience and a “not compelling-negative” one.

Students' Work

As a way of illustrating and guiding the discussion of experimental results, two examples of student's work are included below, respectively the objects created for Experiment #1 – *Raummetaphern*: *Sich benehmen wie die Axt im Walde* - behaving like an axe in a forest, and *Hinter dem Mond leben* - living behind the moon. For a detailed collection of all the metaphors and objects produced under the topic of *Raummetaphern* please see Appendix II.



Fig. 12.19-20: *Raummetaphern*: examples of Students' work, *Sich benehmen wie die Axt im Walde* - behaving like an axe in a forest, and *Hinter dem Mond leben* - living behind the moon.

Results

Experiment #1 – *Raummetaphern* evaluated the emotional experience of body extensions by the analysis of changes in the sensorial perception of the user, while performing with the extensions. The results collected with this experiment were the answers to the Presence Questionnaire and the SAM chart, where recall of experience and believability of simulation are systematized according to specific parameters.

Such data records the subject's physiological response and emotional activation, thereby enabling one to evaluate the extension's ability to condition the user's movements and alter her/his emotional state and corporeal perception. The data is organized according to Presence Questionnaire's "Factors" and "Subscales," as defined by Witmer and Singer, and to the SAM chart's parameters of Valence, Activation and Control, explained in Chapter 11.

The final values considered in the analysis of the PQ results were obtained by averaging the ratings assigned by the subjects to each of the questions, according to Witmer and Singer's (1998) 1 through 9-point scale. The analysis of the data collected through the SAM chart also followed the same principle, as the three parameters of "valence", "activation" and "control" were rated by the subjects using also a 1-9 point scale. After making such calculations, we obtained values that qualify each subject's individual experience of the *Raummetaphern* objects, regarding the parameters of "presence," "emotional response", "valence", "activation" and "control." From the data collected, we can also qualify the experience of the group of subjects as a whole, by averaging the results for the same parameters.

Average results, thus, show that the group of 29 subjects who participated in the experiment *Raummetaphern* tended to perceive it as “compelling”, “worthwhile”, “pleasant”, “exciting” and “dominating”. These adjectives are related respectively to the parameters of “presence”, “emotional response”, “valence”, “activation” and “control” referred to above.

Also, out of the group of 29 subjects:

- 2 classified the experience as “not compelling” and 26 classified it as “not very compelling”; and 1 classified it as “compelling”;
- 2 classified the emotional response of the objects as “somewhat not worthwhile”, while the remaining 27 classified their emotional response to the objects as “worthwhile”;
- 22 classified the experience as “pleasant”, while 3 classified it as “very pleasant”, 3 as “somewhat not pleasant” and only one has classified the experience as “not pleasant”;
- 4 classified the experience as “not very exciting” and 1 “as not exciting at all”, while the majority of the subjects classified the experience as “exciting”, 19 subjects, and “very exciting”, 5 subjects;
- 2 subjects stated that the experience was “not very dominating”, while 7 classified it as “very dominating” and 20 as “dominating”.

A detailed description of the subject’s ratings according to Witmer and Singer’s PQ factors and subscales follows.

Out of the group of 29 subjects:

- 17 subjects stated they were “able” to control their emotional response to the object, being 3 were “very able”, and 9 “not able at all”;
- 25 subjects stated they were stimulated by the objects, of which 20 considered them “very stimulating” and 3 “extremely stimulating”, while 2 subjects rated them as “not very stimulating”;
- 27 subjects stated their attention was dedicated to the performance, of which 12 were “very dedicated,” 12 “dedicated”, 3 “completely dedicated”, while only 2 were “not very dedicated”;
- 15 subjects were sensuously “very engaged” and 11 “engaged” while only 3 were “not very engaged”;
- 16 subjects were “not at all” visually involved and 4 were “not very involved”, while 6 were “very involved” and 3 were “involved”;
- 16 were “not at all” aurally involved and 5 were “not involved”, while 3 were “involved” and 5 were “very involved”;
- 12 subjects were haptically “involved” and 4 “very involved”, while 7 were “not very involved” and 6 were “not at all” involved;
- 16 were “not at all” involved by the scent of smell and 7 were “not very” involved, while 5 were “involved” and 1 was “very involved”;
- 12 found the experience with the *Raummetaphern* objects “very convincing”, and 11 “convincing”, while 3 considered it not very convincing and 3 “not convincing at all”;
- 24 were “compelled” by the object, and 1 “very compelled”, while 3 were “not compelled” and 1 “not very compelled”;
- 11 found the experiment “not consistent at all” with real life experiences, 8 “not very consistent” and 4 “not consistent”, while 4 considered it “very consistent” and 2 “consistent”;

- 12 were “able” to anticipate the performance by looking at the objects, 4 were “very able”, while 8 were “not very able”, 3 “not able” and 2 “not able at all”;
- 11 were “able” to survey the environment with the object on, while 7 were “not able”, 6 were “not very able”, and 4 were “not able at all”;
- 9 were “very able” to move and 4 “able”, while were 6 “not very able”, 6 “not able”, and 4 “not able at all”;
- 9 were “not very able” to imagine real actions with objects 3 were “not able” and 2 were “not able at all”, while 8 were “able” and 7 were “very able”;
- 15 were “confused”, and 3 were “very confused”, while 5 were “not at all confused”, 4 were “not very confused”, and 2 were “not confused”;
- 17 were “involved” in the experiment and 6 were “very involved”, while 4 were “not involved” and 2 were “not at all involved”;
- 12 were “not at all distracted” by experimental setting, while 6 were “distracted”, 5 were “not very distracted”, 4 “not distracted” and 2 “very distracted”;
- 14 “adjusted” to the experiment and 8 “adjusted quickly”, while 4 “didn’t adjust well” and 3 “didn’t adjust at all”;
- 11 were “distracted” by object quality, while 7 were “not very distracted”, 5 were “not distracted”, 3 were “very distracted” and 3 were “not at all distracted”;
- 16 felt the camera did “not at all interfere” with performance with object, 6 “not interfered”, while 4 “not very much” and 3 “interfered”;
- 11 were “concentrated in the performance”, while 9 were “not very concentrated”, 6 were “very concentrated” and 2 were “not concentrated” and 1 was “not at all concentrated”;
- 15 found the experiment a “good” learning experience and 9 a “very good”, while 3 “not very good” and 2 “not good”;

- 16 found performance art techniques “enhanced” their creativity and 9 “enhanced a lot”, while 2 “not very much”, 1 “not” and 1 “not at all”;
- 10 “didn’t lose much” track of time during performance, while 9 “lost”, 4 “lost completely”, 3 “not” and 3 “not at all”.

The results of Experiment #1 just described are presented in table format in Appendix III and will be discussed on in detail in the next section, as well as in the conclusions.

Discussion and Conclusions

Experiment #1 – *Raummetaphern* evaluated the emotional experience of body extensions by analysing changes in the sensorial perception of the user, while performing with the extensions. The experimental results support the main research hypothesis H1 as a user’s emotional response to design objects as “compelled or not compelled”, “positive or negative”, “aroused or not aroused” and “dominant or dominated” can be evaluated through objective measurements of emotion. Results collected through the Presence Questionnaire and the SAM charts show that the majority of subjects experienced a high level of “Presence”, “Arousal” and “Pleasure”. Most subjects describe their experience as sensually engaging, being involved by the haptic aspects of the performance, and not involved by the visual or aural aspects. This suggests that the subjects were focused on the most important aspect of the experiment which had to do with the movement of the body while performing with the

objects and were concentrated in exploring the kinaesthetic sense instead of vision, hearing or smelling. Although most subjects report a low level of "control" during performance, the majority was able to control their emotional response to objects, which suggests that although engaging, the experience of the objects was not totally immersive.

Results also show that the majority of subjects was not able to survey their surroundings while performing with the objects and found the performance not consistent with real-life experiences. Still, the results reveal that the majority of the subjects was able to anticipate the performance by looking at the object, was able to imagine real actions with it, and was stimulated by the experience, finding it convincing. The majority of subjects also was compelled by the objects to perform and described the emotional response to them as "positive". Except for 5 subjects, the remaining majority rated the experiment as a good learning experience and found that performance art techniques enhanced their creativity and capacity to design. Therefore, Hypothesis H2, which suggests that the somatic techniques of "performance art" and "emotional design" are an effective strategy to develop corporeal awareness and stimulate the creativity of students/designers, is verified. Finally, the majority of the subjects also reported that although they were confused with the experiment, had difficulties in concentrating in performance and were somewhat distracted by object quality, they adjusted quickly to the experiment, were not distracted by the setting and the camera didn't interfere in the performance. Results also show that most subjects were involved in the experiment and lost track of time during the performance.

This suggests that the illusion of presence and arousal situations can be consciously induced in real-space, although further research is necessary to understand which specific design elements are responsible for this. Therefore Hypothesis H3, which suggests that the feeling of “presence” and emotional activation of the body of a user can be intentionally induced through performance with analogical models, in this case, body extensions, is confirmed.

This experiment also shows that by using PQ and SAM it is possible to objectively discriminate arousal responses related to “positive” or “negative” emotions, from the neutral condition, when users experience body extensions. On-going research in the fields of IT, psychology and marketing uses an established range of values that were used as reference in this experiment, namely, Witmer and Singer (1998) and Biocca and Levy. (1995) The author considers that in upcoming experiments it would be interesting to include the use of EEG and the e-health platform to observe how the emotions of a user are triggered, while experiencing design objects. Another goal is to add to the experimental setting eye-tracking sensing technology to record the position of the user and the direction where s/he is looking at.

Experiment II – “Feel your Design”

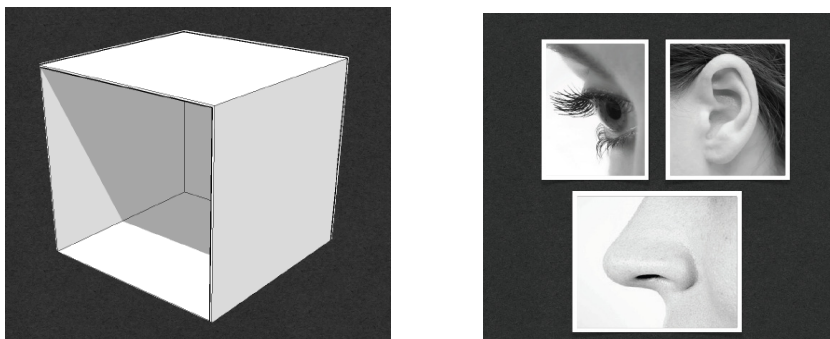
Introduction

The goal of Experiment #2 – “Feel your Design” was to evaluate the emotional reaction of a viewer to changes in the sensory perception when being stimulated by viewing, listening and smelling immersive architectural models. This experiment took place on the last day of the workshop “Feel your Design.” The workshop functioned as an elective course for students of architecture and dealt with the physical construction of immersive architectural models and the evaluation of subjects’ response to the atmosphere’s created by the models. The name of the workshop comes from the assumption that an architectural space can be designed as an experience if the architect takes in consideration sensory aspects such as haptics, sound, and scent in addition to vision. The idea was inspired by Pallasmaa’s work mentioned in Chapter 10. Recall that Pallasmaa proposes the theory that architects should use an embodied, sensorial approach to design as a way of stimulating the body, as a holistic sensory system which is not exclusively dependent on vision, but also on other senses. The workshop also incorporated concepts of “Sensory Design” and “Emotional Design” as discussed in Chapter 11. The task assigned to the students proposed that immersive, atmospheric models were built according to a specific narrative and included specific scents and sounds which were supposed to re-enforce such a narrative or promote a certain mood. This Experiment had the participation of 7 students who produced one model each and served in the Experiment as subjects. The “Feel your Design” workshop occurred from June 19th through July 25th 2013, the last day of the workshop and the date when Experiment #2 took place.

The host institution was the Fachbereich Architektur, Digitale Werkzeuge, TU Kaiserslautern.

Description

Each participant was given a cube measuring 50 x 50 x 50 cm and was requested to choose a room type which could be any kind of interior space such as an attic, a bedroom, a working room, a library, a museum, or a hospital room. The students were asked to choose a narrative that described a mood that was to be explored through the model and design an immersive experience through the combined design of an interior space, the choice of a scent which accentuated the narrative (“scentscape”), and a specifically created sound-loop which re-enforced the desired atmosphere (soundscape). The scale of the interior spaces was left for each student to choose according to her/his idea for the model, as well as the location and dimension of the peeping holes which were meant to condition the viewer’s gaze. (Figs. 12.22-25)



Figs. 12.22-23: “Feel your Design”: working area, a cube of 0.5 x 0.5 x 0.5 m (left), and scheme of sensory design (right).

The setup of the Experiment consisted of Architectural models placed at seating level, installed with peep-holes, scent- and soundscape in the interior of a box with the same dimensions as an old phone-booth, with a bench for the viewer to sit and look at the models and a black fabric curtain to keep the booth in the dark. The tools used for the experiment were one laptop with plugged headphones which was set at a table next to the booth where the models were installed. While inside the booth, the viewer was asked to sit on the bench and take a look into the peeping hole of the model, while listening to the soundscape through the headphones connected to the laptop outside of the booth. Students were advised to install, if possible, small vents inside the models so that the viewers could feel the chosen “scentscape” more intensely.

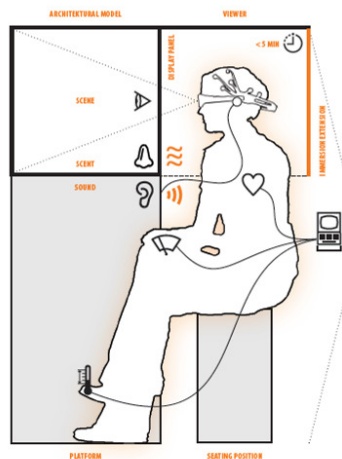


Fig. 12.24: Feel your Design: experiment setup scheme.

The students had to define the possible views into the model space on the display side of the cube, to create a soundscape as a loop in mp3-format, and to complete the experience by adding a specific scent to the model.

The selected title had to describe the desired mood for the architectural space and provide the viewer with the key to the understanding of the narrative. The goal of the exercise was to explore through these immersive models the multi-sensory experience of architectural space and evaluate viewer's emotional reactions to the narrative experienced inside the booth through the analysis of data collected and processed with the emotion measurement methodology also used for Experiment #1.



Fig. 12.25-26: Feel your Design: immersive booth with black/opaque curtain, bench, and peeping area (left) and author peeping through the opening to view the model.



Fig. 12.27-28: Feel your Design: students installing model over a pedestal at booth's window height (left) and detail of student's model "Surfstation" with automated fan to spread "scentscape" into the booth (right).

To support the design process during the workshop, students were introduced to artwork on the topics related with the task such as cinema, model making, art installations, as well as basic notions of architectural archetypes and Plutchik's vocabulary of emotions described in Chapter 11. Students were also introduced to the concepts of emotion measurement, immersion, presence, sensory design and emotional design. Students were encouraged to use CAD/CAM technologies to aid in the process of manufacturing the models. The results of the Experiment were evaluated through the use of a "Presence Questionnaire" and a "SAM chart", as was used in Experiment #1. Recall that the main goal of this experiment was to qualify users' response to immersive architecture models, by analysing sensory data, having in mind that our main hypothesis was:

H1 - a user's emotional response as "compelled or not compelled", "positive or negative", "aroused or not aroused" and "dominant or dominated" to an immersive architecture model can be evaluated through objective measurements of emotion using a Presence Questionnaire (PQ) and a SAM chart.

Two secondary hypotheses were then formulated:

H2 - architecture is an immersive experience which can be consciously composed by the architect; the techniques of "emotional design" and "sensory design" are an effective strategy to compose specific experiences of architectural spaces and develop the sensorial awareness of students and designers;

H3 - the feeling of presence and emotional activation can be induced through the experience of analogical models, in this case, immersive architectural models;

To verify these hypotheses, the experiment was developed considering four stages:

1. Identify the design characteristics that are more suitable to induce certain sensations in the user, such as “positive, aroused, dominant, compelled”, “negative, not aroused, dominated, not compelled”, “joy, sadness, anger, boredom, ecstasy”;
2. Design an immersive model so that those characteristics are the most important aspects of the design;
3. Perform experiments with users interacting with these architectural models and assess their emotional experience through the use of a PQ and a SAM chart;
4. Process and analyse the sensory data collected to understand if significant differences can be found in the classification and differentiation between a “compelling-positive” experience and a “not compelling-negative” one.

Students' Work

As a way of illustrating and guiding the discussion of results, two examples of student's work created for Experiment #2 - “Feel your Design” work are included below, respectively the immersive models “*Surfstation*” and “*Spiegel*” are presented below. (Figs.12.31-31)

For a detailed collection of all the models created for “Feel your Design”, including a description of the narrative, soundscape and “scentscape” please see Appendix III.



Fig. 12.30-31: “Feel your Design”: inside view of student’s immersive model “*Surfstation*” (left) and inside view of student’s immersive model “*Spiegel*” (right).

Results

Experiment #2 – “Feel your Design” evaluated the emotional experience of architectural models by analysing changes in the sensorial perception of the viewer, while looking at the model, listening to specifically created sounds (soundscape) and inhaling specifically chosen scents (“scentscape”). The results of this experiment were the answers to the Presence Questionnaire and the SAM chart, where recall of experience and believability of simulation are systematized. Such data describes the subject’s physiological response and emotional activation, thereby enabling one to evaluate the model’s ability to alter the subject’s emotional state. The data is organized according to Presence Questionnaire’s “Factors” and “Subscales”, as defined by Witmer and Singer, as well as SAM’s parameters of Valence, Activation and Control, explained in Chapter 11.

As in Experiment #1, the final values considered in the analysis of the PQ results were obtained by averaging the ratings assigned by the subjects to each of the questions, according to Witmer and Singer's (1995) 1 through 9-point scale. The analysis of the data collected through the SAM chart also followed the same principle, as the three parameters of "valence", "activation" and "control" were rated by the subjects using also a 1 through 9-point scale. After making these calculations, we obtained values that qualify the subject's individual experience of the "Feel your Design" models regarding the parameters of "presence", "emotional response", "valence", "activation", and "control". From the data collected, we can also qualify the experience of the group of subjects as a whole, by averaging the results for the same parameters.

Results for model "Psycho"

Average results show that the group of 5 participating subjects tended to classify the experience with the "Psycho" model as "compelling", "worthwhile", "moderately pleasant", "very exciting" and "dominating". These adjectives relate respectively to the parameters of "presence", "emotional response", "valence", "activation" and "control".

Out of the group of 5 subjects who experienced the model Psycho:

- 2 subjects classified it as "compelling" and 3 as "very compelling";

- 2 subjects rated it as “worthwhile”, 2 as “very worthwhile”, while 1 classified the experience as “not worthwhile”;
- 2 subjects rated it as “very pleasant” and 1 as “pleasant”, while 2 classified it as “very unpleasant”;
- 4 subjects rated it as “very exciting” and 1 as “exciting”;
- 2 subjects rated the experience as “very dominating”, while 2 rated it as “not very dominating” and 1 as “not dominating at all”;

A detailed description of the subject’s ratings according to Witmer and Singer’s PQ Factors and Subscales follows.

Out of the group of 5 subjects:

- 1 was “not very able” to control emotional response and 1 was “not able”, while 2 were “able” and 1 was “very able”;
- 4 were “very stimulated” by the scene and 1 was “stimulated”;
- 4 had their attention “very dedicated” while 1 “not very dedicated”;
- 3 were sensually “completely engaged” and 2 were “engaged”;
- 4 were “very involved” by visual aspects and 1 was “involved”;
- 3 were “involved” by auditory aspects and 2 were “very involved”;
- 4 were “very involved” by haptic aspects and 1 was “involved”;
- 2 were “very involved” by the scentscape and 3 were “involved”;
- 3 found the scene in the model “very convincing” and 2 found it “convincing”;
- 2 were “very compelled” by the scene and 1 “compelled”, while 1 “somewhat compelled” and 1 “not compelled”;
- 3 found the sensual information “very consistent” and 2 “consistent”;

- 2 were “very able” to anticipate events and 1 “able”, while 2 were “not very able”;
- 3 were “able” to survey inside the box, 2 were “very able”;
- 3 were “very able” to move inside the booth and 2 were “able”;
- 2 were “very able” to imagine real actions in the model and 2 were “able” while 1 was “not very able”;
- 3 were “compelled” by the scene in the model and 1 “very compelled”, while 1 was “not compelled”;
- 3 could manipulate objects “very well”, 2 “well”;
- 3 were “involved” in the experiment and 2 were “very involved”;
- 4 were “not at all” distracted by booth, chair, curtain and headphones while 1 was “somewhat” distracted;
- 3 “quickly” adjusted to the experiment and 2 “very quickly”;
- 3 were “not very distracted” by model quality while 2 were “distracted”;
- 2 could concentrate “very well” on the scene and 2 “well” while 1 “not well”;
- 3 found the experiment a “very good” learning experience and 1 “good”, while 1 “not very good”;
- 4 “didn’t lose at all” track of time while 1 lost “completely”.

Results for model “Turm”

Average results show that the group of 5 participating subjects tended to classify the experience with the “Turm” model as “compelling”, “worthwhile”, “pleasant”, “very exciting” and “dominating”.

These adjectives relate respectively to the parameters of “presence”, “emotional response”, “valence”, “activation” and “control”. Out of the group of 5 subjects who experienced the model:

- 3 subjects classified the experience of the “Turm” model as “compelling”, 1 “very compelling” and 1 “moderately compelling”;
- 3 subjects classified the emotional experience of the “Turm” model as “very worthwhile” and 2 as “worthwhile”;
- 3 subjects rated the experience of “Turm” as “very pleasant” and 1 as “pleasant”, while only 1 classified it as “unpleasant”;
- 4 subjects rated the experience of “Turm” as “very exciting” and 1 as “exciting”;
- 2 subjects rated the experience of “Turm” as “very dominating” and 1 as “moderately dominating”, while 2 considered it as “not very dominating”;

A detailed description of the subjects’ ratings according to Witmer and Singer’s PQ “Factors” and “Subscales” follows.

Out of the group of 5 subjects:

- 3 were sensually “completely engaged” and 2 were “engaged”;
- 5 were “very involved” by visual aspects of the scene”;
- 5 were “very involved” by auditory aspects of the scene;
- 2 were “very involved” by the haptic aspects of the scene and 2 were “involved”, while 1 was “not very involved”;

- 2 were “very involved” by the “scentscape” of the scene and 1 was “involved”, while 2 were “not very involved”;
- 2 were “compelled” by the scene in the model, while 2 were “not very compelled” and 1 was “not compelled”;
- 2 found the sensuous information “consistent” and 2 “very consistent”, while 1 considered “not consistent”;
- 2 found the experiment “not consistent”, while 3 considered it “very consistent”;
- 2 were “able” to anticipate events by looking at the model, while 2 were “not able at all” and 1 was “not able”;
- 2 were “very able” to survey inside model and 2 were “able”, while 1 was “not able”;
- 3 were “very able” to move inside booth and 1 was “able”, while 1 was “not very able”;
- 3 were “very able” to imagine real actions in the model and 2 were “able”;
- 2 were “very compelled” by the scene and 3 were “compelled”;
- 4 could manipulate interface objects “very well” and 1 “well”;
- 3 were “involved” in the experiment and 1 “very involved”, while 1 was “not very” involved;
- 3 found the booth “not distracting at all”, 1 “not distracting” and 1 “not very distracting”;
- 5 adjusted “very quickly” to the experiment;
- 5 were “not at all” distracted by the model quality;
- 5 could concentrate on the scene “very well”;
- 2 found it a “very good” learning experience, while 2 considered it “not good” and 1 “not good at all”;
- 4 “didn’t lose track of time” and 1 “not at all”.

Results for model “Surfstation”

Average results show that the group of 7 participating subjects tended to classify the experience with the “Surfstation” model as “compelling”, “worthwhile”, “very pleasant”, “not very exciting” and “not dominating”. These adjectives relate respectively to the parameters of “presence”, “emotional response”, “valence”, “activation” and “control”. Out of the group of 7 subjects which experienced the model:

- 6 subjects classified the experience of the “Surfstation” model as “compelling” and 1 “very compelling”.
- 7 subjects classified the emotional experience of the “Surfstation” model as “worthwhile”;
- 5 subjects rated the experience of “Surfstation” as “very pleasant”, while 2 considered it as “unpleasant”;
- 1 subject rated the experience of “Surfstation” as “very exciting” and 1 as “exciting”, while 5 perceived it as “not very exciting”;
- 2 subjects rated the experience of “Surfstation” as “very dominating” and 1 as “dominating”, while 1 considered it as “not very dominating” and 3 as “not dominating at all”;
- 3 subjects rated the experience of “Surfstation” as “very dominating”, while 3 considered it as “not very dominating” and 1 as “not dominating at all”;

A detailed description of the subject's ratings according to Witmer and Singer's PQ Factors and Subscales follows. Out of the group of 7 subjects:

- 2 were "very able" to control emotional response and 4 "able", while 1 was "not able";
- 5 found the scene "very stimulating" and 2 "stimulating";
- 4 had their attention "very dedicated" to the scene and 3 "dedicated";
- 4 were sensually "very engaged" and 3 "engaged";
- 4 were "very involved" by the auditory aspects of the experiment and 3 "involved";
- 4 were "very involved" by the haptic aspects of the experiment and 3 "involved";
- 5 were "very involved" by the visual aspects of the experiment and 2 were "involved";
- 6 found the scene in the model "very convincing" and 1 "convincing";
- 3 were "compelled" by the experiment, while 4 were "not very compelled";
- 3 were "very able" to anticipate events in the model, while 2 were "not very able" and 2 "not able";
- 4 were "very able" to survey inside model and 2 "able", while 1 was "not able";
- 5 were "very able" to move inside booth and 1 was "able", while 1 was "not very able";
- 7 were "very able" to survey the interior of the model;
- 5 could manipulate interface objects "well" and 2 "very well";
- 4 were "very involved" in the experiment and 2 "involved", while 1 was "not very involved";

- 4 found the booth, curtain and headphones “not very distracting” and 3 “not distracting at all”;
- 5 adjusted “very quickly” to the experiment and 2 “quickly”;
- 3 were “not at all” distracted by the model’s quality and 2 “not very” distracted, while 2 were “distracted”;
- 4 could concentrate on the scene “well” and 3 “very well”;
- 5 found it a “very good” learning experience and 2 a “good” one;
- 5 “lost track of time”, while 2 “not at all”.

Results for model “Spiegel”

Average results show that the group of 7 participating subjects tended to classify the experience with the “Spiegel” model as “compelling”, “worthwhile”, “very pleasant”, “not very exciting” and “not dominating”. These adjectives relate respectively to the parameters of “presence”, “emotional response”, “valence”, “activation” and “control”.

Out of the group of 7 subjects who experienced the model:

- 6 subjects classified the experience of the “Spiegel” model as “compelling”, while 1 classified it as “not very compelling”;
- 5 subjects classified the emotional experience of the “Spiegel” model as “worthwhile” and 1 as “very worthwhile”, while 1 classified it as “not very worthwhile”;
- 4 subjects rated the experience as “very pleasant” and 3 as “pleasant”;

- 2 subjects rated the experience as “very exciting” 1 as “exciting”, while 4 considered it as “not very exciting”;

- 3 subjects rated the experience of “Spiegel” as “very dominating” while 3 rated it as “not very dominating” and 1 as “not dominating at all”.

A detailed description of the subjects’ ratings according to Witmer and Singer’s PQ “Factors” and “Subscales” follows.

Out of the group of 7 subjects:

- 3 were “very able” to control the emotional response to the model; 2 “able”, while 1 was “not very able” and 1 “not able at all”;

- 5 found the scene “stimulating”, 1 “very stimulating”, while 1 found it “not stimulating at all”;

- 3 had their attention “very dedicated” to the scene and 4 “dedicated”;

- 4 were sensually “engaged” and 3 were “engaged”;

- 5 were “very involved” by the visual aspects of the scene” and 2 “involved”;

- 4 were “very involved” by the auditory aspects of the scene and 3 “involved”;

- 4 were “involved” by the haptic aspects of the scene and 2 “very involved”, while 1 was “not involved”;

- 5 were “involved” by the olfactory aspects of the scene and 1 “very involved”, while 1 was “not involved”;

- 5 found the scene “very convincing” and 2 “convincing”;

- 4 were “compelled” by the scene and 1 “very compelled”, while 2 were “not very compelled”;

- 4 found the sensuous information “very consistent” and 2 “consistent”, while 1 found it “not very consistent”;
- 3 were “very able” to anticipate events in the model and 3 “able”, while 1 was “not very able”;
- 3 were “very able” to survey inside model” and 3 “able”, while 1 was “not very able”;
- 3 were “very able” to move inside booth and 4 “able”;
- 3 were “very able” to imagine real actions in the model and 3 were “able”, while 1 was “not able at all”;
- 4 were “very compelled” by the scene in the model and 2 “compelled”, while 1 was “not very compelled”;
- 5 were “involved” in the experiment and 2 “very involved”;
- 3 found the booth, curtain and headphones “not very distracting”, 2 “not distracting” and 2 “not distracting at all”;
- 3 adjusted “very quickly” to the experiment and 2 “quickly”, while 1 adjusted “not quickly” and 1 “not quickly at all”;
- 2 were “distracted” by the model’s quality and 2 “very distracted”, while 2 were “not distracted” and 1 “not distracted at all”;
- 5 could concentrate on the scene “very well” and 2 “well”;
- 3 found it a “very good” learning experience and 3 “good”, while 1 found it “not very good”;
- 4 “didn’t lose track of time at all” and 3 “didn’t”.

Results for model “Blumenpassage”

Average results show that the group of 7 participating subjects tended to classify the experience with the “Blumenpassage” model as “compelling”, “worthwhile”, “very pleasant”, “not very exciting” and “not dominating”.

These adjectives relate respectively to the parameters of “presence”, “emotional response”, “valence”, “activation” and “control”.

Out of the group of 7 subjects who experienced the model:

- 6 subjects classified the experience of the “Blummenpassage” model as “compelling”, while 1 classified it as “not compelling”;
- 5 subjects classified it as “worthwhile” and 1 as “very worthwhile”, while 1 considered it “not very worthwhile”;
- 4 subjects rated the experience as “very pleasant” and 3 as “pleasant”;
- 4 subjects rated the experience of “Blummenpassage” as “not very exciting”, while 1 rated it as “exciting” and 2 as “very exciting”;
- 3 subjects rated the experience as “very dominating”, while 1 rated it as “not very dominating” and 1 as “not dominating at all”.

A detailed description of the subject’s ratings according to Witmer and Singer’s PQ “Factors” and “Subscales” follows.

Out of the group of 7 subjects:

- 4 were “very able” to control emotional response and 2 “able”, while 1 was “not able”;
- 5 found the scene “stimulating” and 1 “very stimulating”, while 1 found it “not stimulating at all”;

- 4 had their attention “dedicated” to the scene and 3 “very dedicated”;
- 4 were sensually “very engaged” and 3 “engaged”;
- 5 were “very involved” by the visual aspects and 2 “involved”;
- 5 were “involved” by the auditory aspects and 2 “very involved”;
- 5 were “involved” by the haptic aspects and 2 “very involved”;
- 5 were “involved” by the “scentscape” of the scene and 2 “very involved”;
- 5 found the scene “very convincing” and 2 “convincing”;
- 5 were “compelled” by the scene, while 2 were “not very compelled”;
- 4 found the sensuous information “very consistent” and 2 “consistent”, while 1 found it “not very consistent”;
- 4 were “not able” to anticipate events by looking at the model, while 2 were “able” and 1 “very able”;
- 3 were “very able” to survey inside the model, 3 “able”, while 1 was “not able”;
- 3 were “very able” to move inside the booth and 4 “able”;
- 3 were “very able” to imagine real actions in the model and 3 “able”, while 1 was “not able”;
- 5 found the scene “engaging” and 1 “very engaging”, while 1 found it “not very engaging”;
- 5 were able to manipulate interface objects “well” and 2 “very well”;
- 3 were “involved” in the experiment, 2 “very involved”, while 2 was “not involved at all”;
- 3 were “not distracted” by booth, curtain and headphones and 2 “not very distracted”, while 2 were “distracted”;
- 3 adjusted “quickly” to the experiment and 2 “very quickly”, while 1 adjusted “not very quickly” and 1 “not quickly at all”;
- 3 were “distracted” by the model’s quality, while 1 was “not very distracted” and 3 “not distracted at all”;
- 5 could concentrate on the scene “very well” and 2 “well”;

- 4 found the experiment a “very good” learning experience and 2 “good”, while 1 found it “not very good”;
- 4 didn’t lose track of time “at all” and 2 did “not”, while 1 did “completely”.

The results of Experiment #2 are presented in table format in Appendix IV and will be discussed in the next section in detail, as well as in the conclusions.

Discussion and Conclusions

Experiment #2 – “Feel your Design” evaluated the emotional experience of architectural models by analysing changes in the sensorial perception of the viewer, while looking at the model, listening to specifically created sounds (soundscape) and inhaling specifically chosen scents (“scentscape”). The experimental results support the main research hypothesis H1 - a user’s emotional response as “compelled or not compelled”, “positive or negative”, “aroused or not aroused” and “dominant or dominated” to an immersive architecture model can be evaluated through objective measurements of emotion using Presence Questionnaire and SAM charts. The results collected through these means show that:

- for the immersive model “Psycho”, the majority of subjects experienced a high level of “Presence”, “Arousal” and “pleasure”;
- for the immersive model “Turm”, the majority of subjects experienced a high level of “Presence”, “Arousal” and “pleasure”;

- for the immersive model “Surfstation”, the majority of subjects experienced high levels of “Presence” and “pleasure” and a low level of “arousal”;
- for the immersive model “Spiegel”, the majority of subjects experienced high levels of “Presence” and “pleasure” and a low level of “arousal”;
- for the immersive model “Blumenpassage”, the majority of subjects experienced high levels of “Presence” and “pleasure” and a low level of “arousal”.

All subjects felt they were able to control their emotional response to the scenes in the models and also described them as a positive experience. Most subjects described the scenes as “not very dominating”, although the scenes “Turm” and “Surfstation” were described as “dominating”. Interestingly enough, these experiments explored opposite atmospheres, anxiety in the case of “Turm” and relaxation in the case of “Surfstation”. All subjects reported to have felt compelled by all the scenes in the experiment, with the scenes “Psycho”, “Turm” and “Spiegel” being rated in average as “very stimulating” and the remaining two “Surfstation” and “Blumenpassage” as “stimulating”. The scenes in the models were unanimously rated by the subjects as “convincing”, “engaging” and “consistent” with real life-experiences in terms of the sensual information.

Most subjects reported to have been visually involved by all the scenes, as well as by the corresponding “scentscapes”, soundscapes and, surprisingly, by the haptic aspects as well, since the latter was not directly explored in this experiment, but the former three were. This suggests that the models induced a very high level of immersion.

All scenes were rated by the subjects as able to trigger the imagination of real actions and the majority of subjects reported to have had their attention dedicated to the scene. This permits one to conclude that Hypothesis H2 is verified - architecture is an immersive experience which can be intentionally composed by the architect and the simulation techniques of “emotional design” and “sensory design” are an effective strategy to compose specific experiences of architectural spaces and develop the sensorial awareness of students/designers.

The majority of subjects reported that they were able to survey inside the models, were not distracted by the quality of their execution and could move inside the booth and manipulate the interface objects without being distracted by them. Subjects also adjusted quickly to the experiment, could concentrate well on the scene and the majority rated it as a good learning experience. Still, except for the case of the scene “Psycho”, which the final average score shows that the subjects lost track of time, this did not happen in the remaining scenes. This suggests that the experience of the model “Psycho” was the most immersive.

Finally, it can be concluded that the illusion of presence and arousal situations can be intentionally induced through immersive architectural models, although further research is necessary to understand which specific design elements are responsible for this. Therefore, Hypothesis H3, which suggests that the feeling of “presence” and emotional activation of the body of a user can be intentionally induced through the experience of immersive architectural models, also is confirmed. Experimental results of this experiment show that PQ and SAM are effective in identifying arousal responses related to “positive” or “negative” emotions, from the neutral condition, when users experience immersive architectural

models. On-going research in the fields of IT, psychology and marketing uses an established range of values that also were user used as reference in this experiment, as explained in Chapter 11. The use of electroencephalogram (EEG) and the e-health platform is an additional, interesting method to be used in future experiments to observe how the emotions of a user are triggered while experiencing immersive architectural models. As mentioned in the Introduction, this platform was unavailable for this experiment, but it was used in Experiment #3 and Experiment #4 as described in the next sections. Eye-tracking sensing technology also is another method that might be useful to use in the future to detect which points are of most and least interest for the viewer of the scene. Unfortunately, this technology was not available for the current research.

Experiment III – “Corporeal Architecture”

Introduction

This Experiment took place on the last day of the elective course “Corporeal Architecture” that the author taught to students of Architecture at the Fachbereich Architektur TU Kaiserslautern. The course took place during the Winter Semester of 2013/2014 and the date of the final presentation was February 14th 2014. The purpose of the course was to encourage students to think about the human body when they design an object or an architectural space. The goal of Experiment #3 was the evaluation of emotional reaction to changes in the sensory perception when performing with self-constructed objects, namely body extensions or restrictions, and architectural elements. The course was taken by 7 students who acted as subjects in the Experiment. Experiment #3 had the support of the DFKI - Deutsches Forschungszentrum für Künstliche Intelligenz that provided the equipment necessary for biometric measurement and processed the data collected during the experiment.

Description

The seminar on Corporeal Architecture intended to make students aware that understanding the dynamics of human movement and how such movement is altered and shaped by different spaces and objects affects directly the human mind. The classes explored the relationship between body and space through an embodied approach to the design process that was translated into the construction of objects.

Students experienced two main interlocking strands during the course: an introduction to conceptual references on artwork dedicated to the subject of the body, namely the somatic techniques of performance art and class assignments which were meant to encourage the incorporation of these concepts in the design of objects. The participants of the course built portable structures with simple materials such as paper, wood, string, cardboard, and so on, and they were encouraged to discover through their bodies how these structures would move and behave in space, and how their bodies reacted emotionally to the incorporation of extensions and restrictions of movement, and how they felt when performing as an architectural element. Experiment #3 took place on the last day of the course when students were assigned to perform with the objects developed during the semester. Such performances were documented on camera and film. The setting of Experiment #3 developed the same concept that was used on the setting of Experiment #1 – *Raummetaphern*, but this time the setting for the experiment included a 2.5 x 2.5 x 2.5 m cube with a square grid of 0.5 m on all sides and a black background, instead of a piece of black fabric to cover the back wall and the floor. The cube was intended to work as the stage where the performances of the students should take place on the last day of the course.

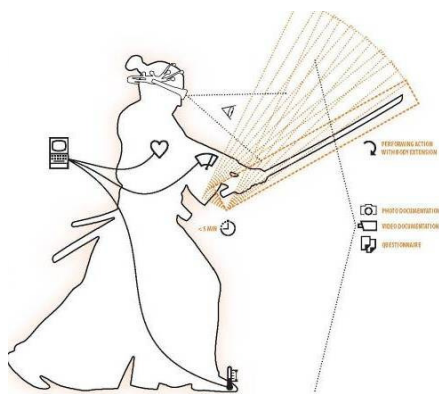


Fig. 12.32: *Raummetaphern*: experimental setting scheme.

The white grid on the walls of the cube was meant to allow for students to guide their performances taking in consideration the specific location of their joints and limbs in space. This idea appeared as a direct consequence of the studies on movement that were undertaken while developing in the Grammar presented in the first section of this Chapter. As mentioned, the Grammar was developed as a Pilot Project and is further documented in Appendix II.



Fig. 12.33: Corporeal Architecture: the Body as Architectural Element. “Entablature with Caryatid and Atlas”. Students performing with object inside the cube during Experiment #3.

The students who participated in the Experiments were not introduced to the Shape Grammar framework directly, but were initiated in basic notions of kinesiology that were systematized in the Grammar (Figs. 12.34-37) and which were applied in specific exercises. For a detailed description of the exercises see Appendix IV.

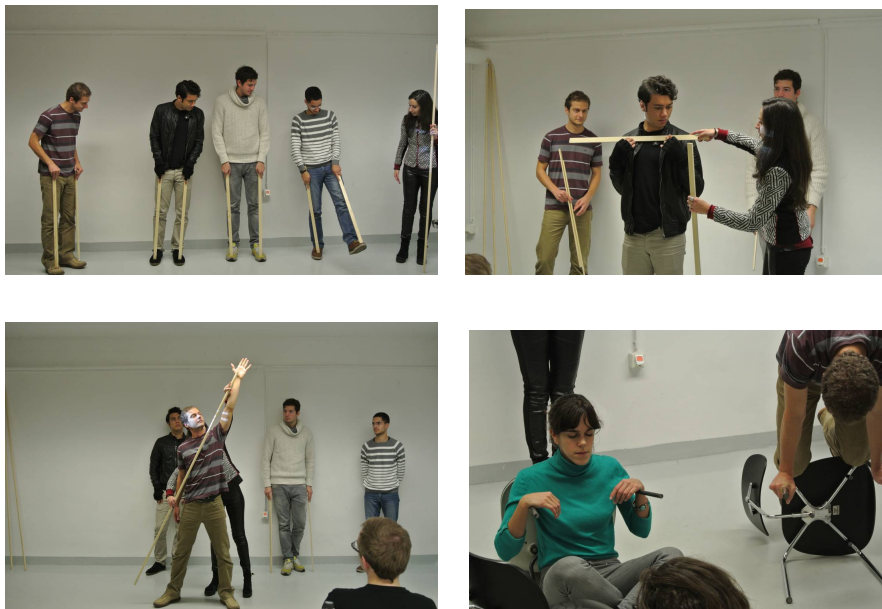


Fig. 12.34-37: Corporeal Architecture: students performing with sticks to explore basic kinesiology concepts – planes, axes, diagonals and degrees of movement according to Laban and Schlemmer.

The use of a setting consisting of a black stage, a grid and a camera follows the tradition of Muybridge's setting for movement analysis, which Gilbreth would equally apply in his efficiency studies, as described in Chapter 7. Such a cubic space, with strings located to increase students' spatial and corporeal awareness, also were used by Schlemmer to teach his students at the Bauhaus, as described in Chapter 8.

The changes of emotional reactions in the body's sensory perception when using the objects were evaluated through the use of biometric technology, the e-health platform, a Presence Questionnaire, and a SAM chart. Students were required to wear black comfortable clothing and the neutral mask, as was the case in Experiment #1. Recall that the main goal of this experiment was to classify users' response to corporeal stimuli, by analysing sensory data, having in mind that the main hypothesis was:

H1 - a user's emotional response as "compelled or not compelled", "positive or negative", "aroused or not aroused" and "dominant or dominated" to design objects can be evaluated through objective measurements of emotion using the Presence Questionnaire (PQ) and the SAM chart.

Two secondary hypotheses were then formulated:

H2 - the feeling of presence and emotional activation can be induced through the performance with analogical models, in this case, body extensions and restrictions;

H3 - the somatic techniques of "performance art" and "emotional design" are an effective strategy to develop corporeal awareness and stimulate the creativity of students and designers.

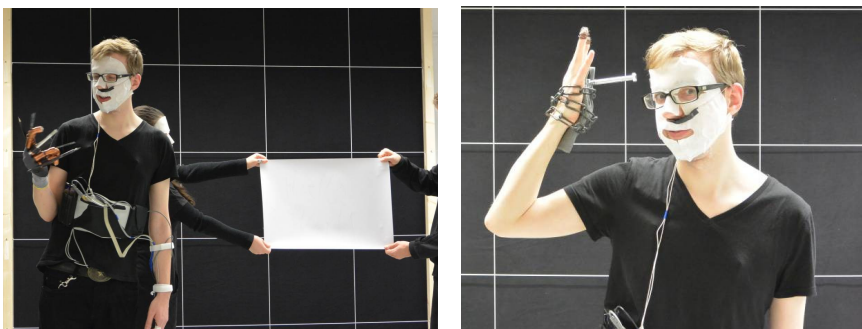
To verify these hypotheses, the experiment was developed considering four stages:

1. Identify the design elements that are more suitable to induce specific sensations in a user, such as "positive, aroused, dominant, compelled" or "negative, not aroused, dominated, not compelled";

2. Design an object so that those elements are the most important aspects of the design;
3. Perform experiments with users interacting with these objects, while being monitored by camera and then assess their emotional experience through the use of a PQ and a SAM chart;
4. Process and analyse the sensory data collected to understand if statistically significant differences can be found in the classification and differentiation between a “compelling-positive” experience and a “not compelling-negative” one.

Students' Work

As a way of illustrating and guiding the discussion of results, two examples of student's work created for Experiment #3 - Corporeal Architecture are included below, respectively the body extension “The Architect's Hand” and the body restriction “Out of Touch” (Figs. 12.38-39). For a detailed collection of all the objects created for “Corporeal Architecture”, please see Appendix IV.



Figs. 12.38-39: Corporeal Architecture: body Extension “The Architect's Hand” and body Restriction “Out of Touch” (left) and student performing with object (right).

Results

Experiment #3 – Corporeal Architecture evaluated the emotional experience of body extensions, body restrictions, and the body performing as an architectural element, by analysing changes in the sensorial perception of the user, while performing with the objects. The results of this experiment were the answers to the Presence Questionnaire and the SAM chart, where recall of experience and believability of simulation are systematized. Such data describes the subject’s physiological response and emotional activation through the evaluation of the extension’s ability to condition the user’s movements and alter his emotional state and corporeal perception. The data is organized according to the Presence Questionnaire’s “Factors” and “Subscales”, defined by Witmer and Singer (1995), and SAM’s parameters of “valence”, “activation”, and “control”, as well as biometric data collected with the e-health platform technology, as explained in Chapter 11. (Figs.12.40-12.41)

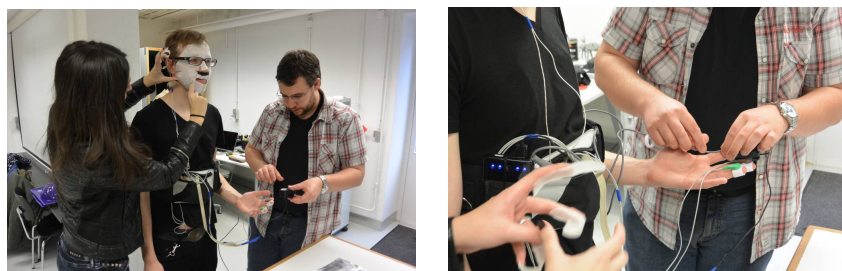


Fig. 12.40-41: Corporeal Architecture: performance day, author and assistant installing e-health platform sensors and neutral mask on student.

As in the previous two experiments, the final values considered in the analysis of the PQ results were obtained by averaging the ratings assigned by the subjects to each of the questions, according to Witmer and Singer’s (1995) 1 through 9-point scale.

The final values used in the analysis of the data collected through the SAM charts were obtained following the same principle, as the three parameters of “valence”, “activation” and “control” also were rated by the subjects using a similar 1 through 9-point scale. The values obtained qualify each subject’s experience with the “Corporeal Architecture” objects regarding the parameters of “presence”, “emotional response”, “valence”, “activation”, and “control”. From the data collected we can also qualify the experience of the group of subjects as a whole, by averaging the results for the same parameters.

The average value given by the group of 7 subjects to the Presence Questionnaire (PQ) and the SAM chart shows that they tended to classify the performance in the “Corporeal Architecture” Experiment as “compelling”, “worthwhile”, “moderately pleasant”, “very exciting” and “dominating”. These adjectives relate respectively to the parameters of “presence”, “emotional response”, “valence”, “activation” and “control”.

Out of the group of 7 subjects who participated in the experiment:

- 7 subjects classified the experience of the performance with the “Corporeal Architecture” objects as “compelling”;
- 4 subjects rated the emotional experience as “very worthwhile” and 3 as “worthwhile”;
- 6 subjects rated the experience as “very pleasant”, while 1 considered it as “not very pleasant”;

- 6 rated the experience as “very exciting” and 1 as “exciting”;
- 5 rated the experience “dominating” and 1 “very dominating”, while 1 graded it as “not very dominating”.

A detailed description of the subject’s ratings, according to Witmer and Singer’s PQ “Factors” and “Subscales”, is provided in following.

Also, out of the group of 7 subjects:

- 6 were “able” to control their emotional response to the objects and 1 “very able”;
- 5 could consider that they were able to move with their objects on “well” and 2 “very well”;
- 4 found the experimental setting “very stimulating” and 2 “stimulating”, while 1 considered it “not very stimulating”;
- 3 had their attention “very dedicated” during the performance and 2 “dedicated”, while 2 had it “not very dedicated”;
- 4 found the objects “very engaging” and 2 “engaging”, while 1 found it “not engaging”;
- 3 were “very involved” in the performance and 2 “involved”, while 1 was “not very involved” and another 1 “not involved”;
- 4 were “involved” by the haptic aspects of the performance and 3 “very involved”;
- 4 were “involved” by the auditory aspects of the performance, while 2 were “not very involved” and 1 “not at all”;
- 7 found the performance setting “very convincing”;

- 3 were “very aware” of the space around during the performance and 2 “aware”, while 2 were “not very aware”;
- 5 were “very able” to anticipate the use of the setting and objects just by looking at them and 2 “able”;
- 3 could move “well” while performing with objects in the setting and 1 “very well”, whereas 1 could do it “not very well” and 2 “not well”.
- 2 felt “very compelled” to perform in the setting and 5 “compelled”;
- 4 “really felt” that objects stimulated imagination and corporeal awareness and 2 just “felt”, while 1 “didn’t feel much”;
- 3 were “very distracted” by the suit, mask, and e-health platform and 1 “distracted”, while 2 were “not very distracted” and 1 “not distracted”;
- 3 considered that the camera “didn’t interfere at all” in the performance and 3 “not much”, while 1 considered that it “interfered”;
- 4 could concentrate “very well” on the performance and not on the objects and 3 “well”;
- 7 found that performance art corporeal techniques “enhanced” their skills as designers;
- 7 found the “Corporeal Architecture” course and experiment a “very good” learning experience;
- 4 considered that they “lost track of time” during the performance, 2 “almost completely” and 1 “completely”.

The of Experiment #3 just described are presented in table format in Appendix V and will be discussed in the next section in detail, as well as in the conclusion.

Discussion and Conclusions

In Experiment #3 – Corporeal Architecture the emotional experience of body extensions, body restrictions, and the body performing as an architectural element were evaluated by analysing changes in the sensorial perception of the user, while performing with objects. The experimental results support the main research hypothesis H1 - a user's emotional response to design objects as “compelled or not compelled”, “positive or negative”, “aroused or not aroused” and “dominant or dominated” can be evaluated through objective measurements of emotion. The results collected through the Presence Questionnaire and the SAM charts show that the majority of subjects experienced a high level of “Presence”, “Pleasure” and “Arousal”. Most subjects described their emotional response to the performance with the objects as “positive” and results reveal that most subjects could control the emotional response to the setting and objects while performing, although they did showed a low level of control regarding the objects.

Results also show that the majority of subjects found the performance with the objects sensually very engaging, was very involved by visual aspects and involved by the haptic and auditory aspects. This suggests that although the subjects were focused on the most important aspect of the experiment which had to do with the movement of the body while performing with the objects, the kinaesthetic sense, they were also involved by the sense of vision and hearing. This suggests a high-level of engagement which makes the experience of the objects totally immersive. Most subjects found the experimental setting stimulating and convincing and were able to anticipate the use of the objects just by looking at them.

The majority felt compelled to move in the setting and could interact with the setting and objects and manipulate their surrounding environment well. Most subjects had their attention dedicated to the performance, although they remained aware of the events around, as well as of the surrounding space. Results show that the majority was very involved in the experiment, although distracted by the suit, mask, and e-health platform. Results also show that most participants in the experiment could concentrate on the performance itself and not on the objects and setting and were not distracted by the camera. Therefore, results verify Hypothesis H2, which suggests that the feeling of “presence” and emotional activation can be induced through the performance with analogical models, in this case, body extensions and restrictions.

Results also show that most subjects were involved in the experiment and lost track of time during the performance. This suggests that the feeling of presence and arousal situations can be consciously induced in real-space although further research is necessary to understand which specific design elements are responsible for this. The majority of subjects also was compelled by the objects to perform and described the emotional response to them as “positive”. The majority of subjects rated the experiment as a very good learning experience and found that performance art techniques enhanced their creativity and capacity to design. Therefore, results also verify Hypothesis H3, which suggests that somatic techniques of “performance art” and “emotional design” are an effective strategy to develop corporeal awareness and stimulate the creativity of students and designers.

With this experiment it is shown that with the PQ, the SAM charts, and biometric technology it is possible to objectively discriminate arousal responses related to “positive” or “negative” emotions, from the neutral condition, when users experience body extensions and restrictions and when the body performs as an architectural element. On-going research in the fields of IT, psychology, and marketing uses an established range of values that also were used in this experiment, as explained in Chapter 11. Results confirm that it was useful to include the e-health platform in this experiment, to determine with real-time data how the emotions of a user are triggered while experiencing design objects. This is done mainly through the analysis of skin conductance changes and cardiac accelerations, which are strongly correlated with emotional arousal, according to emotion measurement methodologies. Our aim in the experiment was to observe peak and limit reactions that provided for a wide scale of physiological measures. Nevertheless further work is necessary to establish solid conclusions. In future experiments, it is proposed to maintain the use of electroencephalogram (EEG) and add to the experimental setting eye-tracking sensing technology to record the position of the user and where s/he is looking at.

Experiment IV - *De Humani Corporis Fabrica*

Introduction

This experiment took place as the last day of the elective course “*De Humani Corporis Fabrica – Fabricating Emotions through Architecture*”. The title of the experiment is a reference to the first anatomy treatise with the same name (from Latin to English, “On the Constitution of the Human Body”), in which Andreas Vesalius presents dissections of human bodies in order to explain its inner workings. It was suitable for the experiment also because the original Latin word for *fabrica* can have the multiple meaning of “fabrication, constitution, or construction”. It was taken as the motto of an experiment in which the subjects would design, fabricate, assemble, and perform in architectural settings, taking in consideration the direct effect that the design elements in such settings would produce specific physical and emotional effects on users, or as the subtitle suggests “fabricating emotions through architecture.”

The course was attended by students of Architecture and was hosted by the Digitale Werkzeuge at the Fachbereich Architektur of the TU Kaiserslautern during the Winter Semester of 2013/2014. The goal of the experiment was the evaluation of emotional reaction to changes in the sensory perception when a user is performing the same actions in settings that have the same design but significantly different dimensions. The goal of the course was to increase students’ awareness of the direct effect that variation in the values of basic design parameters, such as scale and dimensions, produces on the human body, while conditioning movement.

Psycho-physiological changes in the body's sensory perception during the performances were evaluated through the combined use of biometric technology (e-health platform), the Presence Questionnaire and the SAM chart, as was the case with Experiment #3 – Corporeal Architecture. The course was attended by 4 students who participated as subjects in the Experiment. The course was offered during the Winter Semester of 2013/2014 and Experiment #4 took place on the last day of the course, on February 14th. The Experiment had the technical support of the DFKI - Deutsches Forschungszentrum für Künstliche Intelligenz, which provided the machinery necessary to collect the biometric data during the Experiment (e-health platform) and the knowledge needed to process them.

Description

For the final presentation, during which the Experiment would take place, students were asked to prepare a performance that explored chosen actions in settings designed and constructed at 1:1 scale. Students also were required to wear black comfortable clothing and the neutral mask, as was the case in Experiment #1 and in Experiment #3.



Fig. 12.42-44: *De Humani Corporis Fabrica*: “Eating Dinner”, Student performing the same actions in Setting #1, Setting #4 and Setting #5.

The task required students to choose an architectural setting, for example a basic unit such as a dining table and a bench, and to design at least two variations of the setting, for example one with a dining table 1 m high and the other with a dining table 0.5 m high. Students were encouraged to include movement notations in the design process in order to analyse the different stages of basic actions, such as eating at a table or baking a cake in a kitchen. The settings were designed and produced with the combined use of analog and digital tools and were installed in the cubic space used for the performance in Experiment #3 – Corporeal Architecture. The performances with the objects were documented by photography and film. Biometric and emotion measurement tools were connected to a laptop via Wi-Fi and installed on the performer's body to measure while the body was performing with the objects. Recall that the main goal of this experiment was to classify users' response to corporeal stimuli, by analysing sensory data, having in mind that our main hypothesis was:

H1 - a user's emotional response as "compelled or not compelled", "positive or negative", "aroused or not aroused" and "dominant or dominated" to an architectural setting can be evaluated through objective measurements of emotion using the Presence Questionnaire, the SAM chart and the e-health platform.

Two secondary hypotheses were formulated:

H2 - the feeling of presence and emotional activation can be induced through the performance in analogical models, in this case, 1:1 scale architectural settings;

- H3 - the somatic techniques of “performance art” and “emotional design” are an effective strategy to develop corporeal awareness and stimulate the creativity of students and designers;

To verify these hypotheses, the experiment was developed considering four stages:

1. Identify the design characteristics that are more suitable to induce certain sensations in a user, such as “positive, aroused, dominant, compelled” or “negative, not aroused, dominated, not compelled”;
2. Design an architectural setting so that those characteristics are the most important aspects of the design;
3. Perform experiments with users interacting with such architectural settings, while being monitored by camera and assess their emotional experience through the use of a PQ, a SAM chart, and a biometric platform;
4. Process and analyse the sensory data collected to understand if significant differences can be found in the classification and differentiation between a “compelling-positive” experience and a “not compelling-negative” one.

Students' Work

As a way of illustrating and guiding the discussion of results, two examples of student's work created for Experiment #4 - “*De Humani Corporis Fabrica*” are included below, respectively, the

setting “Working, Reading and Relaxing at the office space” and the setting “Eating Dinner”. For a detailed collection of all the objects created for “*De Humani Corporis Fabrica*”, please see Appendix V.



Fig. 12.42-43: *De Humani Corporis Fabrica*. “Working, reading and relaxing at the office space” (left) and “Eating Dinner” (right), students performing in Settings.

Results

Experiment #4 – *De Humani Corporis Fabrica* evaluated the emotional experience of 1:1 scale architectural settings by analysing changes in the sensorial perception of the user while performing a pre-set choreography of actions in settings built for the same purpose but with significantly different dimensions. The results of this experiment were the answers to the Presence Questionnaire and the SAM chart, where recall of experience and believability of simulation are systematized. Such data depicts the subject’s physiological response and emotional activation and allows for the evaluation of the setting’s ability to condition the user’s movements and alter his emotional state and perception. The data is organized according to Presence Questionnaire’s “Factors” and “Subscales”, as defined by Witmer and Singer (1995), as well as SAM’s parameters of “Valence”, “Activation” and “Control”, as explained in Chapter 11.

As in the previous three experiments, the final values considered in the analysis of the PQ results were obtained by averaging the ratings assigned by the subjects to each of the questions, according to Witmer and Singer's 1 through 9-point scale. (1995) The final values used in the analysis of the data collected through the SAM charts were obtained following the same principle, as the three parameters of "valence", "activation" and "control" also were rated by the subjects using a similar 1 through 9-point scale. After making these calculations, we obtained values that qualify each subject's individual experience with the "*De Humani Corporis Fabrica*" settings, regarding the parameters of "presence", "emotional response", "valence", "activation" and "control". From the data collected, we can also qualify the experience of the group of subjects as a whole, by averaging the results for the same parameters.

The average value of the answers given by the group of 4 subjects to the Presence Questionnaire (PQ) and the SAM chart shows that they have classified the experiment "*De Humani Corporis Fabrica*" as "compelling", "worthwhile", "moderately pleasant", "very exciting" and "dominating". These adjectives relate respectively to the parameters of "presence", "emotional response", "valence", "activation" and "control".

Out of the group of 4 subjects which participated in the experiment:

- 4 subjects classified the experience of the performance with the "*De Humani Corporis Fabrica*" settings as "compelling";

- 3 subjects rated the emotional experience of the performance with the “*De Humani Corporis Fabrica*” settings as “worthwhile” and 1 as “very worthwhile”;
- 2 subjects rated the experience of the performance with the “*De Humani Coporis Fabrica*” settings as “very pleasant” and 2 as “pleasant”;
- 2 rated the experience of the performance with the “*De Humani Corporis Fabrica*” settings as “very exciting” and 2 as “exciting”;
- 2 rated the experience of the performance with the “*De Humani Corporis Fabrica*” settings as “dominating” and 1 “very dominating”, while 1 rated it as “not very dominating”.

Also, out of the group of 4 subjects:

- 3 could control emotional response to settings “well” and 1 “very well”;
- 2 were “able” to control objects in performance and 1 “very able”, while 1 was “not very able”;
- 4 found the experimental setting “very stimulating” in imagining the performance to take place;
- 2 had their attention “very dedicated” during performance and 2 “dedicated”;
- 3 found the performance sensually “very engaging” and 1 “engaging”;
- 2 were “very involved” in the visual aspects of the performance and 1 “involved”, while 1 was “not involved”;

- 2 were “involved” by the haptic aspects of the performance, 1 “very involved” and 1 “somewhat involved”;
- 2 were “involved” by the auditory aspects of the performance, while 2 were “not very much”;
- 3 found the performance settings “very convincing” and 1 “convincing”;
- 2 were “aware” of events around, while 2 were “not very aware”;
- 3 were “very aware” of the surrounding space and 1 “aware”;
- 3 were “very able” to anticipate use of settings just by looking at them and 1 “able”;
- 2 were “very compelled” to move in the settings and 2 “compelled”;
- 3 felt that settings and objects “really stimulated” their imagination for the performance and 1 just “felt” so;
- 3 could interact with settings and objects “very well” and 1 “well”;
- 3 could manipulate the surrounding environment “very well” and 1 “well”;
- 4 were “very involved in the experiment”;
- 2 were “very distracted” by the suit, mask, and e-health platform, 1 was “distracted” and 1 “not very much”;
- 2 felt the camera didn’t interfere with performance “at all”, 1 “not much”, while 1 thought that it “interfered”.
- 2 could concentrate “very well” on the performance and not on the objects and settings and 2 just “well”;
- 4 thought that they had learned new techniques which expanded their skills as designers;
- 4 found the experiment a “very good” learning experience;
- 2 “lost track of time” and 1 “almost completely”, while 1 “not at all.”

The results of Experiment #4 just described are presented in table format in Appendix VI and will be discussed in the next section in detail, as well as in the Conclusion.

Discussion and Conclusions

Experiment #4 – *De Humani Corporis Fabrica* evaluated the emotional experience of 1:1 scale architectural settings by analysing changes in the sensorial perception of the user while performing a pre-set choreography of actions in settings built for the same purpose but with significantly different dimensions. The experimental results support the main research Hypothesis H1 - a user's emotional response to design objects as “compelled or not compelled”, “positive or negative”, “aroused or not aroused” and “dominant or dominated” can be evaluated through objective measurements of emotion. The results collected through the Presence Questionnaire and the SAM charts show that the majority of subjects experienced a high level of “Presence”, “Pleasure” and “Arousal”. Most subjects describe their emotional response to the performance with the objects as “positive”. Results reveal that most subjects could control the emotional response to the setting and objects during the performance, but they experienced a low level of control of the performance itself. This indicates that the subjects probably didn't feel confident with the stability of their designs or perhaps their motor-skills got in the way and so they couldn't perform at ease. Still, results show that the majority of subjects didn't feel the camera interfered in the performance and felt able to anticipate the use of the experimental settings just by looking at them, as well as

compelled to move in them, and found them convincing and very stimulating in imagining the performance before it took place.

Most subjects reported to be very involved in the experiment, found the performance sensually very engaging, were very involved by visual aspects and involved by haptic and auditory aspects, while remaining aware of events around and the surrounding space. This suggests that subjects were focused on the most important aspect of the experiment which had to do with the movement of the body while performing with the objects, the kinaesthetic sense. It also suggests that they were involved by the sense of vision and hearing. This confirms a high-level of engagement and suggests that the experience was immersive, although other results show that subjects were somewhat distracted by the suit, mask, and e-health platform. Therefore, results support Hypothesis H2, which suggests that the feeling of “presence” and emotional activation can be intentionally induced through the performance with analogical models, in this case, architectural settings.

Results also show that most subjects were involved in experiment and lost track of time during the performance. This suggests that the feeling of “presence” and arousal situations can be intentionally induced in real-space, but further research is necessary to understand which specific design elements are responsible for this. All subjects rated the experiment as a very good learning experience and found that performance art techniques enhanced their creativity and capacity to design. Therefore, results also support hypothesis H3 which suggests that the somatic techniques of “performance art” and “emotional design” are an effective strategy to develop corporeal awareness and stimulate the creativity of students and designers.

This experiment shows that PQ, SAM, and biometric technology can be used to objectively discriminate arousal responses related to “positive” or “negative” emotions, from the neutral condition, when users experience body extensions. On-going research in the fields of IT, psychology and marketing uses an established range of values that also were used in experiment. Results confirm that it was useful to include the e-health platform in the experiment, to observe how user emotions are triggered while experiencing design objects. This is done mainly through the analysis of skin conductance changes and cardiac accelerations which are strongly correlated with emotional arousal, according to the literature review undertaken at the beginning of this research. Our aim in the experiment was to observe peak and limit reactions that would provide for a wide scale of physiological measures. Nevertheless, more work is necessary to establish solid conclusions. In future experiments, it is proposed to maintain the use of EEG and to add to the experimental setting eye-tracking sensing technology to record the position of the user and where s/he is looking at.

Conclusion

If Vitruvius were a Dancer

This chapter presents the final conclusions and identifies paths for further research. It is shown that it is possible to design objects and architectural spaces to trigger specific emotions in the users. It also is demonstrated the effectiveness of such artefacts to influence users' emotions can be verified by quantifiable means and therefore the hypothesis is confirmed.

Summary and Conclusions

This thesis was dedicated to the topic of the relationship between Body and Architecture, in particular taking in consideration the contemporary scientific view of the body and mind as a whole, what is generally addressed as the “embodied mind” theory. The thesis made a theoretical review on the topic of the human Body based on the study of the different ways Architecture has accompanied the transformations that the views on the Body went through, following the evolution and influence of different disciplines, such as philosophy, technology, science, religion and art throughout Western history. This thesis proposed that contemporary challenges brought by the digital age have had direct influence in many areas of knowledge, particularly through the advances in fields related to study of the brain, such as neurosciences and neurobiology. This thesis shows, I would argue, that such advances shouldn’t be ignored by architects, since architecture as a discipline is presented with an opportunity to re-think itself and its approaches to design and teaching. Methodologies of “emotion measurement” have demonstrated to be helpful in evaluating the effectiveness of design objects and architectural settings to influence the human body emotionally or, in other words, in “touching” or “moving” it, as experimental results described in the previous chapter suggest.

Contemporary studies in the social and political sciences fields relate the extreme use of digital technologies to a collective sense of dissatisfaction with the built environment and the incapacity of architecture today to gather people and offer them a meaningful experience of individual and collective spaces.

Alberto Pérez Gómez states in his last article, “*Architecture: a performing art,*” that the origins of architecture are profoundly related to ritual and refers to the role of the architect in ancient Greece and Rome as the director of performances, not only in the theatrical sense, but in the sense that it is through his actions, by directing others to use the best of their skills and creativity towards the common good. Pérez-Gómez is concerned with the ethical role of the architect, especially in a culture in which many times the value of a building or an idea is communicated mostly through an image. Pérez-Gómez blames 19th century’s legacy, when representation of Architecture began to be valued almost as much as the constructed work.

This poses an interesting paradox, since we now know from neurosciences that what is communicated to us through visual images triggers in our brain almost the same sensations as if we experienced the event directly. At the same time, it is also now known that multisensory experiences play a very important part in the learning and creative process and that the lack of direct sensory stimuli is responsible for illness. The author of this thesis was aware of the complexity of such topics and the research process became even more challenging, as the economic crisis in Portugal limited considerably the means to conduct the research and prompted a change in approach to the topic.

In the beginning of the research process there was a clear interest in experimenting with advanced technology, especially with the promise of getting data such as emotions into quantifiable means. As the experimental work had to be developed with many restrictions and reduced means, one could realize that it is possible conduct research on “emotion measurement” of architectural spaces or design objects, using only analogical means such as the SAM chart, the

Presence Questionnaire, and real-life models instead of virtual reality simulations.

Within this context, the thesis proposed a methodology based on performance arts, which explores the use of embodied practices in design education with the active creative participation of students in the design and fabrication of objects, architectural models, and 1:1 scale architectural settings. Such a methodology aimed to test how it is possible to influence user's emotions through architectural space, as the thesis argued that this can be achieved through a process of empathy between the user's body and the surrounding space. To demonstrate this claim, a set of experiments were undertaken in the context of architectural teaching and the results of such experiments were evaluated through the analysis of quantitative data collected by emotion measurement tools and qualitative data gathered using questionnaires.

One of the conclusions regarding the experiments described in this thesis is that contemporary science still accepts that the human body is the most fine and precise evaluation tool of an object, a model, or an architectural or urban space. It is for this reason that it is important to include it in any experiments that aim to analyze the emotional experience of architectural space methodologies. These include the Presence Questionnaire and the SAM chart, which address directly the subjective, emotional experience of each subject through precise and well-established parameters. Also, as any certified physician would probably agree, biometric technologies do not replace a talk and direct observation of a patient to establish a comprehensive diagnosis, despite being increasingly accurate.

What an electrocardiogram may express as a strongly beating heart does not necessarily refer to a malfunction of a body, but to its current state which might be induced by internal or external factors, or be chronic or temporary in nature. Human interaction is still fundamental for a comprehensive diagnosis, especially regarding psychological issues. As Mallgrave tells us, new knowledge is brought up everyday in areas of research, such as neurosciences, but there still is a lot of uncertainty about the workings of the brain, especially regarding the field of emotional experience of architectural space.

Experimental results were effective in demonstrating that it is possible to consciously induce certain emotional states in a user or to analyze how specific environments affect their users. Understanding this mechanism, I believe, is a useful way for becoming a better designer, especially nowadays that the understanding of human mind promises to be almost at hand's-reach. Nonetheless, only through constant research and especially design practice, one can actively work to improve the quality of the built environment. Most importantly, I firmly believe that it is not the architect's role to dictate how a dweller should feel, by leading her/his actions through designs that follow a specific ideological program, as discussed in Chapter 7, and as was the case with the architecture of both the National-Socialists and the Soviets.

The role of the architect is to provide, as best as possible, places where comfort, health, imagination and happiness might happen and to make such spaces come to reality through cooperation with users, craftsmen and builders.

Vitruvius states that architectural space is a “*clearing in the forest that makes possible language and culture, one that will eventually become the political space of the city*”¹.”

Contributions

As originally intended in the PhD proposal, the research carried out for this thesis resulted in a diverse set of contributions, which emerged from the exploration of solutions for the research problem. The paragraphs below list and describe the main and complementary contributions of this thesis and the possibilities for further development, which the author is already working on and plans to continue exploring in the near future.

On a primary level, the main contributions are the following:

- Within the scientific realm, a qualified assessment of user’s emotional response to simulated architectural spaces and design objects, based on the analysis of psycho-physiological data collected by emotion measurement and biometric tools (quantitative), as well as in questionnaires (qualitative) in the course of experiments done in a multidisciplinary architectural education context;

- an overview of the topic of the human body based on the current paradigm of the “embodied mind,” which can be of interest to raise awareness on the need to include such knowledge in design guidelines and building regulations;

¹ M.P. Vitruvius, *Ten Books on Architecture*, trans. I.D. Rowland and T.N. Howe (Cambridge UK, 2001), p. 34.

- a historical review of works of architecture that explored corporeality as a way of connecting both physically and emotionally, with the user while moving through space and which can still be used today as examples offering important possibilities for exploration through design;
- the description, illustration and evaluation of a set of experiments involving the use of biometric and emotion measurement data with the goal of evaluating the user's engagement and psychophysiological reaction to design objects and architectural spaces;
- a reflection on the role of corporeal extensions and restrictions, such as design objects, tools, clothing, vehicles or architectural spaces, as instruments for conditioning the human body and, therefore, as active participants in the user's assessment and shaping of reality.

On a secondary level, the research work developed for this thesis brought about other complementary contributions, namely:

- Within the architectural realm, the discovery and suggestion of new possibilities for architects to use a "classical" topic, such as the human body, to address their design interests, taking advantage of the new knowledge brought by the study of the human brain;
- the demonstration that the use of "somaesthetics" and, more specifically, of practices from performance art, in the teaching of architecture can be of interest to raise awareness on the importance of designing from an embodied perspective and thinking about the well-being of users;

- Within the artistic realm, the creation of a shape grammar that permits composing and notating the movement of the human body and relating it to space, opening up the possibility of its use also for choreographic purposes, but also for implementing practices from performance art in the teaching of architecture and design;
- Within the academic realm, the proposal of strategies to implement a corporeal approach to the use of both analogic and digital tools, such as drawing, model making, and CAD/CAM technologies, expanding their potential to support a holistic approach to design, overcoming current design limitations and matching contemporary society concerns;

Outlook on Further Research

The research developed in the course of this thesis left behind some possibilities for further work. For instance, there were no experiments undertaken in virtual settings. The author considers that it would be scientifically useful to apply the same methodology to experiments in virtual settings, specifically to compare the emotional response of users in virtual simulations of existing architectural spaces with their responses in the real versions of such spaces. Within the immersive approach to the experience of architecture and urban spaces, some possibilities for further research are listed below:

- Creating virtual immersive spaces by 3D-laser-scanning physical architectural models;
- Creating virtual immersive spaces by 3D-laser-scanning existing architectural spaces;

- Analysis of movement in architectural spaces and users' interaction with design objects;
- Psycho-physiological evaluation of simulated motion in space and cinematic experience;
- Incorporation of psycho-physiological equipment in an educational design context;
- Developing building design guidelines based on psycho-physiological data collected in experiments.

Ending Note

According to Pérez-Gómez, Vitruvius speaks of the architecture of the theatre, where performance takes place, as a cathartic event, not merely as a building or a construction of an object. He continues this ideas saying that *“Drama in Greek and Roman theatre was experienced as a tight weaving of temporality and spatiality that aligned human action with the purposeful movements of the cosmos (...) participating in the emotionally charged direction of the plot, the spectators grasped answers to fundamental human questions and attained a heightened self-understanding.”*²

In what architectural education is concerned, I believe that this is the time to re-think the importance that corporeal training and performance art had in the avant-garde, such as in the pedagogy of the Bauhaus, and the tradition that involved architects

² PÉREZ-GÓMEZ, Alberto (2012). “Architecture, a performing Art: two analogical reflections”. In Online Review of Architecture, Architektur N in <http://www.architecturenorway.no/questions/histories/perez-gomez-performance/> accessed on in 07/11/2013

with craftsmen, which allowed them learning how to value their work not as mechanical manual work but as embodied knowledge. I agree with Pérez-Gómez and I believe that such embodied knowledge should not only be learned at university but searched for in practice continuously.

As Oskar Niemeyer said in an interview few months prior to his death, “*it is life that inspires architecture and not architecture that dictates life*”³. I agree with this statement in the sense that it is through the direct engagement with students, collaborators and clients and their collective participation as creative individuals that architects can truly perform their duty or their call to the profession, as ambassadors of culture and builders of collective knowledge.

But most importantly, it is through constant study of contemporary possibilities that an architect can understand and integrate in her/his practice knowledge that leads to a better understanding of human emotional needs and how architecture can response to them, nowadays and in the future.

³ The author apologises but it was not possible to trace back the reference of Oskar Niemeyer’s interview.

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