Bodies and Labour:

Industrialisation, Dance and Performance

A thesis submitted for the degree of Master in Philosophy

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Abstract

This thesis presents an interdisciplinary analysis of ideas regarding the introduction of technologies in the field of dance and performance since the industrial era. The first two chapters analyse different historical periods, thus creating a parallel between the establishment of work-science, and emerging methods and styles within performing arts that utilise technology as a core element for its creation. The historical examination of the field of work-science studies allows the sketching of a variety of relationships between labour and technical developments, focusing especially on the systematisation of productive processes, the integration of new technical developments and the measurements of body's rhythms and capacities. Therefore, rather than presenting a full historical study of industrialisation and technological performance, this research proposes a segmented analysis of two different periods: firstly, a parallel between Taylorism and Electric Dance since the late nineteenth century; and secondly, some relevant notions of Fordism, Mass Ornament and film studies from the 1920s. In the last part of this thesis, I present some general ideas on post-Fordism and digital performance that will serve as a base for future research development.

This investigation is rooted in the field of performing arts, introducing ideas and concepts from labour studies and generating a critical approach to the integration of technologies within performing arts and its aesthetical, methodological and creative outcomes. The research encompasses a wide range of perspectives, from early photographic experiments, film studies, entertainment culture, video games, and digital technologies, formulating a general approach to technological transformations since the late nineteenth century.

The key question throughout this research is precisely a double-sided adaptation between movement style and technical development: a process of intermedial configurations based on technological progress, analysed from a labour-science perspective, and then applied to performance art and entertainment culture.

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Introduction

During the twentieth century we witnessed one of the most significant technological changes in the history of humanity, which radically transformed our everyday life, public and private spaces, our standard of living, our ways of communicating, and how we specifically interact with new technical and technological apparatuses. The multiple concepts that have informed the discourses on the body since the late nineteenth century create a complex network of theoretical discussions that serves as a basis for the emergence of the central aim of this research: to analyse the notions of body, movement and gesture regarding both the integration of technologies within performing arts and the establishment of work-science since the industrialisation era.

It is important to highlight the explicit connection between military industries, medicine technologies, information processing, communication systems and the constant technological development as one of the main issues of our time. It is specifically within this context where it becomes relevant to emphasise the relationship between labour and technological developments – a relationship that particularly focuses on a systematisation of productive processes through the structuration of behaviour patterns for workers and a rigorous re-design of the workplaces.

The emergence of certain art performances that directly integrate scientific concepts – focussing on the relationship between body, stage, and technology – are the product of technical developments that constantly affect our daily life, and therefore, might be analysed as a reflexive axis for contemporary society. Hence, this research integrates a variety of perspectives in order to generate a more general understanding of technological transformations since the late nineteenth century. Thus, technical developments related to thermodynamics, science and engineering determined a specific viewpoint on the rise of mechanical rhythms, generating a social sense of dynamism and new cultural representations of this dynamism in the entertainment industries. Early photographic and cinematic experiments, in addition to dance and performing art creation play a key role in the analysis of entertainment culture. Within this framework, my research attempts to open a specific line of analysis from early industrialisation and time-and-motion studies for productivity to actual ideas on Lean

Manufacturing and its way of understanding the organisation of the working-body today.

Since the late twentieth century, there have been considerable contributions by engineers applying their knowledge to artistic creation, as well as multiple artists working with highly technological apparatuses, not only in their *mise-en-scène* and designs, but also as part of the compositional process. Simultaneously, a variety of colloquiums, laboratories, papers, books, journals, and interesting compilations on the insertion of technological devices have emerged. Within this context, the thesis does not want to dwell on a collection of case studies, art pieces, and artists that integrate technological machinery in their work; nor be part of an overcomplicated agglomeration of concepts that may divert us from the main purpose of this research. Rather, this investigation attempts to look in depth at a specific constellation that, in my viewpoint, has been affecting performance art creation since the late nineteenth century: the analysis of working-bodies in an industrial context of systematisation for production, and its relation to the aesthetical outcome of the integration of technological aspects in performing arts.

Consequently, I would like to emphasise that this research does not attempt, in any sense, to create a history of "performance and technology". More precisely, I concentrate on the analysis of two different historical periods established by work-science, creating a parallel between technological development for industrial production and the integration of technological apparatuses within performing arts. Therefore, it is relevant to mention that this thesis arises from the following question: does work-science present some relevant concepts that could open new analytical perspectives about the way technology is integrated into performing arts?

For this to happen, the reader will find different parallel analytical lines within this research: on the one hand, the development of work-science has been approached from three different periods, Taylorism, Fordism, and post-Fordism, in order to integrate a strict analysis on the physical capacities of workers' bodies. On the other hand, and following the same historical time-line of work-science, the emergence of early photographic experiments from the late nineteenth century, the development of cinema studies and the insertion of visual effects during the first half of the twentieth century, and the emergence of video games and digital social networks since the late twentieth century, have been included alongside this research to present a relationship between

entertainment culture and social changes regarding technological progression. Finally, the two first historical moments have also been correlated to the development of dance and embodied performance, in strict relation to technologies, thus presenting a critical path of analysis within the field of performing arts.

The first chapter, "Motion Machines: Taylorism and Electric Dance", presents some relevant concepts involved in work systematisation at the turn of the twentieth century. The development of technical apparatuses for labour studies, economy of gesture, and work-science instrumentation are examined in relation to entertainment culture and new rhythmic perception. Early photographic experiments and the origins of motion pictures and cinema serve here to understand how the working-body is entangled to productive sequences under a strict study of human capacities. The implementation of a new relationship with technical developments unfolds new paradigms of movement, production, time and space. This analysis is then paralleled to late nineteenth century's dance performances and music hall spectacles, specifically complementing the existing work on Loïe Fuller's and Marie Leyton's "electric dances", thus presenting a specific perspective on how industrial development affected dance and performance during the late nineteenth century.

Chapter number two, "Dynamic Assembly Lines: Fordism and Mass Ornament", specifically focuses on the adaptation of fast technical devices for labour and the re-organisation of workplaces within Ford Automobile Company. The continuous upgrading of speed imposed by constant technological developments, and the new understanding of time and space, in addition to movement pattern analysis generate a context from where to approach the introduction of mass production. Within this chapter, new ideas on the disciplining of the body for production and the harmonisation of the body to the pace of the machinery led to a new paradigm of production and consumption. These ideas are also reinforced by the extensive integration of cinema, and the specific technical developments that changed the social understanding of entertainment. The film *Metropolis* (1927) by Fritz Lang is analysed as a depiction of a vast social transformation, also portraying ideas of social and labouring division. This second chapter concludes with an analysis of the performance of the Chorus Girls in Europe and United States, since the beginning of the twentieth century, as a massive cultural exponent of serialised production of movements and specifically trained bodies as productive agents within entertainment industry.

Consequently, the third chapter of this research initiates an investigation on Flexible Specialisation of post-Fordism systematisation of labour and digital performance. Alongside I will introduce some relevant concepts in digital cinema, video games, and social networks focusing on the emergence of new conceptual operations that arise from digital media development. Hence, the last chapter of this thesis presents some basic ideas that will serve as a starting point for a future PhD research.

It is necessary to highlight that this MPhil research does not pretend to create an enclosed frame for the study of performing arts; rather, it stands as a basis from where to explore a critical line of research in the future. For this to happen, I present several open concepts from a historical-analytical background that, from my perspective, help to critically approach the utilisation of technology within embodied art practices.

Nowadays, it becomes necessary to reflect upon the idea of pre-established knowledge disciplines, delving into blurred boundaries between labour studies, cultural and artistic practices, and both technical and scientific progress. Technological developments allow the integration of analytical elements in order to study interdisciplinary fields, as a sign of constant cultural transformations. Consequently, what is relevant for this research is to present a basis from where to reflect on spaces and operations, processes and concepts that arise from the strict relationship between body and new technologies.

Chapter 1

Motion Machines: Taylorism and Electric Dance

> By repeating operations along a continuous track, the escalator, the motion picture camera and projector, the central conveyor belt, the roller-coaster and the phonograph integrated series of elements into products that had, it seemed, a rhythm of their own (Schwartz 1992: 89).

Rhythm

Technological transformations constantly modify the way we understand and perceive our everyday life. Since the beginning of the British Industrial Revolution until the middle nineteenth century[1] new energy sources, such as coal and steam engines, and mechanical inventions and tools, established a period of technical development that overcame medieval technologies such as the windmill and the waterwheel. These new technical developments directly affected the way people lived, transforming the concentration of working environments, education and ways of recreation.
The acceleration of transportation and communication systems, with the introduction of the steamship and steam locomotive, took place within an industrial transformation that was based on the implementation and refinement of traditional methods. The increased efficiency of manufacturing also affected the distribution of food and commodities. Technical developments related to steamed-powered engines, thermodynamics, motors and vast engineering procedures determined a specific perspective on the modern idea of progress.

Even though such technological developments spread over a long period of time, the process of continuous appearance of technological devices in the social arena completely modifies the common experience of speed and velocity. Since the eighteenth century, the gradual introduction of steam-powered locomotive, railways, thermodynamics, motor-powered engines and the telegraph, the vast distribution of electricity and the introduction of new machinery in the workplace generated a social sense of dynamism, a new way to understand social rhythms, entertainment and the core sense of motion. This caused an extensive process in which the emergence of mechanical rhythms led to new approaches about the body and its performance in a variety of senses.

Although factory coordination of work and labour specialization arose within the textile industry and the spinning process of the Cotton mills, it was not until the last quarter of the nineteenth century that these specific processes were rationalized

[1] Industrial Revolution dated between the eighteenth and the beginning of the nineteenth centuries, Please see Kranzberg's article "The Information Age: Evolution or Revolution?". In: *Information Technologies and Social Transformation*. (Washington: National Academy Press).

through a methodological approach to productivity and efficiency.[2] It is this specific historical moment that will serve as a starting point for this investigation, deepening in the methodological approaches to human movement and its implication in work-science and performing arts since the last quarter of the nineteenth century.

With this as a background, thermodynamic studies, a science that investigates energy conversions, specifically in relation with mechanical work, emerged as a part of a study on steam engine efficiency that ran throughout the eighteenth and nineteenth centuries. Later on, thermodynamics was applied to human mechanical work and its relation to industrial machines. Consequently, the appearance of steam and motor machines on the work-floor changed the whole perception of labour rhythms, inducing a massive transformation in the way the body was perceived and organised within the workplace. This process of fragmentation and mechanisation of a rhythmic sense crosses over different fields such as physiology, medicine, physical education, art and psychology, also influencing a wide range of changes in working environments and social areas such as popular entertainment, dancing spectacles and funfairs. Therefore it can be said, that the notion of "rhythm" plays a relevant part within European and American modern understanding of the relationship between the body and technological development.

Since the late ninetieth century, this labour-based approach to the body was built on the understanding of internal rhythmic operations, such as the study of muscle reactions, nerve impulses, breathing and the circulatory systems. The new dynamic context embedded a social sense of a non-stoppable movement. A physiological, psychological, technical, and sociological perspective where no gap has to be perceived, and every single rhythmic impulse was understandable and controllable. "Studying reflex arcs, cardiovascular and circulatory mechanisms and the relationship of brain to muscle motions and nerve impulses, they announced that the human body was, above all, a device for producing rhythm", in other words, a social and physical understanding of the "importance of rhythm within the physical person" (Schwartz 1992: 81).

Hillel Schwartz, a cultural historian at University of California, in his article "Torque: The New Kinaesthetic of the Twentieth Century" (1992), introduces an accurate

[2] Manuel Castells 1996 book: *The Information Age: Economy, Society and Culture. Vol. 1: The Rise of the Network Society*. (Cambridge: Blackwell Publishers Inc.).

evocation of these transformations throughout the twentieth century, presenting a close reading of the development of physical education, body rhythms and Dalcrozian eurhythmy, in correlation with mechanical devices:

> Escalator, projector, conveyor belt, phonograph, these all lay within the realm of Dalcroze eurhythmy: Bodies could be made (or made to appear) whole and mobile if only one understood the principles of rhythm. In order to improve the escalator, one had to smooth out the rhythm of the moving stairs. To improve the assembly line, one transformed the rhythms of the worker on the basis of 'time-and-motion studies,' which reflected the new kinaesthetic in their own transition from the original stopwatch techniques of Frederick W. Taylor to the polished cinematics of the efficiency experts (…) To improve the phonograph, one had to adjust the prime movers, cams and gearing so that nothing interfered with the spoken and musical rhythms already inscribed on the cylinders or discs. In each case, one sought a natural, fluid transition from step to step, frame to frame, task to task, bar to bar (Schwartz 1992: 89).

This main and massive change on rhythm perception, in addition to the development of technical devices for labour studies, will inform the progression of this first chapter. With the idea of creating a specific link between early technological development for industrial work and the technical display involved in cinema, dance, and performance art creation, I will present some relevant concepts involved in the systematisation of work, focusing on the turn of the twentieth century, and then apply them in a particular analysis of the entertainment culture, especially in early cinema, dance performances, and music hall spectacle by Loïe Fuller and Marie Leyton.

Labour Organisation

The exploitation of wage labour has been one of the main driving forces of capitalist profit since the late eighteenth century. Although the tendency to increase profits by streamlining the rhythms of work is as old as capitalism, most of the factories, until the mid-nineteenth century depended on scarce and undisciplined labour forces.[3] The ones that dominated within this relative turmoil were the guilds, the associations of skilled workers in areas or specific aspects of production processes.[4]

From the labour-organisation point of view, the key to the guilds' culture was that workers possessed the effective and immediate knowledge on production processes and could, in many ways, from that knowledge, manage the rhythm of work. Passive resistance was the only administration of time that workers could apply in their work places, in a combination of effective working times and times of relative leisure. Slow or neglected working times were common forms of resistance to oppressive situations during the nineteenth and the early twentieth century. The fact that trained workers remained organised in global skills allowed them to hasten or slow-down the work in general terms, or enlarge the unproductive interstices (empty times - spare times) into the production process, using those times as relative pauses.

The idea of increasing profits through the increment of labour productivity – either by increasing the rate of production or intensifying the rate of daily work – has been a basis for the development of a series of studies and investigations about the management of working rhythms, embodiment and movement patterns necessary for industrial rationalisation. This process has been generally labelled as systematisation of labour, a course of action where the elimination of old patterns of behaviour within factories, and the insertion of new schemes of work and leisure "settled upon the working man" (Rabinbach 1990: 29). It is precisely these studies on motion and movement for production that are the crucial idea behind this research, and therefore, the accurate "systematisation of movement" run by factory owners and managers

[3] See E. G. Wakefield *Lectures on colonies and colonization*. Quoted on K. Marx *A Critique of Political Economy – Volume 3 Part 1.*

[4] Carlos Pérez, *Proposiciones en torno a la Historia de la Danza* (Santiago: LOM Ediciones, 2008). Pérez presents an interesting perspective on dance history in his book, specifically related to the development of this research is the chapter B: "Sobre la condición social de la danza" (On the social condition of dance).

since the late nineteenth century, specifically focusing on Frederick Taylor's research, acts as a basis from which to approach movement systematisation, gesture economy, and patterns of behaviour.

Taylorism

Frederick W. Taylor (1856-1915) was a mechanical engineer born in the United States who developed a career as a general manager for the Manufacturing Investment Company of Philadelphia and was the founder of the first independent management consulting office in America. He was specifically concerned with the study of movement patterns within factories. Therefore, during the 1880s he started a meticulous study on manufacturing industries that drove him to develop a system of organisation of workers' movements and work places. F. W. Taylor was not the only one to develop a scientific study of work, but the systematic approach of his proposals, the success and the multiple applications of his studies led historians and economists to commonly use the term Taylorism when referring to the most extreme forms of rationalisation applied to industrial labour in the first half of the twentieth century.[5]

The Taylorist system transformed the basic understanding of work organisation transferring the specific knowledge from workers to managers, designers and coordinators of work – removing the control of the work process from the workers and placing it in the hands of Taylor's time-and-motion-study engineers – imposing specific times for tasks and establishing defined periods for rest and relaxation. The spare times that workers could take advantage of became specifically determined rest times, functional to the rationalisation of the workday with the core idea of training bodies for the increment of productivity. This was based on a slanted perspective about the objective and subjective aspects of bodies at labour.

[5] Harper & Brothers originally published *Principles of Scientific Management* in New York and London in 1911, and *Shop Management* was first presented as a paper read in 1903 (New York), and then was published as a book in 1911 by Harper & Brothers (in New York and London).

One of the main aspects of this rationalisation of labour was the development of a complex system enclosing the idea of efficiency. Fields such as health, medicine and morality were involved in the process to improve a social awareness where idleness was condemned and the virtues of work were highlighted as "a condition of health of morality, and of indefinite progress" [6]. Labour was remarked as a necessary "expenditure of energy", but also as a part of a system that requires a "recuperation" of energy through adequate nutrition, rest, and sleep (Rabinbach 1990: 36). Therefore, this systematisation has been understood as a social process within industrial societies, that not only includes the programmability of working times but of a whole social system: precise times for social life, specific hours for eating, sleeping, and resting begin to determine the behaviour of workers and families, and from there, of the entire society.

The process of rationalisation also involved the development of a system in which each productive process was divided in basic operations as part of a whole assembly system. This implies that the entire productive process was divided in abstract fundamental sections, creating an immeasurable intensity and monotony within industrial work that involved a strict study of the capacities and possibilities of the human body in addition to a particular order of corporeality required by this new work organisation. This extreme segmentation of the industrial assembly process in a series of abstract fundamental operations allowed the emergence of *abstract workers*: workers who had no special training and performed repetitive tasks, which had no meaning in themselves; workers who were part of the apparatus their physiological cycles or their subjective needs. Within industrial society, workers must learn rhythms and routines that are unfamiliar to them, historically, objectively and subjectively speaking.

In this context we can understand that the disciplining of the body driven by time-and-motion studies far exceeds industrial work routines. All spheres of life were configured through the ethos of productivity, a perfect harmonisation between labour, entertainment, social events, everyday life, and discipline, where a whole new

[6] Anson Rabinbach, *The Human Motor: Energy, Fatigue, and the Origins of Modernity*. Berkeley and Los Angeles: University of California Press, 1990. In the first chapter of the book, Rabinbach presents an accurate revision of idleness and fatigue, specifically focusing on how moralizing writers condemned idleness and wrote about the virtues of work in order to generate a social sense of productivity.

conceptualisation of scientific discoveries applied to body movement in relation to production began to emerge. Concepts like human motor, physiology of labour, conservation of energy, automation, and body without fatigue, started to be developed and applied into a new science focused on strict analysis of the worker's body. A process that cannot be approached just as an abstract situation, but as a whole experimental practice: the diversity of tests for the measurements of human capacities, the development of a series of machines for the documentations of labour performance, and the maximisation of the worker capacities was run directly within factories in the United States and Europe.

Anson Rabinbach, a specialist in modern European history and Professor of Princeton University, in the introduction to his book *The Human Motor: Energy, fatigue, and the origins of modernity* (1990), presents some leading ideas behind the science of work and explains how these ideas have influenced an entire social transformation in Europe.

> The protean force of nature, the productive power of industrial machines, and the body in motion were all instances of the same dynamic laws, subject to measurement. The metaphor of the human motor translated revolutionary scientific discoveries about physical nature into a new vision of social modernity (Rabinbach 1990: 1).

What Rabinbach presents here is a transformation of the principles of labour with a repercussion on its social perception, breaking with earlier parameters of production and economy: the emergence of a science of work that searches for a perfect productive body without fatigue, drawn from the analysis of muscles, nerves and efficient expenditure of energy. In other words, this constitutes a whole physiological measurement of workers, for productivity, involving a specific training and a strong social commitment, where "the technology of the factory system required more than externally imposed discipline and direction, but rather an internally regulated body ancillary to the machine (…) the ideal of a worker guided by either spiritual authority or direct control and surveillance" (Rabinbach 1990: 35).

The new approaches to the worker body, understood as a productive force that can be technically measured, adapted and subjected to laboratory investigations, in combination with the technical developments in areas like photography and early films, led to the development of a completely new understanding of the physical and

organic capacities of the body. This specific process that I presented above as science of work involved a huge range of disciplines such as economy, physiology, psychology, photography, among others, with the central idea of analysing the capacities of the labouring bodies, their performance, and the different states and conditions that can affect their potential for production. Effort, fatigue, anatomy, motor, energy, mechanism, thermodynamics and hygiene were the most common concepts applied to the study of the body within industrial societies.

> The science of work transformed the perception of work in Europe. Breaking sharply with earlier doctrines of moral and political economy, the new science focused on the body of the worker. Predicated on the metaphor of the human motor and buoyed by a utopian image of the body without fatigue, the search for the precise laws of muscles, nerves and the efficient expenditure of energy centred on the physiology of labour (Rabinbach 1990: 10).

According to Rabinbach, and under the premise that designed movements of factory labour "helped workers to adapt to industrial processes" and "accelerated improved techniques of production" (Rabinbach 1990: 15), a strict process of harmonisation of body movements, machinery rhythms and industrial environments, were conducted by management engineers within large industries at the beginning of the twentieth century; a course of action in which the worker body had to learn how to copy and to simulate the pace of the machine, adapting to it in a fast and quiet way. This new work and social model that was constructed by a multiple combination of scientific disciplines, built up the concept of a pure performatic body: a specific working body – for society – that wholly responds to an economy of gesture and energy.

Economy of Gesture

> Economy of gesture has one source in mechanics, the gesture that hides the work of agency behind it. It has a second source in thermodynamics and the redefinition of labour around it (McCarren 2003: 11).

The idea of "economy of gesture" arises with the development of modern science, especially related with concepts like thermodynamics, efficiency and effort. These four concepts – economy of gesture, effort, thermodynamic, and human motor – became some of the main subjects of study in relation with human and machine energy expenditures during the nineteenth century, especially for scientists and engineers.

In regard to this research it is necessary to explain that the modern approach to thermodynamics as the study of natural laws – in which energy can neither be created nor destroyed, but only transformed – helps us to understand why it was applied to Taylorist time-and-motion studies and how human labour was approached as energy conversion for production management in the twentieth century. Thermodynamic science established an equation in which machine power in addition to human labour has to produce manufactured goods within a minimum amount of wasted energy. Managers and engineers conceived workers as *human motors*, as inputs of energy for production that has to be measured in order to obtain its best performance. In other words, "the human body and the industrial machine", for scientists, "were both motors that converted energy into mechanical work". Therefore, the labouring body was understood as a site of energy conversion; a place of energy exchange with the only goal of heightening labour productiveness (Rabinbach 1990: 2).

For scientists and engineers the main difference between the working body and machines was the notion of *fatigue* as a specific physiological phenomenon. For science of work, machines were unstoppable productive units while workers needed resting time in order to be able to continue with their tasks[7]. For Jules Amar, a French expert on industrial labour at the Conservatoire National des Arts et Métieres, "[f]atigue can be defined as the effect which limits the duration of work. In the case of living motors, man and animals, the fatigue either decreases the intensity of the muscular effort or reduces the contraction of the muscle" (Amar 1920: 206). This is exactly the problem that time-and-motion studies needed to solve: how to increase productivity by training worker bodies in order to eradicate fatigue, dismiss resting time and increase efficiency. In a whole process focused on the modern understanding

[7] Angelo Mosso (1846 – 1910), a physiologist from Turin, was one of the first scientists to work around the idea of fatigue, and in 1874 travelled to Paris to visit E.J. Marey at the Physiological Station, settling the beginning of a long-term scientific collaboration.

of progress the main obstacles needed to be eliminated and, therefore, the implementation of direct harmonisation of worker's bodies with machines through movement analysis, was undertaken.

Taylorist systematisation of movement intended to create a method for training workers in order to achieve a maximum result with minimum effort: an economy of gesture where the ideal worker's body, from the manager's viewpoint, was un-fatigable, un-stoppable and able to achieve the production goals within the working day. This meant that workers had to develop an economy of movement, a retainability of energy in order to constantly produce (and move) in harmony with the rhythm of the machines.

Felicia McCarren, in her book *Dancing Machines: Choreographies of the Age of Mechanical Reproduction* (2003), traces a conceptual relationship between industrial gestures, early cinematic experiences, and avant-garde art, focusing on modern dance and its correlation with Taylorist studies in motion, body training, and automata. *Dancing Machines* introduces an analysis of movement from a diversity of fields, creating a narrow correlation between the modern notions of body, movement, and industrialisation within the early years of the twentieth century. For McCarren, economy of gesture and the notion of effort emerge across a variety of domains – such as physiology, psychology, economy, photography, poetry, and dance – to shape a modern idea of movement economy that was developed within the study of work, and appropriated by the dancers of the time, in order to achieve a "minimum effort, gauged to fit the machine" (McCarren 2003: 10).

> Born from physiology, imaged via chronophotography and elaborated in cinematography, the minimum gesture developed in nineteenth-century work-science became central to the aesthetics of a range of avant-garde modernisms. Representing efficiency and minimum effort in the realm of physiology, representing the speed or rhythm of modernity in poetics, photography or performance (McCarren 2003: 11).

What McCarren evidences here, in relation to the development of an economy of gesture during the nineteenth century, is a specific position about the magnitude and effects of work-science during the twentieth century. The relationship between work-science and dance is established, for McCarren, within the physiological study of movement that responds to a modern culture: "economy of gesture". Modern

techniques uncover not only a movement quality tightly related to machines, in their production and aesthetics, but also a way of understanding the movement generated by machines. Isadora Duncan's work[8], presents some interesting ideas on the way scientific and technical methods were assimilated during the late nineteenth century. Duncan's special interest in scientific discoveries led her to the study of Darwin and Haeckel's evolutionary theories that she applied in the development of her dance theory. The utilization of words such as "soul" or "human spirit" in her writing was commonly seen as Duncan's naturalistic approach to dance, thus eclipsing a more physical and visual understanding of movement. Her intention was to oppose the rigid geometrics of ballet through the understanding of more sinuous movements of nature, based on the communion with natural rhythms. Duncan links the nineteenth century ideas on human motor with ideas about a universal energy, illustrated by waves, trees and clouds, and also with Étienne-Jules Marey's motion photographs[9]. She deepened into a philosophical, literal and scientific re-formulation of art and dance, directly emanating from the empirical experience of the body.

> Before I go out on the stage, I must place a motor in my soul. When that begins to work my legs and arms and my whole body will move independently of my will. But if I do not get time to put that motor in my soul, I cannot dance (Duncan quoted in Preston 2005: n.p.)

Motors, established as a main Industrial Revolution iconic idea, are also indicated as an icon of artistic modernism and movement practices. Within this context, Duncan understands motion through mechanical processes recurrently outlining her dances and choreographies using motorised movement as a principal symbol. The motor also provides an imaginary of constant dancing, un-fatigable repetitions and continuous effortlessly motorised movement through the understanding of a "natural" kinetic that responds to a technical understanding of the body.

In order to understand this extensive and complex process it becomes necessary to examine, not just the specific changes that remodelled the ideas about the body during industrialisation, but the intricate analysis that exists behind these physical and social

[8] Isadora Duncan (1877 – 1927): dancer and choreographer born in United States, considered the precursor of modern dance. The biographic film *Isadora* notably portrayed her dances and ideas.

[9] In Felicia McCarren's *Dancing Machines: Choreographies of the Age of Mechanical Reproduction,* pp.70-71.

transformations, and the specific development of devices for the measurement of human capacities.

Work-Science Instrumentation

> This new scientific revolution meant that the development of modern technology became the prerogative of industry rather than science (Braun 1992: 335).

The development of work-science methodologies was based on an acute observation of worker's performance within factories, especially at the beginning of the twentieth century. A process of "standardisation of scientific terminology and methods" (Braun 1992: 450) led to the creation of a technical approach for bodies at labour based on instrumentation and graphic methods for a physiological analysis of movement patterns. In order to comprehend this process, it is necessary to explain the reinforcement of specific instrumentation to understand the most significant methods used for the measurement of workers' bodies and capacities.

Within this process, a group of inventors, engineers and photographers undertook the goal of analysing body patterns of movement: Étienne-Jules Marey (1830 – 1904), a French physiologist and inventor; Angelo Mosso (1846 - 1910), an Italian physiologist; Charles Frémont (1855 – 1930), an autodidact engineer; Frank Bunker Gilbreth (1868 – 1924), one of the closest associates of Taylor, and J. B. A. Chauveau (1827 – 1917), a French veterinary, anatomist and physiologist, were some of the most relevant contributors. They elaborated on specific techniques and devices, such as the Chronophotographic Gun, that became important for the development and application of time-and-motion analysis on human body and animals.[10]

> By 1900 Marey's pioneering instrumentation and Chauveau's laws of muscle thermodynamics had opened the doors to science of fatigue.

[10] The development of photography and motion studies became an important field of study to which Marey, Fremont and Gilbreth were some of the most significant collaborators. Some other relevant names are: Hugo Kronecker, Jules Amar, Charles Richet, Henry Le Châtelier, and Armand Imbert.

> Identified by both Marey and Chauveau as the key to the efforts of the human motor, the centrality of fatigue to the new science of work was reflected in both the amount of literature and the number of laboratories devoted to its study all over the Continent (Braun 1992: 326).

According to Marta Braun (an internationally renowned historian of art, film, and photography, and an expert on E.J. Marey's and Eadweard Muybridge's work), one of the main ideas behind Marey's photographic instruments was to systematise the study of movement. A course of action that decomposed motion into temporal and spatial coordinates and works as a starting point for a science of labour, changing the conception of the working body and "how it was represented in the social domain".[11]

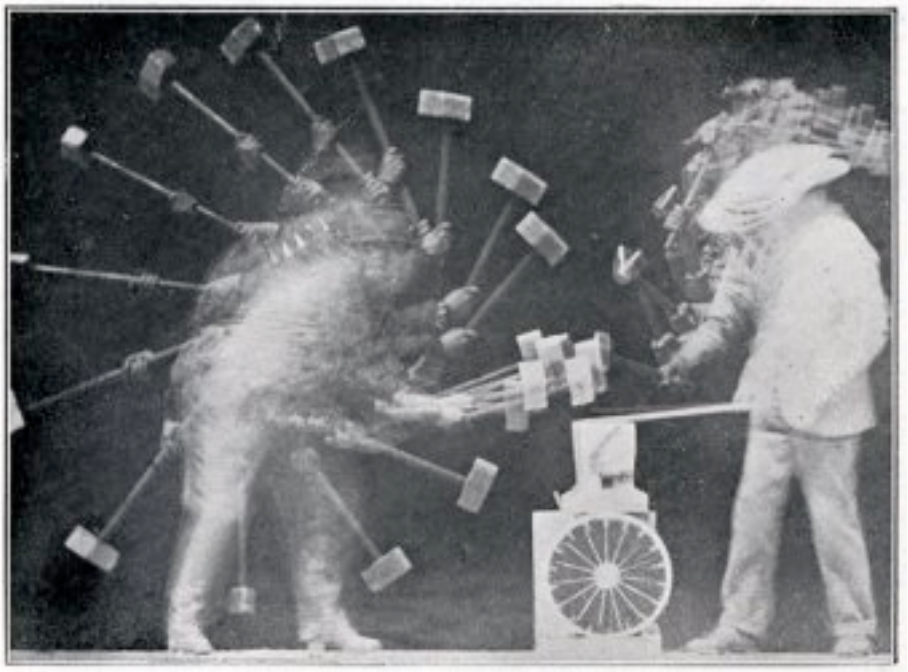

Fig 1.1 Photograph by Étienne-Jules Marey, taken with his Chronophotographic Gun. Published in C.H. Frémont – Etudes Expérimentales de Technologie Industrielle – 64e mémoire - Le Marteau, Le Choc, Le Marteau Pneumatique. Paris 1923.

[11] Jean-François Vincent, *The Science of Movement and the Image of Time* (Paris: Université Paris Descartes, 2005). Available online: http://www.bium.univ-paris5.fr/marey/intro_en/intro25.htm

The development of a series of photographic tools to create recorded fragments of movements by merging notions from anatomy and physiology studies became a way to understand workers' pauses, movements, and postures, and to compare skilled and unskilled workers' performance, fundamentally transforming the conception and execution in the workplace.

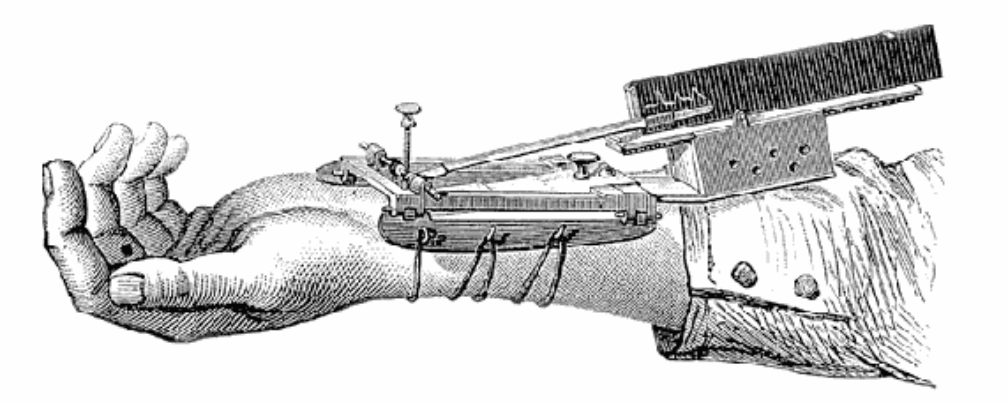

Fig 1.2 Etienne-Jules Marey's sphygmograph. Inscription on the wrist and the route of the pulse. Image from E.J. Marey's 1885 *La méthode Graphique dans les Sciences Expérimentales et Particulièrement en Physiologie et en Médecine* (The Graphic Method in the Experimental Sciences and more specifically in Physiology and Medicine). Paris: G. Masson, pp. 281.

Science of work permitted the emergence of a series of machineries to measure the performance of the body in different contexts: the invention of the *myograph* – or muscle writer – permitted the measuring of force generated by a contracting muscle through a simple transducer that converts force into electrical output; the *dynamometer* – or dyno – was used for measuring the force, power and torque required to operate machines; the *spirometer* measures the volume and rate of air inspired and expired during the performance of specific tasks through a pressure transducer; and the *ergograph* was used to record and compare human bodily information such as temperature, humidity, heart beats, and muscle contractions when, for example, the middle finger rhythmically lifted a weight while the wrist and the other fingers were immobilised.

Fig 1.3 Etienne-Jules Marey's unnamed device for the measurement of the body rhythm while running. Image from E.J. Marey's 1885 *La méthode Graphique dans les Sciences Expérimentales et Particulièrement en Physiologie et en Médecine* (The Graphic Method in the Experimental Sciences and more specifically in Physiology and Medicine). Paris: G. Masson, pp. 156.

Such mechanisms were soon applied to restricted working circumstances and even to cognitive effort, becoming more and more complex, as the *dynamometric bicycle* allowed managers to measure the blood pressure, the muscular tension and the rhythm of a worker's breath when riding static bicycle pedals and performing specific parallel tasks with their arms. All this apparatus created a complex system of motion capture and analysis that quantifies human activities, tests workers in order to determine what physiological and psychological qualities constitute an aptitude for a specific work, and translates them into numbers and graphics. This technical graphic-based process was understood as movement rationalisation for the increment of productivity, looking for a specific balance between mental and physical welfare.

> Taylor's goal was the maximization of output – productivity – irrespective of the physiological cost to the worker. As an engineer, he considered the body as a 'machine,' which either operated efficiently or it did not. He did not consider, as did the physiologists

> concerned with the 'human motor,' how energy and fatigue might be optimally calculated for long-term use, rather than productivity, *per se*. Chronophotography demonstrated the potential for greater economy to be attained from 'training' (Rabinbach 1990: 117)[12].

Rabinbach's analysis of Taylor's methods as "maximization of output (…) irrespective of the physiological cost of the worker" (*ibid.*, 117), points out the social and political aspects of labour systematisation; an analysis of specific body requirements involved in the performance of particular tasks, precise, and usually repetitive movements. This is what McCarren named as "the pathology of fragmented, repetitive work" (McCarren 2003: 18-19). Taylor's methods allowed an ergonomic study of the displacement of labour performance and energy expenditure, and led to the creation of a particular set of exercises to train workers' muscles for a more efficient organisation and utilisation of energy.

Taylorism's sophisticated management systematisation of the worker body, and its large implication on global organisation for production (particularly in industrialised countries) can be considered as a part of the nineteenth-century metaphor of the machine as a copy of the universe – an image where the world itself works as a machine –, a complex mixture between "nature, technology, and society into a single image of mechanical work, universalising and extending the model of energy to a nature conceived of as a vast, unbroken system of production" (Rabinbach 1990: 25).

The idealisation of the automaton[13] as a self-operating mechanical device capable of imitating human movements and therefore, to perform their function according to a range of programmed sets, matches the minimum gesture of the Taylorist worker-body, divested of the social environment and measured as a productive machine in terms of movement quality and performance. It is a perspective that reduces the body to repetitive movements: a modern rhythmic body, driven by the ideal – non-fatigable – automaton.

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[12] In this quote from Rabinbach's *The Human Motor: Energy, fatigue, and the origins of modernity*, he refers to Charles Frémont specific application of Marey's Chronophotographic methods applied to the study of worker's movement.

[13] The word automaton founds its origin in the Greek *αὐτόματον* "acting of itself," a concept frequently used to describe mechanical moving machines that mirror human or animal characteristics and actions.

Abstract work – abstract dance

> Technology is therefore social before it is technical (Deleuze 1986: 34).

Thus far, I have reviewed the main concepts within the study of work applied specifically to the worker body within Taylorist systematisation. It is now time to present some ideas on how and under what premises these mechanisms and new technologies were understood in motion picture and pre-cinematic development, and then applied in performance art, dance, music hall and the entertainment culture at the end of the nineteenth century.

The emergence of modern technologies, as I explained above, determines a culture where the perception of rhythm was drastically transformed. In a time where theatres and industries worked mainly during the day or they were lit by candles or gaslights, the rise of mass electrical systems and light bulbs provided the possibility of vastly illuminating work floors, as well as social and personal spaces like theatres, parks and industries, modifying the perception of the day length and working times. New possibilities of transportation with improved steam engines, and extended railways transformed the perception of time and distance, accelerating the exchange of goods and interconnecting different geographical points. Hence, the invention of the telegraph, the phonograph, the conveyor belt, the picture camera, the elevator and the roller coaster allows us to approach the turn of the century as a moment of massive transformations with strict implications in the social arena.

Pre-cinematic and early cinematic experiments epitomise the massive changes in cultural processes. As I outlined in the first part of this chapter, the analytical tools created by Marey and his collaborators determined new possible ideas through an image-based analysis of worker's bodies. Now I would like to present some notions about the technical apparatus within the pre-cinematic experiences, introducing the work of the Lumière brothers, Thomas Alva Edison, Eadweard Muybridge, and others, from the entertainment cultural perspective, in order to approach the specific context for the utilisation of technologies on stage for dance and music hall spectacles, focusing on the performance of electrical dancers, specifically on the work of Loïe Fuller and Marie Leyton.

Workers Leaving the Factory

At the end of the nineteenth century many developments associated with entertainment culture were based on the idea of motion. The crescent interest in the illusion of moving images established a background of constant experimentation where the magic lantern sequences of Thomas Rasmussen Walgenstein, the phantasmagoria spectacles of Étienne Gaspard Robertson, and the animated drawings of Charles-Émile Reynaud's Théâtre Optique were the first approaches to motion illusion based on the projection of drawing and shadow techniques.[14]

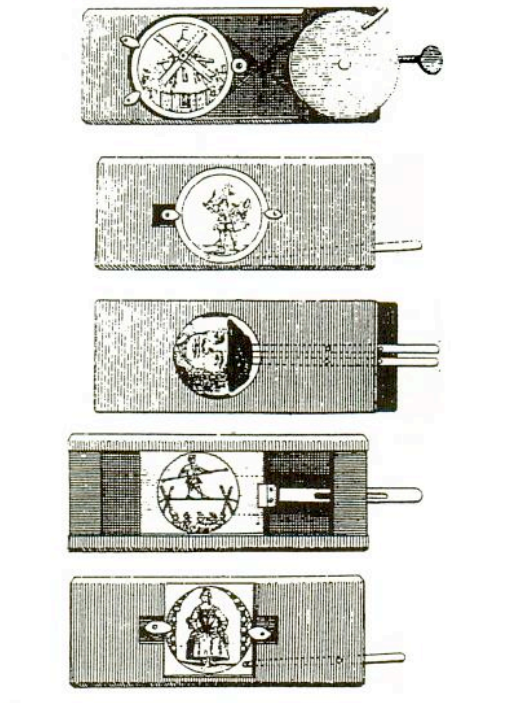

Fig 1.4 Five moving slides for the magic lantern. Top to bottom: the windmill sails revolve, a man drinks, a man rolls his eyes, a tightrope walker moves across his rope, and a woman jumps. From Peter van Musschenbroek, Essai de Physique, 1739.

[14] For a detailed description of early projection of moving images, see Deac Rossel, *Living Pictures: The Origins of the Movies* (New York: State University of New York Press, 1998) and Laurent Mannoni and Richard Crangle, *The Great Art of Light and Shadow: Archaeology of the Cinema* (Exeter: University of Exeter Press, 2000).

In a time when early cinema exhibitions were part of a competing list of a diversity of attractions – such as the X-ray, the escalator, or the amusement park – and were shown in variety theatres, music halls and thoroughfares, a series of inventors were working on refining photographic techniques. Étienne Jules Marey's chronophotographic gun (1882), Eadweard Muybridge's zoopraxiscope (1879)[15], and Thomas Alva Edison's kinetoscope[16], were some of the first referents for the introduction of pictures into dynamic sequences, establishing thus a context from where to start exploring ideas around the optical potential of projected moving photographs for entertainment and educative purposes.[17]

During the same period, the Lumière brothers started to explore ideas about moving images, patenting a series of devices for still image projections. This led them to create the *cinématographe*, registered in 1895, which became a milestone in terms of technological development. It meant a change from the use of consecutive still photographs or drawings as in the Kinetoscope, to the creation of more complex machinery capable to record images in a filmstrip, and then to develop and project them. Within the same year, they recorded *Workers Leaving the Factory* (1895), a short film that shows workers coming out of the Lumière factory, and it is still recognised as the first recorded and projected documentary film.

Workers Leaving the Factory acts as a metaphor, not only of the technical development behind recording and projecting motion pictures on a screen, but depicting a whole social transformation that places the workers within the bounds of one of the most significant technologies developed at the turn of the century: the cinema. As a documentary film it opens up an analysis of the utilisation of motion

[15] Eadweard Muybridge (1830 – 1904) is recognised as one of the most influential photographers of all times due to his famous images of animals and humans in motion. The BBC Scotland recently released an interesting documentary about his life and photographic work, *The Weird Adventures of Eadweard Muybridge*, 2010, produced and directed by Jill Nicholls. Please see http://www.bbc.co.uk. The Tate Britain presented a special exhibition of his work between the 8th September 2010 and the16th January 2011.

[16] Thomas Alva Edison (1847 – 1931) is considered the inventor of some of the most important media equipments during the late nineteenth century. Some of his most famous creations are: the phonograph, the motion picture camera, a mechanical vote recorder, and the battery for electric cars. His implementation of electric power generation, its distribution to factories and private residencies, and the invention of the light bulb were crucial developments for the industrialisation of modern cities.

[17] For more information on pre-cinematic experimentations see Stephen Herbert, *A History of Pre-Cinema, Volume 1* (London: Routledge, 2000). See also: Tom Gunning, "Doing for the Eye What the Photograph Does for the Ear," in Richard Abel and Rick Altman (eds.), *The Sounds of Early Cinema*) Bloomington: Indiana University Press, 2001).

pictures for the documentation and training of worker's performance, and also as a process of registration of social changes resulting from the appearance of cars, trains and railways, elevators, and machinery within factories. Lumière brothers' work unfolds a question about new media (re)usability in contexts of social entertainment, work execution, historical analysis and live performance, a whole process in which workers and technical devices leave the space of the factory to turn up in the public domain.

On 1948, the Lumière brothers wrote: "It would be impossible to deny that the discoveries of science always have affected humanity's material progress" (Lumière 1948: n.p.). Therefore, and considering the multiple possible approaches to the history of cinema, what is relevant for this research is the idea that early cinematic experimentations were not isolated discoveries. They were part of a whole social process that was developed in parallel in different countries, with multiples techniques, but one purpose: the rhythmic illusion of movement for the audience. The mere display of technical apparatuses and optical tricks consolidated a culture of entertainment and technical attractions where simple manipulations of the image such as slow motion, zoom, cut and fade, or multiple exposures acted themselves as a new spectacle.[18] On the other hand, in live performance, the display of technical apparatuses and the integration of electrical lighting and visual effects established an early period where technical and electrical methods were adopted on stage. This leads the audience's expectation to the grandeur of the technological display rather than the execution of the performer, a change of paradigm of the perception of art performances through technological innovations that not only affected the sphere of arts, but also of everyday life.[19]

The technical development aforementioned spread widely through the field of dance and entertainment. It thus determined not only the introduction of modern technologies on stage, but also the actual movement of the performers. A social

[18] "Cinema of attraction" is a term used by the early filmmaker Sergei Mikhailovich Eisenstein, and refers to a new mode of analysis for theatre and early cinema in relation to the sensual and psychological impact mathematically calculated: the montage. See Jay Leyda, *Film Form: Essays in Film Theory* (New York: Harcourt Brace & Company, 1949).
[19] This process has been understood as the enlargement of the entertainment industry: The increasing acceptance by a middle-class culture of simple illustrations and powerful visual effects mixed with gags and humour presented in music hall numbers and variety theatres, especially before 1910.

process of integration therefore introduces specific connotations in the way dance and stage spectacle were perceived as an integration of modern technologies in daily life. This transformation can be understood from a wide range of perspectives: firstly, and as explained in the first part of this chapter, the massive social impact of the introduction of technical developments in different fields of modern life; secondly, the vast distribution of electricity as a key aspect of the day-length perception that opened new possibilities for machines, motors and visual perceptions, both on the entertainment culture and on the work floor. And finally, the new understanding of the body as a performatic agent, that for Taylorism was based on experiments and measurements of body capacities, and now will lead us to a further analysis on electric dance specifically focused on the figure of Loïe Fuller and her imitators around Europe and US.

Electric Dancers: Loïe Fuller and Marie Leyton

> There was a time when the phrase 'danseuse électrique' denoted a young woman whose terpsichorean efforts were supposed to have an electric or magnetic effect upon the spectators. Now it has a distinctly practical significance. An electric dancer is really an electric dancer – one who carries about her person volts, amperes, Watts, ohms and other things, all of which are familiar to the electrician, but rather mystifying to the general public (quoted in Sperling 2006: 1).

Born in United States and then permanently settled in Paris, Loïe Fuller's first public appearance in Europe was in 1892 with her *Serpentine Dance*. Within a cultural framework of Symbolism, Art Noveau, and with friends like Edgar Degas, Claude Monet, Henri de Toulouse-Lautrec, and Pierre-Auguste Renoir, among others, Loïe Fuller was immersed in a context of deep social and artistic changes. This background of innovation conditioned her development of a complex *mise-en-scène.* She experimented with mechanical apparatuses, new technologies available at the time, and vast amounts of fabric. In this way, Fuller opened a field of possibilities for the production of a sense of illusion and abstraction on stage.

Fig 1.5 Jules Chéret's poster for Fuller's appearance at the Folies-Bergère, 1893. Publisher: Folies-Bergère, Paris. Printer: Chaix.

Her figure is not just recognised as a precursor of modern dance, but also as a person that embodied an interdisciplinary approach to scenic art and science. She broke with classical ballet ideas of narrative and physical virtuosity and introduced Isadora Duncan to the European audience. Fuller's work exemplifies a modern entrepreneurial production method through her multiple explorations as an actress, playwright, set designer, lighting technician, dancer, scientist, and filmmaker.[20] It is specifically this interdisciplinary approach that is relevant to the understanding of Fuller's work as a hybrid stage production based on the articulation of a variety of art

[20] Loïe Fuller was, among other rarities, a personal friend of Pierre and Marie Curie, a member of the Société Astronomique de France, and also participated on incipient investigations on cinema projections with Thomas Alva Edison. Her strength laid on the capacity to set all her knowledge together in order to assemble an inter-disciplinary combination of light effects, gas lamps, and fabric design for costumes. She held many patents of chemical combinations for colour lightings and the use of chemical salts and gases for stage lighting and garments.

disciplines. Her performances unfold a process of scenic experimentation with new technologies accessible at the turn of the century.

Movement is what articulates Loïe Fuller's work. An idea of motion understood from the margins of a dance culture based on rigid structures and body standards. In a time when Russian Ballet and late Romanticism commonly highlighted physical expertise, emphasising lightness, slim and ethereal feminised bodies, Fuller's performances of images and colour presented a visual illusion of garments and long-size skirts attached to the body by long bamboo and aluminium sticks, and lit up by polychromatic projections and chemical combinations of gases. Her work reformulates the limits of a conventional dance discipline, and rather than representing a body on stage, she displays a body that appears devoid of its material support. Hence, Fuller places motion on stage through a complex understanding of the technical apparatus and its relation to visual spatiality, where "[e]ach movement of the body was expressed in the folds of silk, in a play of colours in the draperies that could be mathematically and systematically calculated" (Fuller 1913: 33-34).

Accordingly, Fuller's work stands as a turning point from where to consider the idea of motion in relation with technologies. By motion, she not only understood a dancing body, but a dance of light, colour and silk diffused in a visual image and a complex technical set up "designed purely to maximise the drama of the fabric's motion" (Garelick 2007: 33). Stephane Mallarmé described this in his 1893 book *Consideration on the Art of* Loïe *Fuller*:

> Her performance, sui generis, is at once an artistic intoxication and an industrial achievement. In that terrible bath of materials swoons the radiant, cold dancer, illustrating countless themes of gyration. From her proceeds an expanding web - giant butterflies and petals, unfolding – everything of a pure and elemental order. She blends with the rapidly changing colors which vary their limelit phantasmagoria of twilight and grotto, their rapid emotional changes – delight, mourning, anger; and to set these off, prismatic, either violent or dilute as they are, there must be the dizziness of the soul made visible by an artifice (quoted in Sommer 1975: 58).

What is being presented on stage is not just a set of illusions, but an articulation of the concept of movement and staging in relation with the idea of dematerialisation, light, and abstraction. The constant manipulation of movement creates a complex choreography installing a specific language of the silk independently from a body's

dramatic gesture. Motion is the subject of the choreography that presents a dematerialised body on stage: an abstract dance.

> At times, these apparatuses appeared to occult the body altogether; at other times, they served to disperse or fragment it. Overall, Fuller's inventions tended to dissolve the shape of her body into a whirl of fabric and light (…) she was no longer a dancer performing a role, or even a dancer dancing, but somehow a force of performavitity itself, mutating into vast and ephemeral decorative forms (Garelick 2007: 34).

Fuller's innovations in costumes, lighting and stage structures appear to directly blur the entire body, dispersing and fragmenting it. The spinning silk around her body created the motion, the subject of the dance, and the use of electrical bulbs helped to create a visual metaphor "in which the divided or multiplied performing subject can flourish" (McCarren 1998: 158). In 1893 she created the first version of her *Mirror Room*, a semi-polygonal glass box that replicated multiple identical reflections of herself, where "eight Loïe Fullers appear to be dancing at the same time, and the whole stage is bathed in a flood of glorious tints, in which may be seen aerial forms, in cloudlike vestures, whirling and dancing" (Griffith 1894: 545). Four years later, Fuller created an under-lighting device, a platform of rotating lights, covered by coloured gelatine disks.[21] She danced on top of the pedestal lit by a lamp, appearing to be suspended in the air surrounded by yellow and red lights, giving the impression of dancing immerse in growing flames.

> Under these conditions, the pedestal would, essentially, disappear, leaving for the audience only the sight of a woman suspended in midair, dancing four feet above the stage floor, unaffected by gravity, freed from bodily weight, disconnected from her physical context (Garelick 2007: 43).

These constantly changing images presented on stage offers to the viewer the possibility to imagine, not a dancing body, but spinning flames, butterflies, dancing fairies, and an arrangement of multiples body fragments. Therefore, what is presented for the gaze of the audience, is not anymore a persona dancing behind vast garments

[21] Loïe Fuller developed a chemical process for obtaining special pigments and then dissolved them in a gelatine emulsion in order to achieve the colourful projections she wanted. Some stories tell that she burned her house in Paris, in an experiment with new colour gases for her performances.

and visual effects, but an astonishing *mise-en-scène* that transforms the performer through the utilisation of technological tricks and a complex technical set up. Loïe Fuller was known as *la fée éléctricité* (electrical fairy), a "whimsical, female version of Thomas Edison, a mad lady scientist" (Garelick 2007: 6). In 1896, Fuller met Thomas Alva Edison in his laboratory in Menlo Park, New Jersey. On that occasion she discovered Edison's early version of the x-ray machine – the fluoroscope that uses phosphorescent salts which glow in the dark. For Fuller, this was the starting point for the creation of her *Phosphorescent Dance*.

> Mr. Edison explained to me that the wall in the box [the machine] was covered with phosphorescent salts and these salts compressed the light as sand did water and that was why one could see the bones, they were outlined against the light because they were thick and solid and the flesh around the bones resembles matter like a veil. This curious stuff all aglow… held me spellbound. It suddenly occurred to me that if I could have a dress permeated with that substance it would be wonderful. I asked Mr. Edison if the salts would retain the luminousness when the lamp was gone. He hadn't thought of that so we tried it and lo and behold the light remained (Fuller 1911: n.p.).[22]

The *Phosphorescent Dance* created after her meeting with Edison was described by the critic Julius Meier-Graefe in this manner:

> She disappears and all is dark, but something moves in the darkness, It is tiny brilliant points that dance, it is a dance of lights glittering like stars. They form large, brilliant circles that merge into luminous mountains side by side, crisscrossing, nothing but these points of light dance, not an iota of human movement – it takes one's breath away, It is a mystical dance (Lista 1994: 328).

During 1898, Fuller faced a period in which her work was not recognised by dance producers nor protected with legal copyright. In a moment in which she was influencing skirt dancers, cabaret producers, and the whole development of new lighting aesthetics around the world, she had to fight in court to obtain the copyrights of her own inventions. In *Electric Salome: Loïe Fuller's Performance of Modernism* (2007), Rhonda K. Garelick narrates the extravagant historical facts involved in the

[22] Quoted in Rhonda. Garelick, *Electric Salome: Loïe Fuller's Performance of Modernism* (Princeton: Princeton University Press, 2007).

development of Loïe Fuller's *Serpentine Dance*, presenting a quotation from a court document that serves as a starting point for a deeper analysis:

> Illustrating the poetry of motion by a series of graceful movements, combined with an attractive arrangement of drapery, lights, and shadows, but telling no story, portraying no character, and depicting no emotion, is not a 'dramatic composition,' within the meaning of the copyright act (…) The merely mechanical movements by which effects are reproduced on the stage are not subject of copyright where they convey no ideas whose arrangement makes up a dramatic composition (Quoted in Garelick 2007: 214).

Repetition, abstraction, and the implementation of modern technologies such as complex mechanisms and electrical systems were placed on stage, creating what has been called a "light" or "electric" dance based on modern technologies and new performance systematisations that arise from different fields of study. For Mallarmé "is not a woman who dances (…) she is not a woman, but a metaphor" (Mallarmé 1886: n.p.).[23] The figure of Loïe Fuller serves as a point of conjunction for artistic and technical appreciation when she "conducted her own chemical experiments, engineered special lighting instruments, made her own gels and lantern slides, and trained a staff of electricians to expertly operate the equipment" (Sperling 2000: 1). The implications of this *mise-en-scène* is not just an aesthetical approach to the spectacle Fuller was able to set up on stage, but rather a political aspect of stage design.

Fuller has been named as a precursor of modern dance, and as a precursor of pre-cinematic experiments on stage. Even though Loïe Fuller wrote her memories and impressions in a book published under the name *Fifteen Years of a Dancer's Life: With Some Account of her Distinguished Friends* (Boston: Small, Maynard & Company Publishers, 1913), she was practically erased from any general dance history during her career and after her death. Her work has recently been re-discovered by theorists interested in the relationship between dance and technology, and also by film theorists interested in early cinematic and pre-cinematic experiences. Film and dance theorists have studied her work as a complex figure from where to analyse the modern cultural changes in relation to art and technology at the beginning

[23] Between 1886 and 1897, Stephane Mallarmé wrote a series of theatre reviews, newspaper articles later collected under the title *Crayonne au Théâtre* (Penciled at the Theatre).

of the twentieth-century. Consequently, it is now easy to obtain many articles and books dedicated to her, especially the ones by Jody Sperling;[24] *Electric Salome: Loïe Fuller's Performance of Modernism* by Rhonda K. Garelick; *Traces of Light: Absence and Presence in the Work of Loïe Fuller* by choreographer and scholar Ann Cooper Albright; *Loïe Fuller: Danseuse de la Belle Époque*, by Italian scholar Giovanni Lista; "'La Loïe' as Pre-Cinematic Performance – Descriptive Continuity of Movement" by Erin Brannigan; and *Dancing Machines: Choreographies of the Age of Mechanical Reproduction* by Felicia McCarren. Therefore, I will not attempt to present a resume within these pages; rather I would like to present an analysis particularly based on the relationship between serpentine dance and its technical apparatus.

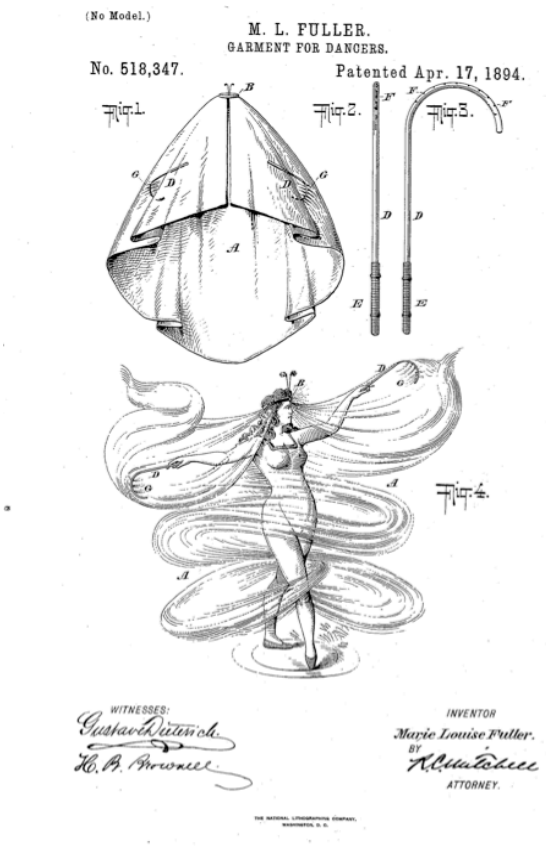

Fig 1.6 Loïe Fuller's "Garment for Dancers". Patent drawing,1894. Imae from Garelick's book: *Electric Salome: Loïe Fuller's Performance of Modernism*. (Princeton and Oxford: Princeton University Press, 2007) pp 41.

[24] For Sperling writing on Fuller's work please see www.timelapsedance.com/publications

The image above (Fig 1.6) shows Fuller's 1893 patented design of a costume that allows her to produce specific effects with the silk. She described it as follow:

> My invention consists of certain improvements hereinafter fully shown and described, which improvements materially assist the dancer in posing, and, in causing, by movements of the body, the folds of the garment to assume variegated and fanciful waves of great beauty and grace… By use of wands (of aluminum or bamboo) connected to the dress a double purpose is afforded. First, it facilitates the creating of a waving motion in the folds of the garment, and second, it assists the dancer in performing statuesque poses, and in imitating different styles of wings. By providing at the end of the wands a single, or double curve, it will be readily seen that by holding the wands aloft the garment will be spread out to give another form of wing… In hanging the skirt from the head of the wearer, it will be readily seen that the curves or spread of the garment will have much more radial latitude than a garment secured around the waist or close under the arms, thus permitting the production of more rounded out and graceful evolutions of the garment. By use of a skirt of variegated colors in connection with white or colored projections of electric or calcium lights, beautiful scenic effects are produced (quoted in Sommer, 1975: 60 – 61)

Loïe Fuller's style inspired many imitators, and serpentine dancers became as famous as skirt dancers were in the middle of the nineteenth century. Dismissing the leg kicking and spontaneous movements through the stage proper of a skirt dancer, serpentine dancers developed a dance based on arm gestures that carried vast amounts of silk. This produced the effect of a continuous serpentine movement of the fabric that served as a moving screen for the projection of colourful lights or magic lantern slides. Within this context, Marie Leyton, a serpentine dancer that followed Fuller's style, will serves as an example to understand the significant technical experiments that were managed on stage with the intention of creating even more astonishing visual effects.[25] Her literal approach to Fuller's developments led her to introduce significant methods on stage. With the main idea of triggering lighting effects with her movements, and to develop a light-emitting technique, Marie Leyton placed multiples bulbs in her garments and around her body, creating a dance style that received the name of "electrical serpentine".

[25] My analysis on Marie Leyton is primary based on Jody Sperling's 2006 article "Sublime or Ridiculous?: Some Thoughts on Marie Leyton's: Electrical Serpentine Dance of the 1890". Sperling founded her research on Marie Leyton's performance at the Tivoli Music Hall in London in 1892.

The technical display of the "electrical dance" requires a particular analysis; one related to the conditioning of movement by specific technological apparatus to produce particular visual products. Leyton's first intent to create a self light-emitting performance entailed a series of experiments with electricity.

> If two metal plates are put on a stage and connected by separate wires with the electric lighting system of the theatre, and if the dancer wears shoes with metal heels and these heels are connected by insulated wires with electric lamps arranged artistically about the body, it is easy enough to understand that if one stands upon the plates the lamps will burn.
>
> (…)
>
> Few persons who have seen such a dancer realize just how the electric effect is brought about or exactly what risks the dancer runs… If ten or twenty lamps were placed about the dancer's person, a big flash of electricity would come from under her feet every time the contact was made or broken. Then, if there were any electricians in the audience, they would realize that twenty lamps needed fully two horsepower of electric current to make them burn, and they would applaud loudly in admiration of a woman who would suffer such an amount of current to be conducted about her body (quoted in Sperling 2006: 1).

The intrinsic movement limitations of this system pushed Leyton to explore the use of voltaic piles, allowing the dancer to carry big pieces of batteries in her costume, hidden in her hat or around her hips. But the capacity of these electrical cells was just enough to light up few small bulbs and therefore the desired effect was not achieved. The large amount of wires, the insulation system,[26] and the necessary tubes for the safety of the performer, limited the dancer's movement. The performer has to constantly keep both feet on the floor to avoid electrical cut-offs or carry heavy devices hidden in the garments determining a dance basically based on arm movement, avoiding jumps or leg kicking, creating a contrary effect to the expected sense of ethereality and weightlessness. The evident and perturbing mechanism behind the dancer's costumes in conjunction with the obvious limitation of movement constantly broke the illusion of an ephemeral "electric dancer". This resulted in a show that was usually categorised as "superlatively ridiculous" and "positively funny" (Sperling 2006: 6).

[26] Marie Leyton was actually covered by a natural rubber suit in order to protect herself from any electrical shock during the performance.

Fuller's and Leyton's performances not only unfold the idea of a live performer playing the role of an "electric woman" on stage, a concept that until the late nineteenth century was restricted to science fiction novels, but they also embody the idea that a live technical display – in this case, an illuminated woman who serves as a sort of "electrical conduit" – might be considered as a technical exhibition, a technological rarity like the amusement park, the zoopraxiscope, or the roller coaster were before. What is relevant for this research is a double issue concerning the relationship between movement and technology: on the one hand, the complex adaptation of technological devices – like the development of small size batteries, insulated wire systems, stage design, and colour lighting and projections – in a time when the technological developments were clearly inadequate to achieve all the expectations of the performer. And on the other hand, the adaptation of movement and dance styles in order to accomplish a multicolour luminous spectacle as part of a complex social and cultural technological transformation.

At the end of the nineteenth century, the parallel between light-emitting performance, like Marey Leyton's electric dance, and light-reflection performance in the case of Loïe Fuller, set up what Sperling assertively calls a "light-and-motion" spectacle. In these cases, the performer manipulate her own image through the agency of technology in both a fully conductive body and the moving screen projection that creates a luminous illusion.

> The fact that Fuller favoured light-reflection over light-emission in performance makes complete sense on both an aesthetic and technical level. Given the era's technological limitations, 'reflected' light offered infinitely more sophisticated and iridescent possibilities, while posing none of the inherent awkwardness involved with trying to carry bulky electrical equipment and dance at the same time in a graceful and fairy-like manner (*ibid.*, 3).

Fuller's conceptual visual effects made by polychromatic lighting and endless moving silk create a frame for the body, a new way in which the body is presented in the cultural domain, based on scientific and design explorations. Fuller not only achieves the first utilisation of black-out on stage, or the creation of optical illusions, refusing to buy pre-made effects offered by magic lantern factories,[27] but creates a whole

[27] "Angel, Butterfly, Demon, Dragon, Dove, Fairy, Flags (All Nations), Flowers (Rose, Lily, etc.), Lighting Flashes, Owl and Bats in Sky, Peacock with Tail Spread, Portraits

complex scenario. It was a motion scene made out of still images and colours projected into moving screens carefully attached to her body. Under the cover of big skirts, colourful lights and visual effects, it was not possible to recognise the persona behind the garments. No specific training was required; every dancer could perform a serpentine dance and therefore, the spectacle was not focused on physical virtuosity, but on the idea of movement that arises from a technical set up of lights and garments. This questions core ideas of a dancer on stage through a whole visual setting where the dancers are part of a mechanism accommodating their movements to a final visual illusion.

> One of Fuller's critics noted that 'the best proof of the Serpentine Dance lay in the fact that within a week of its first production every farce-comedy company in the land has a shapely young woman reproducing it' (Sperling 2001: 5).

This whole process of scenic experimentation involves a strict study of the capacities of a human body as an *electrical performer*, understood as another element on stage that needs to be technically measured, adapted and subjected to investigations in order to understand its technical possibilities and limits. This process of efficiency measurements – body capacities in relation to technical limitations – leads to the development of a completely new understanding of the physical and organic, and of new possibilities for the design of garments and theatres structures, based on the observation and analysis of a dancer's performance. This segmentation of production and standardisation of methods, including the use of lighting, gases, salts and other techniques, becomes an instrumentation of the stage, and a systematic analysis of movement possibilities. In this sense, Marey's decompositions of motion into a temporal coordinate system in order to understand workers' pauses, movements, and postures, can be paralleled to Fuller's technical approach and understanding of stage design. Fuller's approach to new technologies and the analysis of dancers' gestures turned into a standardised understanding of the relationship between a technical and electrical stage design and body capacities, fundamentally transforming the execution

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(Washington, etc.), Plaid Design, Rainbow, Sheaf of Wheat, Spider in Web, Snake, Sky with Stars, Sunburst, Witch in Sky." These are some of the Magic Lantern slides offered for Skirt Dancing Effects in the T. H. McAllister's Catalogue from 1900s. Quoted in Jody Sperling's Loïe Fuller and the Magic-Lantern (2000, Dancing in the Millennium Conference, Washington, DC).

of dance within music hall spectacle. It is specifically this co-relationship between a dancing body and its complex technical surrounding that allowed the emergence of a new specific aesthetic at the turn of the century.

Hence, the same adaptation to new technical devices in workplaces, which set up the necessity to train bodies for the performance of specific tasks in routinised labouring days, can be understood through music hall spectacle. The new order of corporeality required by time-and-motion studies, the strict analysis of the capacities of the worker-body, and the division of the productive process in abstract sections, turn into a mass of abstract workers: workers that must execute specific tasks in determined times, workers who are tethered to the apparatus they run and should accommodate to mechanical rhythms. Within music hall exhibitions, this homologous process of abstraction is strictly related to the achievement of a final aesthetical product, a visual product that has been developed under a strict analysis of human body capacities and the necessary technical set up, thus aesthetically recreating a modern idea of progress, firmly based on technological discoveries and motion, in correspondence with visual effects, in a "very *fin-de-siècle* tendency to turn the stage into a laboratory or vitrine" (Garelick 2007: 51).

The abstract worker of Taylorism corresponds to the abstract performer of the serpentine dance in a conceptualisation of movement based on scientific discoveries. This process opens a series of possibilities on workplaces and on stage, while simultaneously determining specific movement patterns for both artistic and work performance: movements that have no meaning in themselves, unless placed in an significant appropriate context. In the particular case of Loïe Fuller's and Marie Leyton's performances, the achievement of a highly technical stage design dominates the gaze of the audience in an unusual display of technology, where movements are determined by a specific technical set up. It is this disciplining of the body for production that configures all spheres of modern life, creating patterns suitable for specific performances, derived from scientific discoveries, and applied to body training. It is a process profoundly based on the modern idea that machines in addition to human bodies – human labour – must produce goods that are displayable, accessible and consumable, thus promoting the utilisation of technical apparatuses and technological display within entertaining and artistic practices in order to establish and transmit ideas on production and progress.

The process in which photography and pre-cinematic experiments were utilised by Taylor's time-and-motion studies can be considered in strict relation to the serpentine dancer's insertion of still images and light effects. The same techniques developed by Étienne-Jules Marey and applied for the development of Taylor's analysis are now present in Fuller's and Leyton's optical illusions; a totally new understanding of the images of the moving-body and the quantification of body movements for the systematisation of art performances. Loïe Fuller graphically describes her first experiments with light and drapery in front of a mirror in the following way:

> The strong rays of the morning dun streamed through the window playing in the folds of the fabric, making it transparent… I shook the silk and saw a thousand movements unknown up to that moment… I found that every movement of my body caused a combination of folds in the drapery, a certain shimmering of the silk which could be mathematically and systematically foreseen… I obtained the effect of a spiral by holding my arms in the air while turning on myself first to the right and then to the left, and going over the movement until the spiral design was established. Head, hands, and feet followed the swaying of my body and the movements of the robe… I studied each separate movement and finished by counting a dozen. The first required a blue light, the second a red and the third a yellow. For the purpose of illuminating my dances I imagined a projector with a colored glass in front of the lens, but the last of the series I decided to execute with one ray of yellow light crossing the back of the stage (Fuller quoted in Sommer 1975: 56).

Consequently, the specific and mathematical language used by Fuller to describe her experiments, confirm the idea that the main operations and concepts involved in both contexts establish a link: an apparatus of social transformation derived from technological developments. A whole harmonisation of body movements in relation to machines became an adaptation to new rhythms and new optical illusions, where the dancer – as the worker did for Taylorism – needs to adapt to the possibilities of the machine.

The systematisation of movement and the extreme forms of rationalisation applied to industrial labour appear here to be similar to the systematisation of movement for electric dances. Within performing arts, the immense technical apparatus not only determined the size and shape of the heavy costumes (the machinery), but also the particular style of movement (the performance). Parallel to this, the application of various techniques for the measurement of body's capacities (the machinery), under Taylor's productive perspective, determined the movements of the worker within

industries and work environments (the performance). This whole economic, social, and labour model started to change, regulated by a combination of scientific aspects, building up the idea of a pure performatic body: a worker body, a dancer body that fully responds to an economy of gesture and energy.

It is exactly this double-sided adaptation between movement style and appearance of technical devices which provides the ground for the key questions throughout this research. This process of a complementary adjustment to technical development can be analysed from a work-science perspective and then applied to performance art and entertainment culture.

Chapter 2

Dynamic Assembly Lines: Fordism and Mass Ornament

> We are on the extreme promontory of the centuries! What is the use of looking behind at the moment when we must open the mysterious shutters of the impossible? Time and Space died yesterday. We are already living in the absolute, since we have already created eternal, omnipresent speed (Marinetti 1909: n.p.).

Speed

As I outlined in the first chapter, the process of adaptation to new rhythmic parameters of production, entertainment and socialisation during the late nineteenth century created new perceptions for the idea of motion. Consequently, during the early twentieth century this process became a fast adjustment to speed increment imposed by constant technological developments. This transformation of the productive model and the new technical innovations determined a new social understanding of time and space.

The continuous upgrading of motorcars, trains, and communication systems, in conjunction with more complex machineries on the work floor generated a sense of dynamism, modifying the modern experience of speed and velocity. The common idea of disciplining the body for production and harmonising the body to the pace of the machine, in a rhythmic ideal, was now pushed toward the possible – and impossible – limits of velocity. The constant transformations on the work floor tended toward the increment of velocity leading to a new paradigm of quick production and fast consumption: workers that needed to produce faster and consume faster. More than ever they formed part of a crescendo culture of staccato movements, with extended labouring hours, and strictly determined social and resting times.

A series of technical implementations, such as airplane flights, underground metro lines, passenger-carrying trams, and an increasing amount of speed-cars on the streets, built up a new perspective on dynamism and velocity, which embedded a social sense of non-stoppable movement. This whole landscape enthralled several avant-garde groups and filmmakers, which became interested in notions of speed in relation to technological innovations. Among these, Dziga Vertov's *Man with a Movie Camera*, (1929) offered a visual concerto, a montage sequence of fast movement of streetcars, automobiles, bicycles, and pedestrians, depicting the speed and intensity of modern rhythm and circulation.

Vertov considered film as a technological continuum within industrial society. This allows us to understand his montage as the organisation of fragments (the shots) into a final object (the film). In this way, *Man with a Movie Camera* elucidates ideas of rationalisation, standardisation and fragmentation of the industrial production. An

extension of the modern assemblage processes presented in the medium of film, a condition for production in modern life. This means that the montage can be perceived as a site for the visual harmonisation between human beings and machines through repetition and the rhythmic speeds of the editing. The hard cuts and juxtaposition of images suggest film as an appropriate medium for the capturing of a particular experience of modernity as the overtaking of organic rhythms.

> WE find the soul of machinery, we love the worker sitting at his table, we love the farmer on his tractor, the engineer in his train.
> WE cause the joy of creation in all mechanical activities
> WE make peace between man and the machine
> WE train the new man (Vertov 1925: n.p.).

Fig 2.1 Still from Dziga Vertov's film *Man with a Movie Camera*, (1929). Image from http://whitecitycinema.com/

The appropriation of these modern concepts involved a redefinition of creative parameters. Within this context, the Italian Futurist Movement was specifically concerned with these new concepts as a way of rejecting the past and embracing new ideas of speed, noise, and machinery. The Futurists integrated a variety of artistic disciplines and techniques in order to break with a traditional conceptualisation of art. Therefore, Futurist artefacts – such as toys or the *intonarumori* – in conjunction with

their several manifestos, enfolded the idea of art based on technological developments, inspired by technical devices, mechanical movement, and gear noises. The discovery of the essential laws of speed, energy and mechanical engines; the idea of dynamism as trajectory; and the emphasis on modern velocity are specifically stated in F. T. Marinetti's (1876 – 1944) first Futurist Manifesto.

> We declare that the splendour of the world has been enriched by a new beauty: the beauty of speed. A racing automobile with its bonnet adorned with great tubes like serpents with explosive breath... a roaring motor car which seems to run on machine-gun fire, is more beautiful than the Victory of Samothrace (Marinetti 1909: n.p.).

It is specifically this background of fast technical adaptations that will serve as a base for the development of this second chapter. In order to create a specific link between technical development for labour and technological development in cinema, dance, and performing art creation, I will present some relevant concepts involved in the reorganisation of workplaces, specifically inside the Ford automobile company. Subsequently, I will apply them in the analysis of the entertainment culture, film industry, and the performance of the chorus girls since the beginning of the twentieth century.

Mass Production

The appearances of this new condition of speed increment through technical developments allow us to understand the social perception of a massive change of paradigm. The studies realised by F.W. Taylor focusing on time-and-motion, worker movement efficiency, the development of technical apparatuses for the measurement of worker bodies and performance, in addition to the mechanisation of the work floor, generated a huge transformation. This new rearrangement not only affected the production systems or the new requirements for workers but determined a whole new culture based on speed increment, motorisation of the urban spaces, mass production and mass consumption.

The constantly increasing need for production, in relation to new technological developments, turns into a system that needs to operate 24 hours a day. The maximisation of working speed and the increment in transport velocity, in addition to the introduction of motors in every single aspect of production, produced a many-folded phenomenon. A series of organisational management concepts were needed in order to re-organise human labour around the machine. The minimisation of the workers' movements took Taylor's ideas on efficiency and fatigue to an extreme, restructuring the production chain under a systematic arrangement around production flow.

What for Taylorism was an original utilisation of mechanical tools in coordination with a new rhythm of work, derived into a massive increment of speed of production directly determined by the introduction of the conveyor belt. This is the world presented in early films from the 1930s, such as *Modern Times* (Chaplin, 1936), where Charles Chaplin, as "The Little Tramp", frantically has to adapt to faster-than-human movements of the production line, performing repetitive tasks on a continuous flow made possible by the steam engine and the motorisation of factories. The iconic embodiment of Charles Chaplin tangled in giant gear amid the Great Depression, depicts the idea of men as machines or machines absorbing workers into strenuous working hours of repetitive and monotonous movement patterns.

Therefore, it can be said that electric motor efficiency enabled modern ideas of mass production, the manufacturing of everyday items, the raise of wages, and the increase of consumption: a process of standardisation and massification of products that creates identical needs to be satisfied with identical goods. While Taylor mainly focuses on the efficiency of the workers' movement, endorsed by technical devices, the new re-organisation of the work floor focuses on machine efficiency, where the worker only needs to adapt to its speed in a flow of highly precision work. Hence, mass production refers to the manufacture of large amounts of standardised goods and the utilisation of moving tracks where the production process moves in front of the worker. This process was firmly based on the idea of interchangeable parts, motor-powered tools and extensive distribution of electricity.

Fordism

> We are not living in a machine age, we are living in the power age (Ford 1991: 141).
>
> 'Railroad tracks', with the peculiar and unmistakable dream world that attaches to them, are a very impressive example of just how great the natural symbolic power of technological innovation can be (Benjamin 1999: 156).

Based on Taylorist time-and-motion analysis and several studies on movement and efficiency, an updated working system was developed by Henry Ford, thus determining a new kind of organisation of the whole productive structure. Based on space, time, and movement reorganisation, factories needed to be an un-stoppable machine that runs the times for production and human labour through the implementation of an automatic system independent of the workman.

Henry Ford (1863 – 1947) was an engineer at Edison Illuminating Company, a position that enabled him to develop his own personal experiments on the construction of motors and engines – even contrary to Thomas Alva Edison's ideas on electrical development rather than gas-based motors. In 1903, with the help of several investors, Ford founded the Ford Motor Company based in Detroit, where the organisation of the industry allowed him to produce few cars per day built by small groups of operators that worked on each car.

> In our first assembling we simply started to put a car together at a spot on the floor and workmen brought to it the parts as they were needed in exactly the same way that one builds a house. (…) The undirected worker spends more of his time walking about for materials and tools than he does in working; he gets small pay because pedestrianism is not a highly paid line (Ford 1922: 57-58).

The inefficiency involved in this system, the necessity to order the components from other factories, and the waste of time in carrying pieces, led Ford to re-think the organisation of the productive system. Therefore, within the first year the Company developed the Model A and through press advertisement of that time we can understand some of the core aims within Ford Motor Company.

> Our purpose is to construct and market an automobile specially designed for everyday wear and tear – business, professional, and family use; an automobile which will attain to a sufficient speed to satisfy the average person without acquiring any of those breakneck velocities which are so universally condemned; a machine which will be admired by man, woman, and child alike for its compactness, its simplicity, its safety, its all-around convenience, and – last but not least – its exceedingly reasonable price, which places it within the reach of many thousands who could not think of paying the comparatively fabulous prices asked for most machines (Ford 1922: 39).

Ford's main ideas on large-scale production and the decrease of products' price led to a re-organisation of the factory floor based on a purely technical division of work. His application of Taylor's *Scientific Management* to improve efficiency and workflow in the productive process, in addition to the increment of machinery, the design of mechanical tools, the use of electricity, and motor-powered devices, allowed the implementation of a new organisation based on interchangeable parts. Henry Ford explored Taylor's ideas on effort and efficiency, but applied them to both workmen and machinery as the main rhythmic device within the manufacturing process.

Fig 2.2 Workers on a flywheel assembly line at the Ford Motor Company's Highland Park, Michigan. Image from http://www.ford.co.uk/FordInnovation/Heritage/EvolutionOfMassProduction, 1918.

> The first step forward in assembly came when we began taking the work to the men instead of the men to the work. We now have two general principles in all operations – that a man shall never have to take more than one step, if possible it can be avoided, and that no man need ever stop over (Ford 1922: 58).

The moving assembly line basically consists in a progressive chain and optimal logistics to improve handcrafting methods. It was developed between 1908 and 1915 and it is considered, until now, one of the main methods for large-scale production and management.

> The principles of assembly are:
>
> (1) Place the tools and the men in the sequence of the operations so that each component part shall travel the least possible distance while in the process of finishing.
> (2) Use work slides or some other form of carrier so that when a workman completes his operation, he drops the part always in the same place – which place must always be the most convenient place to his hand – and if possible have gravity carry the part to the next workman for his operation.
> (3) Use sliding assembling lines by which the parts to be assembled are delivered at convenient distances.
>
> The next result of the application of these principles is the reduction of the necessity for thought on the part of the worker and the reduction of his movements to a minimum. He does as nearly as possible only one thing with only one movement (Ford 1922: 58).

The constantly moving conveyor belt set up a new rate of motion for production, determining a new labour organisation based on the speed of the machine. The process of accommodation to possible velocities was basically regulated by the speed of the machine but conditioned by the preservation – and increment – of the quality of production, and the capability of the worker to follow its pace. "One of the most important problems, therefore, which the owner of a factory has to solve is to find out the maximum speed at which he can run" (Marx 1867: 452).

The modern idea that machines were an un-stoppable dynamic source of production, in addition to artificial light, extended not just the length of the working-day, but allowed workers to not be tied up to seasonal work. Within this period, a worker's schedule ran between twelve to sixteen hours per day, six or seven days per week. Henry Ford implemented a system of 40-hour-work-week, encouraging working shifts. He had realised that the shortening of working time per person induces an increment on productivity, while the increment of leisure time increases the time for

consumption. It is in this context that the reduction of the labouring hours created what Marx describes as the "subjective conditions for the condensation of labour" (Marx 1867: 450). Therefore a new adaptation of the rhythm of production was achieved, "squeezing out more labour in a given time. This is effected in two ways: by increasing the speed of machinery, and by giving the workman more machinery to tend" (Marx 1867: 450). For factory owners it was ideal to accept young workers (commonly children) that could be quickly moulded to the new productive rhythm and therefore could be better trained under these new requirements.

> To work at a machine, the workman should be taught from childhood, in order that he may learn to adapt his own movements to the uniform and unceasing motion of an automaton. When the machinery, as a whole, forms a system of manifold machines, working simultaneously and in concert, the co-operation based upon it, requires the distribution of various groups of workmen among the different kinds of machines. But the employment of machinery does away with the necessity of crystallising this distribution after the manner of Manufacture, by the constant annexation of a particular man to a particular function (Marx 1867: 38).

This process of compensating hours of labour by heightening its intensity can be analysed from different perspectives. What is relevant for this research is the idea that the work pace does not proceed from the workman, but from the machinery, and that any worker without any specific skills can be trained to perform repetitive movements. It became necessary that the workers adapted to the pace of the machine in an even more arduous way than in Taylorism. This is due to the hyper mechanisation of factories and a life-long speciality that converts the worker into "a part" of the machine, following its specific movements and becoming a mere appendage of it. "In handicrafts and manufacture, the workman makes use of a tool, in the factory, the machine makes use of him" (Marx 1867: 461). It is not anymore the worker who employs the tools for labouring, but the instrument that employs the workman in an increasing labouring rhythm.

Another main aspect of the Fordist systematisation is the separation of the intellectual powers from the manual work. This is an idea that was also present in Taylor's transference of the specific knowledge from the workers to managers, designers and work coordinators. Now, within Fordist systematisation, this gap grows bigger in order to subordinate the worker to the monotonous motion of the conveyor belt. Henry Ford divided workpeople into those who will operate the

machine – the operatives – and those who will inspect the operators – the overlookers: a process of training bodies for both, the specific rhythm and the performance of the specific task required by the dynamic assembly lines under the constant surveillance of the managers. The work floor was more than ever an immense automaton constituted by mechanical elements and intellectual parts that work together in the production of common objects: a structure that it is inherent to a self-regulated moving motor. For Marx "the automaton itself is the subject, and the workmen are merely conscious organs, co-ordinate with the unconscious organs of the automaton, and together with them, subordinated to the central moving-power" (Marx 1867: 458). This process is characteristic of the modern factory systematisation and the implementation of machinery in a large scale for production, where the worker is immersed and redefined as an amalgamated productive element.

From the organisational point of view, it is relevant to explain that this specific setup creates a code, a discipline, a language that has to suit the necessities of the factory. Ford's ideas on labour management presented a new way of looking at organisation within factories where the information moves in a hierarchical way.

> New forms of control within factories were also introduced, following the pandemonic imperative to promote environments of local intelligence over the Fordist and Taylorist citadels of global information control. While Ford and Taylor were instrumental in abstracting the labour process, the 'rationalism' of their modes of control led them to analyze the problem of labour in a sense analogous to the dictates of a central processing unit; that is, both analyzed and imposed solutions from above (Hookway 1999: 55).

In this quote from *Pandemonium, The Rise of Predatory Locales in the Postwar World,* Branden Hookway presents a parallel between architectural design and factory organisation. For Hookway, Fordist industries are organised as citadels, with a main central processing unit, the managers, that control the performance of the whole factory. This means that Ford designed a pyramid organisational structure, where the flow of information moves up and down the corporate hierarchy and, as it goes down this hierarchy, finds less room for autonomous decisions. It is a dispositional system that required an absolute control and a fixed communicational system for its best performance. Therefore, it can be said that distributed bodies and organised mass corporealities were well structured in terms of a scientific matrix that has striven for a

rigorous study of these bodies and their productive functions. By measuring and taking averages, a whole study was conducted in relation to movement, space, behaviour and social aspects. This gives room for reflection regarding the way of looking at the body, its relationship to technological rationalisation, and its functions.

Hookway, in another assertive article "Cockpit" [28], presents a specific analysis of how intellectual and physical capacity measurements were developed during the Second World War – and then applied for social, economical and educational purposes – in order to achieve an "even-more-tightly calibrated feedback loops between man and machine" (Hookway 2004: 26). Scientists who contributed to the war effort recognised that the work done during the war period could be applied to industry and to society in general. One of the most relevant tools within the context of organisational behaviour was the General Aptitude Test, consisting in separating personnel firstly by segregating illiterates, and then dividing the literates in five groups according to the best suitable characteristics for leadership. Roughly this system created a division between "'mass work,' pertaining to the organisation of personnel, and 'analytic work,' involving man-machine interaction" (Hookway 2004: 27).

> If for the state of war we can measure roughly the intelligence of a third of a million soldiers a month, and find it profitable to do so, can we not each year measure the intelligence of every child coming ten years of age, and will that not be still more profitable? (Thorndike 1919: 54).

The same analytical tools for intelligence measurement that were being applied for soldiers during the Second World War were now available for being applied to ten year old school children. The next logical step for the development of a large-scale management project in industries was to implement these tests to workers in order to achieve a successful organisation structure based on the workman's capacities. It is necessary to highlight that the result of this testing only makes sense in the context – and as a part – of an extended organisation of behaviour and the systematic use of capacities. This process of segregation of personnel in different social areas provides

[28] Branden Hookway, "Cockpit" in: *Cold War Hothouses: Inventing Postwar Culture, From Cockpit to Playboy,* ed. B. Colomina, A. Brennan and J. Kim (New York: Princeton Architectural Press, 2004), pp 22 – 54.

an effective description of individual qualifications regulated by a simple parameter: intelligence as a quantifiable attribute.

> The advertisement is impressive. If it were true, the emotional and the worldly satisfactions in store for the intelligence tester would be very great. If he were really measuring intelligence, and if intelligence were a fixed hereditary quantity, it would be for him to say not only where to place each child in school, but also which children should go to high school, which to college, which into the professions, which into the manual trades and common labour (Lippmann 1922: 9-11).

This new organisational system was developed in a tight relationship within specific scientific and technological developments of the time. What, for Taylorism, was a concern in relation to human movement, economy of gesture, and time-and-motion studies, in strict relation to new scientific concepts and photographic technologies; for Fordism it was an issue of production line and a complete reformulation of the industrial plant in relation to motor development and improved transportation systems. Hence, for Fordist organisation, the distribution system corresponds to a specific technological development: the flow of information was based on communicational technologies like the telegraph and the telephone, while expanded railways fundamentally determined the distribution of goods and raw materials for factories and consumption. It became evident that one of the major problems faced by Fordism was neither the new labour rationalisation nor the timesaving mechanical technologies, but the lack of flexibility to accommodate organisational structures to new technologies that were becoming available. This is exactly what Jeremy Rifkin – an American economist, writer and political advisor – exposes in his book *The End of Work: The Decline of the Global Labor Force and the Dawn of the Post-market Era* when he says "it simply isn't good enough to spend money on new technology and then use it in old ways" (Rifkin 1995: 92).

> Foucault has brilliantly analyzed the ideal project of these environments of enclosure, particularly visible within the factory: to concentrate; to distribute in space; to order in time; to compose a productive force within the dimension of space-time whose effect will be greater than the sum of its component forces (Deleuze 1990: n.p.).

Within Fordist chain systematisation, mass production meant a huge increase in efficiency and profits, based on the division of work into simple and routinised movements for the mass production of goods. Accordingly, it can be said that Ford developed a new political and spatial organisation for work, bodies and workplaces in a linear and highly hierarchical pyramid structure. Instructions, doctrines, space division, distinction between experts and laymen, serialisation and regulated times: bodies were getting used to perform specific tasks involved in a process of mass serialisation and cultural adaptation. "Mass production, mass consumption, mass society. Never before in human history such a wide proportion of population had had access to relatively comfortable living standards" (Pérez 2008: 157, my translation). Nevertheless, Fordist industries were animated by a profound tension between industrial working style and cultural ways of regulation. On the one hand prevailed the world of work, which occupied most of the everyday time with mechanical and abstract routines and serialised bureaucracy, requiring a rigorous discipline of the body. And on the other hand, the mass standardisation of goods and services, the creation of mass necessities for higher consumption by the media and the entertainment culture, and their ideas on reproduction, not only depicted but created a whole new paradigm. Henry Ford fully understood the necessary connections between the production of goods and their presentation on the media. In order to achieve a successful economical process, he created a parallel publicity machine in Detroit, ensuring that every newspaper integrated stories about new Ford products. Hence, when in October of 1908 the Ford Motors Company introduced the first Model T, it was also published as a new necessary product.

After the 1920s, the substantive increase in profits and the massive governmental intervention allowed the establishment of contractual arrangements, making possible a progressive increment in real wages. The main targets for consumption were the same workers. Direct wage increment in addition to indirect wage supplements – such as pension funds, state investment in health and education, and massive access to culture through new media – enabled the beginning of a new phenomenon in human history: mass consumption. This meant that the massive introduction of cars, accompanied by a high sense of publicity, illustrated the process of establishment of a brand-new social pattern of consumption. For Bob Jessop – a British academic of Lancaster University who has extensively

written on political economy – Fordism can be understood, in the first place, as a *mass production* system, founded on moving assembly-line techniques that create a mass of semi-skilled workers. Secondly, Fordism can be thought of as a *mode of regulation* based on centralised control and organisation, separating – as in Taylorism – managers and designers from mass workers, creating a mode of social and economic regulation firmly connected to productivity growth. Thirdly, it can be thought as a *regime of accumulation*, not only of products and commodities but also of equipment, techniques and especially mass demand. And finally, Fordism can be seen as a *pattern for social organisation*, determining standardised consumption, worker behaviour and capacities, production of goods, and services.[29]

Fig 2.3 Poster advertising payment plans for Ford Model T (1925). Image from http://collections.thehenryford.org/Collection.aspx?objectKey=149966

[29] For more information on this analysis, see Bob Jessop. *State Theory: Putting Capitalist States in their Place* (Philadelphia: Pennsylvania State University Press, 1990)

In the socio-political sphere many thinkers and philosophers tend to link technological development and means of production with different social phases. The tabulation of this epoch under a certain periodisation helps us to understand this phenomenon from the perspective of a massive social and cultural transformation: for Ernest Mandel – a German Marxist theorist – this period is considered as the beginning of a Late Capitalism specially focusing on the idea of mass production and mass consumption; Friedrich Kittler – a German media theorist – in his book *Discourse Networks, 1800/1900*, presents a more general categorisation, situating this period within the "kingdom of pattern", highly based on images, mathematical concepts, and networks of distribution; and Fredric Jameson – an American Marxist theorist and literary critic – like other social writers of the late twentieth-century, explains that the term Late Capitalism has been coined within the Frankfurt School, widely expanding to social critics.[30]

Within this context, it seems particularly relevant to mention the connection Gilles Deleuze's draws between different social stages and their inherent machinic technologies. In his 1990's interview with Antonio Negri, Deleuze suggests that "[e]ach kind of society corresponds to a particular kind of machine" (Deleuze 1990: 175), and later on, in his article "Postscript on the Societies of Control", he explains how disciplinary societies were analysed by Michel Foucault, stating that "[t]ypes of machines are easily matched with each type of society – not that machines are determining, but because they express those social forms capable of generating them and using them… The old societies of sovereignty made use of simple machines--levers, pulleys, clicks; but recent disciplinary societies were equipped with thermodynamic machines" (Deleuze 1990: n.p.).

Therefore, what I am trying to elucidate here is a general understanding of a period that marked a specific behaviour pattern affecting several aspects of social and private life. The massive cultural transformation in the work-floor and the fast adaptation to new rhythms of production and consumption have had several implications over the set up of a new way of approaching goods, distribution, speed, social spaces and, of

[30] Some relevant readings on this idea are Bernstein's *The Frankfurt School: Critical Assessments;* Mandel's *Late Capitalism*; and Kittler's *Discourse Networks, 1800/1900*.

course, the ideas that surround the body and the necessity of specific training for the achievement of appropriate conducts and productive levels.

Movement Pattern Analysis

> The tendency of our age to replace human-power by machine-power represents one side of the problem of the economy of human effort. The other side is the rational use of human-power where it is still employed in industry (Laban 1947: 8).

Hillel Schwartz, in his article mentioned in the first chapter of this thesis, "Torque: The New Kinaesthetic of the Twentieth Century", presents an interesting argument about the correlation between photographic techniques, early movies and modern dancers, drawing connections between "industrial time-and-motion experts and scientific physiologists" (Schwartz 1992: 101). From the late nineteenth century to the 1930s modern dance propagation, the combination between physiological approaches, dance styles and methods, physical education, and new technologies applied to the study of the body, redefined a physical manner by which one can expect to *read* bodies' postures and movements. Henceforth, rather than elaborating here a deep analysis on bodies and gestures as a complex phenomenon since the nineteenth century – an extensive examination that should certainly include Giorgio Agamben's perspective on the "bourgeois gesture", Andrew Hewitt's readings of "social choreography", Pasi Väliaho perspective on gestures and automata, and so on[31] – I would simply focus on gestures in relation to a new kineasthetic approach to efficiency and productivity, and the way cinema, physical pedagogy, and entertainment culture developed a social sense of body culture from a variety of perspectives.

[31] Relevant literature on movement study and gesture include: Giorgio Agamben, *Infancy and history: the destruction of experience* (London: Verso, 1978); Pasi Väliaho, *Mapping the Moving Image: Gesture, Thought and Cinema Circa 1900*, 2010 (Amsterdam: Amsterdam University Press, 2010); Andrew Hewitt, *Social Choreography: Ideology as Performance in Dance and Everyday Life* (Durham and London: Duke University Press, 2005).

For Schwartz, "motion pictures as technology were a metaphor for the new kinaesthetic's concern with fluid motion along a natural path, motion pictures as theatre were literally instrumental in re-educating old and young alike in posture, gesture and gracious or efficacious movement" (Schwartz 1992: 101). Within this context is necessary to understand that this "new kinaesthetic" refers, not merely to a discursive approach to body movements and gestures within modern society; but to a bigger transformation of the way movement has been historically perceived, analysed and understood within socio-cultural realms. The key role of cinema will be explained in the second part of this chapter: "The Heart Machine (Film Approach)", as one of the main forms utilised to visually spread new ideas and perspectives around body-culture.

The rise of a new "culture of the body", where "[c]hanges took place in every branch of dance: dance pedagogy, children's dance, dance therapy, the so-called artistic lay dance, concert or podium dance" (Karina 2003: 13), encompassed an explosion of a variety of techniques for physical education, dance, gymnastic and pedagogy in a wide sense. At the turn of the century, most of the ideas on movement education were based on the searching for a natural, organic rhythm that compensates the hyper-technicality of modern life.

> Over the next century, between 1840 and 1940, children and adults alike would slowly be rehearsed into a habit of gesturing and a repertoire of 'streamlined' gestures central to the new kinaesthetic – clean, fluid, curvilinear gestures moving from the center of the body outward through uninterrupted but muscularly well-controlled rhythmic impulses (Schwartz 1992: 91).

One of the main icons of music and drama exploration within the nineteenth century was the French teacher François Delsarte (1811 –1871). His methods were widely disseminated in Europe and United States by modern dancers such as Isadora Duncan (1877 – 1927), Ted Shawn (1891 - 1972) and Rudolf von Laban (1879-1958), amongst others. One of his main assistants, Steele MacKaye (1842 - 1894), developed a series of Delsartean exercises – known as Harmonic Gymnastics – to train and discipline the body under the idea that movements serve as a reflection of inner states. In the same context, the Swiss composer Émile Jaques-Dalcroze (1865 – 1950) developed a technique called Eurhythmics, a method for experiencing music and

rhythm through movement, specifically used in therapy and music education in schools. Following Dalcroze training, Rudolf Bode (1881 – 1971) a German teacher of physical education who later on became a participant in the National Socialism, created the Bode-School for rhythmic gymnastics in Munich in 1911, later becoming a leading figure of physical education in Germany. In his study *Rhythm and Bodily Education* (1925), Bode described technology as a suppressor of a primal rhythmic strength, explaining modernisation as a process of "derhythmification" where only Eurhythmics could liberate the natural body rhythms.[32]

On the other hand, during the 1920s, the work of the Russian actor and theatre director Vsevolod Meyerhold introduces a system for training actors that integrates Taylorist approach of the body as a machine, "seeking to train not only the performers but a new human of the future – what the Constructivists labelled *life-construction*" (Salter 2010: 232). Meyerhold's work articulates constructivist's ideas and mechanical principles for acting and experimenting acrobatics, gymnastics and circus movements on stage developing a geometrical pattern of movement that includes rhythm techniques. The biological aspect of anatomical functions, in addition with the mechanical factors of human movement are the two main components of Biomechanics. Therefore, Biomechanics can be understood as an acting technique where the actors have no room for personal initiatives and the director carefully controls every movement and timing. This idea followed Scientific Management principles, under Lenin's understanding of Taylorism, detached from its capitalist ideas on production,[33] establishing precise analytical and scientific execution of movements with the purpose of a maximum precision through geometric movements

[32] A great amount of different theories and techniques were developed within the 1920s in Europe and specifically in Germany. For example, Rudolf Steiner (1861 – 1925), an Austrian philosopher, developed an expressive movement for therapy and education: Eurhythmy. This forms part of the Anthroposophical philosophy and search for the right balance between natural experience and expression.

[33] Slavoj Zizek, on his 2002's article states: "This repression of the regime's own excess was strictly correlative to the invention of the psychological individual that took place in the Soviet Union in the late twenties and early thirties. Russian avant-garde art of the early twenties (futurism, constructivism) not only zealously endorsed industrialization, it even endeavored to reinvent a new industrial man, one who was no longer the old man of sentimental passions and traditions but the new man who gladly accepts his role as a bolt or screw in the gigantic coordinated industrial machine. As such, it was subversive in its very ultraorthodoxy, that is, in its overidentification with the core of the official ideology: the human image that we get in Eisenstein, Meyerhold, constructivist paintings, and so on emphasizes the beauty of his or her mechanical movements, his or her thorough depsychologization" (Zizek 2002: n.p.).

and rhythms on stage.

Perhaps one of the most famous and consistent approaches to movement analysis in the early 20th century is owed to Rudolf von Laban, a dancer, choreographer, and movement theorist who developed a rigorous system for the analysis of movement, its characteristics and pathways through space. He also created a system for movement notation, the Kinetography, now known as Labanotation. Since 1930, Laban directed the Allied State Theatres from 1930 until 1936, when he was evicted from Nazi Germany[34] after the presentation of *Vom Tauwind und der Neuen Freude* (*Of the Spring Wind and the New Joy*), for not expressing the required Nazi ideology. He was forced to leave Berlin, moving to France and then England, where he joined the Jooss-Leeder School of Dance at Dartington Hall. In 1946, he founded the Art of Movement Studio in Manchester, and posteriorly the Laban Art of Movement Centre.

When Laban arrived in Manchester, he met F.C. Lawrence, an engineer, time-and-motion specialist and one of the first management consultants in Britain. Lawrence believed that time-and-motion study was a strict and close understanding of efficiency training. Therefore, and inspired by the Labanotation approach to movement observation, together they began to develop a system that focused on workers as living individuals, considering mental and emotional aspects, and the impact of work satisfaction and achievements. As a way to improve productivity, Laban and Lawrence realised the weakness of merely analytical tools for the improvement of human-mechanised production. They "recognized these various analytical tools as incomplete, as they left the individual mind and the individual need for physical, emotional, and mental variation and expression behind" (Kaylo 2007: 2).

For Laban, "[m]ovement in industrial work is only one special case where human effort and its balance becomes observable. The nervous reactions in emotion and thinking produce many movements in which the effort-habit of a person are mirrored" (Laban and Lawrence 1947: 49). Therefore, during the early 1940s, they created the Laban-Lawrence Industrial Rhythm that later led onto Personal Effort Assessment, dedicated to the analysis of movement of workers in farms and production lines, especially during the war effort. This interest in movement quality drove them to

[34] Rudolf von Laban directed the Allied State Theatres since 1930, and in 1933 Hitler was appointed Chancellor of Germany after the National Socialists won the election. Three years later Laban was forced to leave Germany.

apply concepts of Effort, Flow and Posture – which Laban had previously developed in dance – to industrial production.

> Laban's concepts of Effort, which referred to the quality of kinetic energy expended in an action, broadened the understanding of bodily contribution to task-oriented production, and provided a more accurate and developed framework for utilising movement to improve the process of production (Kaylo 2007: 2).

For Laban, efficiency was not simply based on movement reduction but on a complex equation that refers to energy expenditure, breathing training, and a rhythmic balance between relaxation and tension during the execution of specific movements. Therefore, for both Laban and Lawrence, workers' movements had to be harmonised in relation to industrial operations, in a specific timing, using the weight and flow of the body and integrating recuperative movements into the productive dynamic in order to improve physical and psychological welfare within the work-floor.

> For example, the use of flow might be utilised to overcome the weight of an object too heavy to lift; or precision and fine touch would alternate with quick and strong accents to create a more effective rhythm of exertion and recuperation, allowing the worker to continue with less fatigue and more energy available for the next task (*ibid.*, 3).

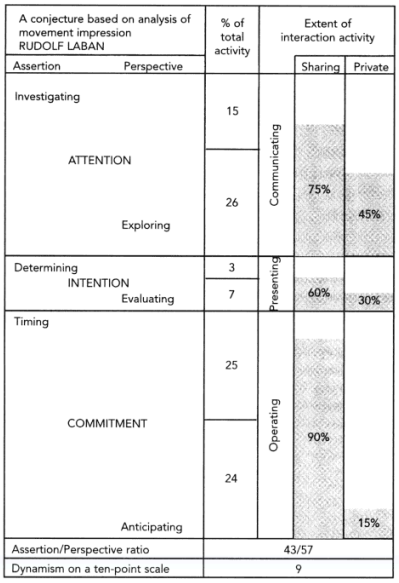

Fig 2.4 Tabular presentation of an Action Profile by Rudolf Laban, prepared by Warren Lamb. Image from Eden Davies' book *Beyond Dance: Laban's Legacy of Movement Analysis (*2006), pp. 87.

At the beginning of their collaboration, the analysis was primarily focused on physical labour. After 1947, Warren Lamb, an English pioneer in modern dance, assisted Laban and Lawrence on Effort rhythm notation within British industries. Lamb's assertive analysis on behaviour and theoretical approach to decision-making analysis led him to create an assessment technique called Action Profiling – a sort of interpretation of movement and corporeal answers into management aptitudes and decision-making. For both Taylorism and Fordism, worker emotions were considered as "a negative factor to be overcome by resistance or be pacified" but "the fact remained that emotions could be neither expunged nor transformed" (Franko 2002: 30). Therefore, emotional embodiment was considered a threat for production maximisation, and a new balance between physical capacities and emotional resistance needed to be developed through the study and analysis of workers relationship with personal, social and emotional conditions. It is within this context, that Lamb's approach shifts its focus from physical factory work to management capacities. He "clarified parameters of movement that were relevant for assessing decision making... and translated this movement into terms that could be grasped by managers and related to their practical experience" (Moore 2005: n.p.). Based on "posture-gesture mergers", he provided a disciplined and systematic analysis for the training, education, and evaluation of movement patterns in relation to decision-making. In summary, the methodology was based on the observation of six categories of behaviour:

1. Posture and Shape
2. Gesture and Shape
3. Flow of Shape
4. Posture and Effort
5. Gesture and Effort
6. Flow of Effort

By 1953, Lamb had created his own consulting company, applying Laban's theory of action sequence – attention, intention, decision, and precision – and rigorously studying movement profiles in correspondence to management aptitude. He synthesised certain aspects of thinking that are mirrored by body movements and responses, developing a consistent method that is now known as Movement Pattern Analysis: an analysis that relies on movement observation revealing unconscious non-verbal behaviour, applied to management training and assessment.

This change of perspective, from a merely physical understanding of body and effort to aspects of management and decision-making, construe the idea that factories under Fordist systematisation understood efficiency and movement in a complex way. The training for merely physical, operative movement – the operatives – was equalled to the one of the overlookers. Both manual and mental work were considered under a pattern of movement that mirrored the *inside* of the worker and gives the clues to the factory owner of where and when to place workmen within the work-floor. This was a restricted point of view on labour organisation that basically corresponds to body shapes and movement patterns; a *reading* of the person through voluntary and involuntary movements and gestures, in order to achieve a perfect coordination between managers, workers, and machines.

Therefore, It would seem that the intrinsic relationship between workers' movement efficiency training, gestures analysis, and the development of a body-culture since the early twentieth century[35] have had a massive impact in the social perception of movement from a variety of perspectives. These issues were a specific characteristic of early cinema, thus creating new relations from where to approach visual montages and films, generating a certain social understanding of motion that was part of a completely new perceptive paradigm.

It is precisely within this perspective that the second part of this chapter will focuses on a double-sided analysis of films. On one hand, I will present some ideas related to hierarchical organisation – ideas that emerge from a Fordist analysis on factories' organisation - in strict relation to the film *Metropolis* by Fritz Lang. And on the other hand, I propose to pose some questions in relation to the possibility of silent cinema to evoke the paradigms of an era where the perception of motion was completely transformed.

[35] The analysis of physical pathologies and the relevant development of prosthetic limbs and body parts within that period will not be included in this thesis. This is certainly an important aspect for the establishment of body-culture, but is not strictly related to the purpose of this research. Nevertheless, it could be an important aspect to consider for the development of a subsequent PhD research.

The Heart Machine (Film Approach)

> The working man is no longer master of his own movements. His tools no longer act as his servants, as enhanced bodily limbs. Rather, the tools now lord it over him. They dictate to him the measure of his movements. The speed and duration of his labour no longer obey his will (Bücher 1924: 460).

Traditional societies – what Foucault calls *societies of sovereignty* that made use of simple machines: levers, pulleys, clicks – had generally used tools for the implementation of an integrated rhythm between the body and the object. On the other hand, industrial societies – what Foucault describes as *disciplinary societies* regulated by watchwords, where man is a discontinuous producer of energy equipped with machines involving energy – had subordinated the body to the machine in both its rhythm and movement pattern.[36] From the perspective of film studies and montage – and focussing on movement, production, body, and tempo within industries – it can be said that "[t]he rhythms of industry had left those of the body behind" (*ibid.*, 461). Looking at early European and American cinema from the 1920s and 1930s, it is possible to find a series of examples of accelerated pace, disturbing opening sequences, machinery rhythms, superimposition of geometrical shapes, sharp cuts, turning wheels, trains, telephone lines… all depicted in fast visual symphonies.

Following what I already mentioned at the beginning of this chapter, Dziga Vertov's *Man with a Movie Camera* (1929) serves as an opening reflection about montage, documentation, acceleration and rhythmic image compositions but also introduces an idea of the body from a new deranged kinetic point of view – a body that appears in different planes, fast cuts, multitudes of people, or simple superposition of small-scaled bodies in comparison with magnified machines within a single frame. This new approach was also developed in the context of Weimar culture and German film industry from the 1920s focusing specifically on the analysis and integration of a variety of perspectives. Therefore, it can be said that the idea of hyper-mechanisation of the work-floor and the constant acceleration of life was depicted by a series of

[36] Gilles Deleuze, in his article, "Postscript on the Societies of Control." October 59 (Winter 1990), pp. 3-7, offers an interesting analysis on Foucault's ideas on *societies of sovereignty*, *disciplinary societies*, and *societies of control*, and how they became particularly visible within industrial environments, concentrating and distributing the productive force in relation to technical developments.

filmmakers from different countries, contrasting the idea of *natural* movements and *body rhythms* with images of cities, cars, machines and factories.

Within this context, another relevant example is Fernand Léger's and Dudley Murphy's *Ballet Mécanique*. This film piece from 1924 offers a juxtaposition of mechanical rhythms and human movements emphasising "the reaction of man to his mechanical environment" (Lawder 1975: 90). Repetition of movements and gestures (lips, eyes, stairs) superposition of bodies, gears and geometrical shapes, kaleidoscopic montage, superposition of images and the accelerated pace of the original music declare a state of constant speed that was being captured, and presented by painters, sculptures, filmmakers and musicians in the social domain.

Wilhelm Prager's 1925 film *Wege zu Kraft und Schönheit* (*Paths to Strength and Beauty*) depicts the urban environment in "an impressionist collage of superimposed images of hustling city traffic; and endless tracking shots showing lines of workers attached to oppressive factory machines" (Cowan 2007: 232). This montage includes images of trains and factory movements that are abruptly followed by images of a variety of physical tests for babies and children, examples of postures at schools and workplaces, finally presenting a whole section on Eurhythmics, gymnastics and dance. Hence, Prager's collage of images portrays a specific approach to body-culture in relation to technical development, where the idea "is to balance the existing [body] damage" [37]. It is particularly the development of this body-culture, in addition with the hyper-mechanisation of industries – mainly in Europe and United States – that seems to be the central point for a series of films produced at the time. Thus, they created a context for the visual exploration of ideas on body, workers, serialisation, training, alienation, technology implementation, new rhythms and visual codes.

We can find several examples of artists from different disciplines, and specifically from cinema, that grasped this new paradigm – speed increment, body rhythms, machine rhythms and body-machine relationships – and developed a language parallel to specific social changes. This obsession with machinery in addition to a new perspective of the body – its gesture and its kinetic aspects – originated substantial film works that present a counterpoint between the ideal body in a *natural state* – body-culture – and the hyper-mechanisation of social spaces. Within this context,

[37] "Der anfang aller Körper-Kultur ist es, die vorhandenen Schäden auszugleichen"

Walter Ruttmann's 1927 film *Berlin: Die Sinfonie der Großstadt* (*Berlin: The Symphony of a Great City*), presents a particular analysis on the idea of rhythmic acceleration, speed and the limits of the body. The film starts with a train trip to Berlin, and in the following scenes rhythms of mechanical repetition are mirrored in human movement presented as fast-montage sequences. Series of typists and telephone operators, close-up scenes of the legs of chorus-line performing Charleston-like movements, and repeated dance steps parallel the motion of machines in the industrial production. The constantly accelerating rhythm of the montage also introduces mannequin and automata images, reflecting on the central notions of rhythm and accelerated speed during Weimar culture, and also the dichotomy between technological and organic movements within European modern culture.

Fig 2.5. Advertisement of Walter Ruttmann's *Berlin: Die Sinfonie der Großstadt* (1927). From Michael Cowan's "The Heart Machine: "Rhythm" and Body in Weimar Film and Fritz Lang's Metropolis" (2007), pp. 233.

Therefore, taking into consideration ideas on rhythm and the early development of motion pictures presented in the first chapter of this thesis, I will now focus on the idea of the body within film industry and the organisation of labour structures, utilising the film *Metropolis* as an example of how machinery is placed in the centre of a new paradigm.

Tom Gunning, Professor of Cinema and Media Studies at the University of Chicago, in his article "The Dance of Death: The Allegory of the Machine" [38], presents a specific analysis of Fritz Lang 1927 film *Metropolis*. For Gunning, "*Metropolis* is the allegory of the future as the triumph of the machine. And the machine in a variety of manifestations becomes the central allegorical figure of the film" (Gunning 2000: 55). It is specifically this article that will help us to approach the film *Metropolis* as an allegory of modernisation, with vast implications on the idea of body, movement, rhythms, spatial organisation and the insertion of visual effects as a core part of its narrative.

Firstly, it is important to say that for Gunning, early films – especially silent ones – present a universal language based on gestures and rhythms, a "legible and visible" iconic communication where the images were accessible for every audience in terms of connotation and rhythmical composition. The perception of cinema was transformed as new technical and aesthetical ways to present film and visual tricks were being exposed to the public. Gunning's perspective on the utilisation of visual effects for the construction of *Metropolis*'s narrative links up some of the concepts presented in the first chapter of this thesis especially in relation to the manipulation of images and new optical illusions. At the turn of the century the mere display of slow motion, zooms, cuts and fades, and multiple exposures acted as a new spectacle that epitomised a massive cultural process in relation to entertainment and popular culture.

Therefore, as a result of experimentation with new technology applied to cinema a whole new idea about optical tricks and visual effects started to emerge. The utilisation of dark studios for film shooting introduced new possibilities of lighting, integrating diffuse light effects, spotlights and rim-light onto actors, producing higher light contrasts and modelling the figure of the body, separating them from the lower light backgrounds. The use of vignettes and filters, cross-cutting,

[38] Tom Gunning. "The Dance of Death: The Allegory of the Machine," in *The Films of Fritz Lang: Allegories of Vision and Modernity* (London: British Film Institute, 2000).

underexposure, reverse-angle cutting, insert shots and inter-titles were highly popular. Before 1920, the irising-in and out – which basically means the revelation of a film shot by appearing inside a small circular (or any shape) vignette mask that gradually gets larger – became a common effect specifically in American and European films. The utilisation of close ups, first-person shooting (unstable hand-held shots), soft focus (intentional out of focus shots), diffused images (mainly by placing cotton mesh or other materials in front of the lens), and multiple superimposition of images were usually popular to convey subjective feelings of the characters, especially romantic scenes, delirious states, or to depict the use of drugs, among others. Hence, it can be said, that during the late 1920s the utilisation of "optical tricks" as "a purely cinematic image whose reference is metaphoric" created a core structure that supported the narrative of the film, in a context where symbolic effects took over conventional literary narratives.

Within this context, in Fritz Lang's *Metropolis*, the multiplicity of images creates a dramatic set design, a rhythmic dynamism that serves as a basis to tell *a story* through visual icons. The silent film was produced in Germany during the Weimar Republic and released in 1927 being the most expensive silent film of the time. The science fiction film presents a futuristic urban dystopia, Metropolis, where society is divided into two different social classes: The *planners* or *thinkers*, who live high above the city, and the *workers*, who live underground within a highly hierarchical architectural design. The main line within the film is actually based in this established hierarchical idea in which Maria, a female worker who is trying to stop the workers' revolution, aims for a Mediator that will unite the two halves of society. The plot continues in an impressive and highly visual development of the conflict, depicting the class struggle in several layers, specifically focusing on the impossibility of communication between the two social strata. Technology dominates the entire film in a futuristic combination between Art Deco and German Expressionist aesthetics. Dualism is a running theme amongst many characters and dehumanised workers are considered only as working units in strict relation to the machinery. The ultimate expression of technology in the entire film is the female robot Maria, designed by Rotwang and built by the *Maschinenmensch* or "Machine Human".

The visual construction of the film introduced a variety of new effects and innovative visual display marking a turning point within visual effects for filmmaking. The

utilisation of miniatures of the city, swinging cameras, and the introduction of new materials for costumes, like plastic wood sprayed in silver and golden paint, resulting in powerful images of the robot Maria, create a context of innovation highly determined by visual outcomes. One of the most inventive processes utilised in *Metropolis* was the Schüfftan Process, a mirror trick implemented by Eugen Schüfftan that consists in the composition of miniatures into a full-scale shot. Schüfftan mounted a mirror at 45 degrees angle in front of the camera lens. The mirror reflected the miniature model of the city positioned directly behind the camera and then superimposed with live action footage. Every aspect of the scene was composited in the corresponding scale, thus creating the illusion of actors interacting with huge, realistic looking sets.

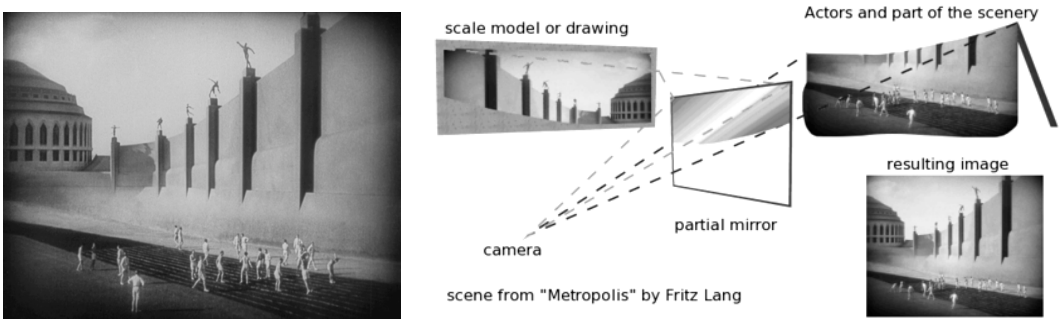

Fig 2.6 and 2.7 Still from the film *Metropolis*, directed by Fritz Lang (1927) utilising the Schüfftan Process and a scheme of the Schüfftan Process used for the film *Metropolis*. Images from http://www.intralinea.it/

There is no doubt that *Metropolis* does not only base its narrative on visual effects, but in many ways it is the mechanical rhythm of the film that rules the aesthetics of a hyper-modernisation of the city, where the ten hours clock represents the anti-humanisation of the workers. The image of the robot is presented throughout the film as a core aspect of its composition. One of the main figures, Maria, as a robot, emphasises the machinic aesthetic of the film. Nevertheless, one of the foremost aspects of *Metropolis* that interests me in relation to this thesis is the highly hierarchical architecture of the city. A city that is fully charged with symbolisms of levels and class divisions that highlights what can be considered one of the main aspects of Fordist modernisation: hierarchical spatial organisation. The range of levels

in Metropolis – which are only connected by the elevator that carries the labourers from the depth of the city to their workplaces – refers to one main and simple division between *hands* and *brains*; an aspect that can be considered similar to the organisational division present at Fordist industries between managers and workers.

"This city is nothing if not hierarchical" (Gunning 2000: 62). The machines that power the city are placed at the bottom of it, in a constant motion of gears that determines the movements of the workers. Workers have no contact with the superior levels reserved for those who design: the *brains*. It is precisely within this vertical order where the intellectual power – placed at the top of this hierarchy – controls the workers and the machines, thus creating a fully "functional, technologically rationalised world" (Gunning 2000: 65). One of the main dramatic lines of the film is based in the *discovering* of these layers – by Freder, the son of Metropolis' founder John Fredersen, who lives the luxury life of the management class – posing questions about control, vertical order and intellectual power, and especially emphasising the impossibility of communication between the brains' motives and the suffering of the hands. It is precisely this differentiation and lack of communication between these *layers* that Maria portrays with the story of the *Tower of Babel*: a political tale that derives from the *heart* as the only possible mediator between *brains* and *hands*.

Fig 2.8 Still from the film *Metropolis*, directed by Fritz Lang (1927). The 10-hour's clock. Image from http://www.fact.co.uk/whats-on/metropolis-re-issue

Another possible reading that emerges from the movie is that of the importance of subjective needs of the workers, power relationships, and the social reaction to a new paradigm in terms of resistance to, or awareness of control. Within this context, Siegfried Kracauer, a German writer and film theorist, in his book *From Caligari to Hitler: A Psychological History of German Film* proposes this idea: "This young girl delivers a speech to the workers in which she declares that they can be redeemed only if the *heart* mediates between *hand* and *brain*". It is important to say that particularly in this moment the subjective needs of the workers emerge as a relevant point in the construction of the city, an aspect that Kracauer also links with social issues like the Nazi propaganda as it "appealed to the heart – in the interest of totalitarian propaganda" (Kracauer quoted in Gunning 2000: 57).

After a year and a half of production, *Metropolis* was released and widely eulogised for its visual and rhythmic composition, particularly for its choreographed movements of mass workers: the mechanical dance.[39] *Metropolis*'s visual construction presents a sense of modernity and acceleration within its montage in addition to the sharply hierarchical architecture of the city – the Metropolis. Michael Cowan, a Professor in German Studies and World Cinemas at McGill University, in his article "The Heart Machine: 'Rhythm' and Body in Weimar Film and Fritz Lang's *Metropolis*", presents an analysis of the collective, rhythmical idea of labour associated with serialised movements, in other words, an examination of the relationship between rhythm as a film aesthetic and body rhythms within the early twentieth century: "Modernization, here, appears as a process entailing the temporal disciplining of the body (…) where the body's natural rhythms are subordinated to the rhythms and the tempo of the industrial clock" (Cowan 2007: 237). For Cowan, *Metropolis* presents to the viewer a conflicted tension between organic and mechanical rhythms, where movements are tied up to the specific pace of modern technologies, in an increasing aesthetic of serialisation and fragmentation of body parts.

This short analysis of Fritz Lang's *Metropolis* helps us to understand the idea of a body-culture that integrates a series of aspects of the modern life of the1920s. This idea specifically focuses on the relationship between body, machine, serialisation, and fragmentation of movements, and a vast change of paradigm in the perception of the

[39] In an article for "La Gazeta Literaria" de Madrid Luis Buñuel wrote: "What a captivating symphony of movement!" (Buñuel, 1927-28, n.p.).

body as a productive agent. Early film developments seem here to be related with the pace of modern technology and its tight and explicit relationship with dance styles. This is seen not only in the way the body was depicted and presented on screen but as a new understanding of the body as a generator of products within industries and dance and film entertainment culture.[40] This vision of collective rhythm represents a "fantasy of community"; from "rhythmical collective labour, with its workers all performing the same gestures in unisons, to the mass ornaments and serialised movements that would come to be associated with industrial work and urban entertainment" (Cowan 2007: 231). This relationship specifically appears in the merging of dance and gymnastic rhythms with mechanical and productive movements within the films of the 1920s, and also as a social understanding of popular dance styles through their appearance on screen.[41]

Therefore, the main figures within Lang's film – the workers, the robot Maria and the city itself – create an image that can be strictly related to Fordist industrial organisation, not just in the obvious workers' routine movements and machine dependency, but in a wider sense of modern stratification within industries, and the above explained Fordist spatial organisation. The modern idea that the intellectual power runs the directions for the mass worker, and that workers simply follow orders without any need for subjective implications, is what has marked the development of modern society. This central pyramidal hierarchy forbids decision-making from the part of the workers and restricts them to the simple use of muscles for the performance of specific and highly determined physical tasks.

Accordingly, the next section of this chapter will introduce some notions of mass ornament as a social space where ideas of collective rhythms, precision, and mass

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[40] Allison Whitney, in her article: "Etched with the Emulsion: Weimar Dance and Body Culture in German Expressionist Cinema" states: **"**For several reasons, Weimar filmmakers and audiences were able to assume a mode of spectatorship competent with dance interpretation. First, filmmakers and dancers often used the same venues to display their work, as in the case of Gert's performance of a trademark "grotesque" dance with a screening of Walter Ruttmann's Opus II (1921), or Elisabeth Grube's live dance prologue at the 1922 Berlin premiere of F. W. Murnau's Nosferatu, eine Symphonie des Grauens (Toepfer 203, 372)."

[41] It is also relevant that "filmmakers and dancers often used the same venues to display their work, as in the case of (Valeska) Gert's performance of a trademark "grotesque" dance with a screening of Walter Ruttmann's Opus II (1921), or Elisabeth Grube's live dance prologue at the 1922 Berlin premiere of F. W. Murnau's Nosferatu, eine Symphonie des Grauens" (Whitney 2010: 241).

production were linked to conform what was one of the main aspects of entertainment culture during the first half of the twentieth century, particularly in Europe and United States. The serialised, abstract patterns of shiny "girls" dancing in a rigorous kick-line seems to penetrate the cultural understanding of production, filling up stadiums, cabarets and films in a whole display of entertainment that has been analysed from a variety of perspectives.

Tiller Girls / The Mass Ornament

> Although the Girls' kickline did not refer directly to anything beyond its own abstract configurations, indirectly it seemed to reflect a modern aesthetic – one derived not from the individual body but from the machine (Jelavich 1996: 180).

Throughout the beginning of the twentieth century until the 1950s, European entertainment culture was firmly based on the idea of *kinesis* and the representation of motion; specifically in relation with dynamic mass spectacle, machinery display, body-culture, film and urban development. New technological devices available allowed to easily portrait the *illusion* of movement, breaking with the static poses of photography, thus giving room to a smooth understanding of film composition and the new possibilities that emerged since the appearance of the kinetoscope and Lumière's early experiments.[42] The development of a body-culture in Weimar Germany, and its spreading to the rest of Europe and United States, introduced another aspect to urban entertainment. Within film industry, the idea of a specifically trained body that can perform for the camera transformed the idea of motion into a perfect machinery, able to display the human body and its parts. This helped construct a notion of welfare from different perspectives: firstly, the cinematic experience that focuses on the actual body and its capacities; secondly, the technological developments that were displayed as innovations; and finally, the specific development of mass spectacle, such as Nazi

[42] Tom Gunning's article "The Attraction of Motion: Modern Representation and the Image of Movement" in the book *Film 1900: Technology, Perception, Culture* (London: John Libbey Publishing Ltd., 2009), presents some interesting ideas regarding motion in early cinema and its tendency toward the introduction of narrative.

mass demonstrations,[43] and organised collective images of music hall shows. The emergence of this phenomenon will serve us as a basis from which to understand urban culture in relation to body, specifically focusing on the appearance of the Tiller Girls.

> The most frequently cited choreography of industrial capitalism was precision dancing. The kickline, in particular, was burned into twentieth-century cultural memory by the British Tiller Girls and immortalized in Kracauer's 1927 essay *The Mass Ornament* (Franko 2002: 31).

When John Tiller (1854 – 1925), a cotton tycoon from Manchester,[44] went bankrupt, he decided to set up on stage a distinct form of dance that included perfectly coordinated dance steps for groups of ten to twenty Chorus Girls that danced in perfect unison, conceiving "what would become his signature system for the formal training of chorus girl troupes" (Brown 2008: 165). Within the context of dance and music-hall skirt dance performers – girls' kickline, cancan, and all sorts of female dancers arranged in harmonious chorus lines – this new outstanding arrangement of Girls appeared to satisfy all requirements of an entertaining show in a structure that also portrayed ideas of serialisation, repetition and standardisation of movements proper to modern society. John Tiller and his second wife founded a series of residential schools in England. They trained young girls, offering them an alternative to industrial work and a way to escape from poverty environments and its "corrupting effects;" specially "to avoid the temptations of the streets – the evils of sex, drink, and idleness - which they were seen as particularly vulnerable to" (Brown 2008: 165). Tiller himself stated: "In most cases I try to separate the children from their old home life, for in most cases their homes may not be of the best" (quoted in Brown 2008: 165). After Tiller's death, his son Lawrence took over the direction of the company, and a new troupe of Girls was born after his name. Tiller's ideas quickly spread and a series of training schools and Girls troupes started to appear all around Europe and United States.

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[43] Hitler made a clever use of mass spectacles to rally German people behind the Nazi regime. Some of them (for example the annual party rallies at Nuremburg) mobilized almost one million people.

[44] Some documents affirm that Tiller's factory was settled in the city of Lancaster, where he developed the initial ideas for the Tiller Girls and then moved to Manchester in order to catch young women for his show.

> Wayburn's school promised 'Health, Fame, Popularity, Independence;' his training system for chorus girls was designed to mould their flesh into the ideal physical manifestation of the new modern ethos – self-cultivated, entitled, and white. Beauty was mass-produced for the consumer. 'In our school we make a business to produce beauty', Wayburn declared. 'Neither sentiment nor art enters the question. Audiences will not come to the box office with their money to see ugly, misshapen girls on the stage. Therefore it is up to me to make them right' (Brown 2008: 167).

This quotation, from Jayna Brown's book *Babylon Girls: Black Women Performers and the Shaping of the Modern*, helps us to understand a whole system of segmentation of girls based on physical capacities. Girls were classified in function of their routines, and divided between "showgirls" and "ponies". They were measured to match the "five feet four inches" criteria, and to weight no more than 105 to 115 pounds (between 47.7 and 52.3 kilograms). After the selection process, the Girls started training for more than 12 hours a day, with specific attention to their feet and hands.

> Brought to market, women were the product described in terms from both merchant and industrial capitalism. The dance instructor David Bennett assessed the women applicants as a horse trainer would his livestock. (…) he stated in an interview. 'I look first at their teeth. Good teeth are the initial beauty essential of the chorus girl … I have always chosen girls with the idea, first, of getting healthy ones. Posture has much to do with my selection. If the girl doesn't sit well, I know she has let herself become slouchy. She probably has been too lazy to brace herself properly at the waist, where the vital organs are' (Brown 2008: 167).

Tiller Girls' first public appearance was in 1890 at the King's Theatre in Manchester, and by the 1920s several Tiller troupes were performing in different cities in Europe and the United States. This systemic approach to dance training hit its climax after World War I, when the number of women on stage dramatically increased to hundreds, dancing and creating corridors, mirror-like images, reflecting urban patterns, mechanistic images, industrial assembly lines, and military training. Before World War II, the Great Depression marked the end of several revues, especially in Germany and Europe, starting a period of adjustment to a new economic system.

What is relevant for this thesis is the idea that specifically trained bodies became productive agents within the entertainment industry. Their rigorous dance routines

reflected a discipline that transformed the Girls into productive workers whose trademark was serialisation and quantity, reducing the space for individual performance. The Girls were trained to look the same, weigh the same, move the same and smile the same in a progressive lengthening of the kick-line. Therefore it can be said that the Tiller Girls were closely trained to mould their personalities, fading away the individuality of each performer into a formal configuration of a collective Girl entity harmonised in uniform precision. This created a series of young dancers who were fundamentally depersonalised and dismembered into a large composition of dynamic body-parts.

> The Tiller Girls cannot be reassembled retrospectively into human beings; the mass gymnastics are never undertaken by total and complete bodies, whose contortions defy rational understanding. Arms, tights, and other parts are the smallest components of the composition (Kracauer 1931: n.p.).

What Siegfried Kracauer, in his 1931 article "Girls und Krise (Girls and Crisis)" states, is that the Tiller Girls composition and the set up of the spectacle replicates the sensation of worker's bodies, particularly when he clearly points out that "the legs of the Tiller Girls correspond to the hands in the factories" (Kracauer 1931: n.p.). The depersonalisation and the fragmentation of body movement, the serialised spatial composition of the lines, and the over-exploitation of the *similarity* with no space for *difference* create a mass spectacle that *symbolises* an economic system, a mechanised environment, an abstract and geometrical perception of the body; a "depersonalization of the dancer" that "paralleled the reduction of the worker's body to economically useful attributes" (Jelavich 1996: 183).

> The human fragments were recorded into dynamic visual forms which, on the surface, appeared vital and progressive, a symbol of rational management and achievement. But more fundamentally, they revealed – or perhaps disguised? – an underlying sense of economic and military order that demanded the dissolution of all personality and the dismemberment of the person (*ibid.*, 186).

Each Girl is considered as an appendage, and even more significantly, each body part of each Girl is considered as a constituent for a higher – entertainment, productive – purpose: the unison kick-line. There is no dramatic unit. Instead, the Tiller Girls created a sense of "dismembered succession of splendid sensory perceptions"

(Kracauer quoted in Jelavich 1996: 186) created by body-parts, where the serialised fragments constitute the parts of the whole. This final product is fundamentally an economic order that matches the hierarchical criteria of Fordist organisation and the productive system of the assembly line. This specifically economical sense leads to the dissolution of all personality, portraying an absolute – and also fragmented – body motion that has been categorised as "precision machine" or "motion machine", a collective ornament that embodies the modern economical utopia depicting "the functioning of the flourishing economy" (Kracauer 1931: n.p.).

Fig 2.9 A line-up of Tiller Girls in a cabaret show at the Piccadilly Hotel in London. 1925. Image from http://1920s.livejournal.com/

Therefore, the Tiller Girls can be understood as part of the entertainment industry, alienated and abstract workers that become a part of a public productive line. For Mark Franko, in his 2002 book *The Work of Dance: Labor, Movement, and Identity in the 1930s*, the female dancer of the kick-line parallels the male worker of Taylorist systematisation, representing a broad economical and labouring system, "thus the commodification of the chorus girl is exactly parallel to the commodification of the

worker" (Franko 2002, 36). Franko explains – following Kracauer's ideas – how the organisation of the dancing body is limited to specialised tasks in a similar way to Taylorist's scientific management, in which dancers were specially trained to function as a *part* of the kick-line routines, in a social and even political portrait of labour organisation.

> When they formed a line that moved up and down, they radiantly represented the superiority of the conveyor belt; when they step-danced at a rapid pace, it sounded like 'business, business'; when they tossed their legs into the air with mathematical precision, they joyfully approved the progress of rationalization; and when they continually repeated the same motions, without breaking their line, one imagined an uninterrupted chain of automobiles streaming from the factories of the world (Kracauer 1931: n.p.).

Kracauer's famous essay, "The Mass Ornament", was published in 1927 in the *Frankfurter Zeitung* before the rise of National Socialists in Germany, in the middle of an economic boom. In it, Kracauer links the aesthetics of the Tiller Girls with that of Taylorist factories and with gymnastic displays, identifying the Tiller Girls with an image of *collective totality*; an anonymous sense of precision that was more than a mere expression of modern times and its rhythm. Hence, it is my belief that the Fordist approach to serialisation, speed increment, mass production and fragmentation, works as an equivalent to the alienation of metropolitan life and therefore, with Kracauer's *symbolic* understanding of the Tiller Girls and their performance.

For Kracauer, the idea of mass ornament included both precision chorus girls and mass gymnastic spectacle – also including Nazi mass demonstrations – where the individual was submerged into a mass collective corporeality, blurring out any possibility for *difference* and becoming a unitary mass, especially as a symptom of modern society. Within this context, and considering ideas on Fordism, production is understood as an anonymous mass of specific tasks that only make sense within an abstract recognition of the totality. "The mass ornament", he argues, "manifests progressive potential as the representation of a new type of collectivity organised not according to the natural bonds of community but as a social mass of functionally linked individuals" (Kracauer 1963, 18). If for Kracauer "the bearer of the ornaments is the mass and not the people" (Kracauer 1927: n.p.), for Ford, production agents are

the mass of workers as a whole, and not individual task routines. This means that both – mass ornament and capitalist production – are considered ends in themselves.

> The ornament is an end in itself [*Selbstzweck*]. … The girl units train … in order to produce innumerable parallel lines; and the training [*Ertüchtigung*] of considerable human masses would be desirable in order to generate a pattern of undreamed-of dimensions. The final result is the ornament, for whose closed uniformity [*Geschlossenheit*] the substance-containing structures are emptied [of their content] (Kracauer 1963: 52).

Serialisation, assemblage, and regularity are reproduced into abstract motifs of a broad mass of people, mirroring a social pattern that includes, and arises from, the development of a body-culture, the establishment of the film industry, and essentially from intricate production processes where everybody has an assigned task, playing a partial function within the entire procedure.

> The patterns seen in the stadiums and cabarets (…) are composed of elements that are mere building blocks and nothing more. The construction of the edifice depends on the size of the stones and their number. It is the mass that is employed here. Only as parts of a mass, not as individuals who believe themselves to be formed from within, do people become fractions of a figure (Kracauer 1963: n.p.).

Consequently, I would like to reinforce the idea that the main concepts involved in both productive processes and entertainment culture, establish a social apparatus based on technical transformations and a new kinaesthetic understanding of the body. The Fordist production line was based on technological development, technical improvement, and the analysis of movement patterns for the increment of production. The highly hierarchical organisation of factories and the mechanising rhythms of labour were common subjects in a variety of films during early 1920s and 1930s commonly portraying a mass of abstract workers, mass ornament, mass dancers and mass propaganda. Additionally, Kracauer's ideas on entertainment culture and mass ornament support my contention that specific forms of movement control – like the ones explained in this chapter – create a scenario from where to understand an organisational system that determined both the productive process as a massive figure with strict implications on social life, and the entertainment culture as a productive agent, where "the organization stands above the masses" (Kracauer 1963: 78). Accordingly, it can be said that the industrial systematisation that prioritises

efficiency and mass production was conceptually applied to how humans should behave and relate to one another for the "enhancement" of society. This process can be understood as an individual internalisation of mechanised production through an ideologically and aesthetically reevaluation of the human body as a machine: the legs and arms moving in synchronicity as part of an abstract spectacle of a collective machine. This machine aesthetics emphasises the notion of repetition, efficiency, speed, precision and power through an overall rhythmic flow. The Tiller Girls performance of standardised movements choreographed into exact precision, aesthetically symbolises the industrial and modern technology proper of the twentieth-century.

> Admittedly, it is the legs of the Tiller Girls that swing in perfect parallel, not the natural unity of their bodies, and it is also true that the thousands of people in the stadium form one single star. But this star does not shine, and the legs of the Tiller Girls are an abstract designation of their bodies (Kracauer 1963: 84).

Therefore, the systematisation of production through movement and gesture administration within Fordist industries can be considered in strict relation to mass forms of entertainment like cinema and chorus line dances. The hierarchical organisation and the presentation of serialised movements determine a new social understanding and quantification of body movements in both artistic and productive performance. The new systematisation of motion and the extreme forms of organisation applied to serialise production appears to be similar to the systematisation of movement of the Tiller Girls. Consequently, and in correlation with the ideas presented in the first chapter of this thesis, the main concepts involved in both contexts establish a link: a social transformation derived from technological developments. A new harmonisation of body movements became an adaptation to new rhythms and compositions, where the Girls – as the worker did for Fordism – adapt to the speed of the machine.

Chapter 3

Flexible Specialisation: Ideas on post-Fordism and Digital Performance

In the cybernetic age, the machinist no longer uses the machine as a tool; rather, the machine is engaged in a dance of mutual surveillance (Hookway 1999: 41).

Nanosecond Culture

Since the late 1960s, the emergence of sophisticated information technologies, transport systems, and communicational protocols began to determine a historical period where time was conceived as one of the most relevant aspects of social development. Melvin Kranzberg, Professor of History of Technology and editor of the Technology and Culture Journal, states, "a single technological feat, no matter how much attention is showered upon it, does not by itself constitute a complete technological transformation". For Kranzbeg, a technological revolution is the result of many innovations that take place within the same period of time, creating a "synergistic, indeed, explosive, impact upon the production of goods and services" (Kranzberg 1985: 37). Therefore, pioneering efforts in launching artificial satellites by the Soviet Union and United States since 1975, the Cold War, the Space Race, and the development of nuclear and electromagnetic power sources for artillery marked, all together, a period of huge military development.

During the 1960s, the establishment of networking structures such as the ARPAnet (Advanced Research Projects Agency Network) involved a process of early developments in computer, programming, and digital tools for control and coordination. Since the 1970s, the quick endowment of local-area computer networks based on signal standards – such as the Ethernet – in addition to the development of complex programming languages triggered an explosive augmentation of the volume and flow of data transference, affecting almost every stage of social communication. Later on, the significant technological transformations that arise with the creation and development of the World Wide Web (www), mobile phones, and satellite communication determine a process of abstraction, speed increment, digitalisation and miniaturisation of technological devices that leads to a system that "seems essentially timeless" (Hookway 1999: 15), constantly looking for the ideal real-time.

> [R]evolutionary advances in the flow, storage, manipulation, and retrieval of information, resulting from the improvements in computers, rightly entitle the future to be known as the Information Age.
> These contemporary major technical changes—in materials, fuels and prime movers, machinery, the organization of work, transportation, and communication—all involve more knowledge and more information (Kranzberg 1985: 41).

The structuration of standard processes, and the development of a network that allows a constant data flow interconnected by nodes and protocols reassert the idea that digital technologies debate is a cluster of diverse points of view. This cultural process – including a whole new productive system – modifies the overall social logic: from serial production to network production; from homogenising domination to differential and distinctive treatment; from purely vertical hierarchy to a mixture of horizontal and interactive control structures. The new decentralised techno-economic condition determines a close relationship between human labour and high-tech machinery. Cybernetics and communicational flow establish new ways for production, new labour necessities and a completely new paradigm for spatial disposition on the work-floor.

As Branden Hookway affirms in his book *Pandemonium: The Rise of Predatory Locales in the Postwar World*, "new decentralized, environmental techniques of social control situate Man within an encompassing techno-economic reality. This new organizational imperative can be said to be infiltrating all fields of human endeavour" (*ibid.*, 20). This constant process of applying informatics to every aspect of social life creates a model "where intelligence is site-specific and fluid" (Hookway 1999: 23-24).

Within this context, one possible way of conceiving the relationship between body and technology is to generalise the notion of technology, understanding it as a way towards flexible structures and organised methods. This premise, under liberal economies, creates a flexible system of control that breaks with old patterns of homogenisation. Jeremy Rifkin in the introduction to his book *Time Wars: The Primary Conflict in Human History* relates the informatics term "nanosecond" to a culture primarily based on computer temporal measurement, where time is "organized at a speed beyond the realm of consciousness" (Rifkin 1989: 23). For Rifkin, a nanosecond – a billionth of a second – can be manipulated, theoretically conceived, and applied to everyday actions, but the intricate impossibility to experience it marks a turning point in the social relation to time.

> The nanosecond culture brings with it a new and more virulent form of reductionism. The clockwork universe of the industrial age is being replaced, in fast order, by the computational universe of the postindustrial age. For several hundred years Western culture has defined mind and matter in mechanistic terms, reducing all of reality to the operating principles of

> clockwork technology. Now, a new journey begins (…) We are entering a new temporal world where time is segmented into nanoseconds, the future is programmed in advance, nature is reconceived as bits of coded information and paradise is viewed as a fully simulated, artificial environment (Rifkin 1989: 218).

Therefore, it can be said that the rise of personal computers, digital networks, along with the emergence of a nanosecond culture established a social distribution where new patterns for labour, consumption, behaviour, and geographical standards evolve based on digital distance-diminishing technologies. These possibilities for production and the radically new communication apparatuses have created a landscape from where to approach contemporary ideas on the relationship between bodies and technology, within both, the industrial re-organisation and the development of performance arts that utilise technology as a core element for its creation.

Some of the main aspects of this transformation are the development of computer networks for internal and external organisation and communication. This produces a shift from stiff structures towards range and flexible systematisations, with a main focus on telecommunications, robotics and electronic databases. Accordingly, in the first part of this chapter, I will introduce some relevant concepts on flexible specialisation as a model of production and regulation, bringing up a basis from where to understand the new patterns of work-organisation and the intricate relationship with human organisation. In the second part, I will focus on the introduction of digital technologies that, somehow, have shaped new ideas on time and production in relation to cinema studies, video games and performing arts. Finally, I will present some general concepts on digital performance introducing some preliminary perspectives on embodied art creation within performing arts that, in a future research, will serve as a starting point for a deeper analysis.

Post-Fordism

> A new era of production has begun (Rifkin 1995:81).

Post-Fordism can be understood from a variety of perspectives. Several points of view conform a technology-based organisation that acts as a form of regulation in cooperation with other existing models. Therefore, studies on post-Fordism include a complex contemporary ensemble that can be approached as an emerging cultural model and as a technologically determined social structure – from a panoptic perspective – specifically focusing on digital networks. This means that post-Fordism can be acknowledged as an emergent signature for the contemporary age, rather than just as a model for production and labour organisation. Nevertheless, I will not intend to offer a totalising description of it as a social establishment; instead, I will present some ideas related to post-Fordist organisation for production, particularly linked with digital technologies and lean manufacturing.

The most important innovations in post-Fordism are symbolised in the figure of Taiichi Ohno (1912-1990)[45] who, as Taylor and Ford did before, created a completely new systematisation for industrialised production firstly applied within the Toyota Motor Company in Japan between the late 1940s and 1970s. Ohno is considered the father of the Toyota Production System, a method that is largely applied in the United States under the name of Lean Manufacturing. He proposed, in the first place, a segmentation of the large serial production lines in small productive units organised in networks. Within this matrix, each cell acts as a client of those that follow, and also demands the parts and pieces from the modules that precede it. Each module controls its own quality and works on research and technological improvements. That means that each section functions independently and simultaneously integrated within an internal market in which everyone can raise input demands while offering products.

Onho proposed to organise the production based on marketing demand, contrary to Fordist stocked supplies. This means that the network is activated only if there is a real demand for products: if demand shrinks down the activity drops, and conversely

[45] For more information please see Ohno, Taiichi and Norman Bodek. *Toyota Production System: Beyond Large-Scale Production*. Tokyo: Productivity Inc., 1988.

the network must be prepared to increase productivity if demand intensifies. Based on the observation of giant United States supermarkets, this model was aimed to achieve: "(1) what is needed, (2) at the time needed, (3) in the amount needed" (Ohno 1988: 26), thus creating a "revolution in consciousness, a change of attitude and viewpoint by business people" (*ibid.*, 15). This structure is based on the Japanese concept of *Kanban* (看板), which refers to the notion of "Just in Time", a real-time strategy for production and inventory.

Hence, the optimisation of production by fastening the whole process is just one side of this phenomenon. The different methods that have been adopted by company management are highly opposed to traditional Taylorist and Fordist approaches. In post-Fordism, quality products cannot be achieved with de-skilled workers, therefore, the whole method for control and organisation integrates groups of semi- and multi-skilled workers. This new structure not only responds to manufacture and maintenance processes but looks for a constant improvement of the production process and final products; a systematisation that has been named Performance Management. This organisational system includes what before was an exclusive task for Fordism's management area, separated from the actual productive process, while in Lean Manufacturing it is an integrated aspect of production. "In post-Fordism, the worker is designed to act as a computer as well as a machine" (Murray 1988: 11).[46]

> Performance Management develops out of Scientific Management by challenging many of its basic tenets and seeking to redress its drawbacks. First and foremost, Performance Management attempts to displace the rational control of workers by empowering them to improve efficiency using their own intuition, creativity, and diversity. Second, Performance Management seeks to counter the monolithic, 'machine' model of bureaucracy described by Max Weber and instituted by Taylor, Ford, and others, offering instead a more 'organic,' systems-oriented model, one that resituates performance within larger organizational and socioeconomic environments. Third, while Scientific Management was developed and deployed in an industrializing economy, Performance Management has become the organizational paradigm for an information economy hardwired to computer and communications technologies, wherein information processing and decision-making no longer take place only from the top down, but are diffused throughout an organization. Fourth, at its most progressive, Performance Management challenges the challenge of efficiency itself, or at least its exclusivity, by introducing a diversity of values and organizational cultures.

[46] Some relevant concepts related to Performance Management and Lean Manufacturing are present in Jon McKenzie's 2001 book *Perform or Else: From Discipline to Performance*. (London: Routledge).

> Performance Management, therefore, is not the replacement of Scientific Management, but its displacement and overcoding (McKenzie 2001: 63).

This new organisational system creates a notorious division between nuclear and peripheral workforce by sub-contracting all non-essential jobs. This aspect, in addition to an increasing utilisation of networking in the assembling and organisational process, creates a non-geographical segregation. During early industrialisation the big metropolis held most of factory jobs, triggering a massive geographical transformation where the periphery did not count within the industrial working force.

Another relevant aspect in post-Fordism is the integration of nanotechnology and programmable machines for customisation, utilising machines that can switch from one product to another through minimum re-setting. This means that flexibility and adaptability is based on quick and easy software reprogramming. This allows the application of a Flexible Manufacturing System that does not respond to the production of standard goods, but uses general-purpose machines to produce a variety of products. Benetton dyeing plant, General Motors, Kawasaki and Toyota Motor Company, among others, serve here as good examples of utilisation of general-purpose machinery in a variety of products.[47] In addition to these phenomena, the elimination of stocks and the reduction and the simplification of components through new materials and innovative design result in a "zero defect policy", utilising machines that stop automatically when a fault occurs. "Or, to put it in other words, it is based on the assumption of the 'five zeros': zero defect in the parts, zero mischief in the machines; zero inventory; zero delays; zero paperwork" (Castells 2010: 170).

This whole system determines a network of intricate processes, both inside and outside the working plant, activating new approaches to time, productivity and organisational structures, constraining a whole process of re-designing the factories, industry's hierarchy and work floor organisation. Therefore, this computer-based organisation integrates different kinds of networks, being immaterial/digital codes, protocols and passwords, the ones that take control within the whole structure.

[47] Benetton's automatic dyeing plant, for example, permits changing the colours in almost real-time with demand. In the car industry, whereas in the early 80s General Motors took nine hours to change the dyes on its presses, Toyota have lowered the time to two minutes, and have cut the average body parts from 5,000 to 500 in the process.

"Moreover, while networks are an old form of organisation in the human experience, digital networking technologies, characteristic of the Information Age, powered social and organizational networks in ways that allowed their endless expansion and reconfiguration" (*ibid.*, xviii).

In addition, flexibility appears to act as a strategy for the increment of efficiency within distributed networks, in opposition to the ideal control and standardisation within Taylorism and Fordism. As a central concept within Information Age, flexibility allows the establishment of a system that can integrate costumers and consumers into a universal standardisation of protocols, aiming for a continuous and unlimited possibility of interactivity with the whole system and its different stages.

Lean Manufacturing

James Womack, in his book *The Machine That Changed The World* (1990), coined for the first time the term of Lean Manufacturing, a concept that relies on a combination of supervision methods and a constant upgrade of necessary machinery to increase the output with less resources.

> Lean production (…) 'combines the advantage of craft and mass production, while avoiding the high cost of the former and the rigidity of the latter.' To meet these production objectives, management brings together teams of multiskilled workers at every level of the organization to work alongside automated machines… (Rifkin 1995: 96)

Traditional vertical hierarchy is replaced by teams of multi-skilled workers (programmers, designers, engineers, and so on) that interact face-to-face in the work place and with the machines. These interconnected productive nodes allow the implementation of new patterns for control and surveillance: a new way of personal involvement of workers in the actual process of design and production. This participatory approach does not work by direct obligation but by socialisation on the work-floor through a subjective intervention and regulation of worker's needs. Therefore, we are not anymore in front of a classical mental–physical division, but a

highly collaborative approach of controlling the entire intellectual–corporeal and subjective–objective experience involved in a productive process.

Within this context, one of post-Fordism's greatest contributions for the increment of productivity was to address the subjective needs of workers, developing personnel policies aimed to promote workers' subjective engagement with means of production and the corporative project. The workers, who were mere parts of a machine for Taylorism, and were even the defective part for Fordism, are now humans again within the post-Fordism system: commitment, initiative, enthusiasm, appreciation of their knowledge and their skills becomes important... and profitable, and now even workers' personality are considered inseparable from the above aspects in terms of productivity.

> Organizational theorists often describe this change in the performance review process as moving the managerial emphasis from controlling workers to empowering them, from giving orders to creating participatory interactions (McKenzie 2001: 57).

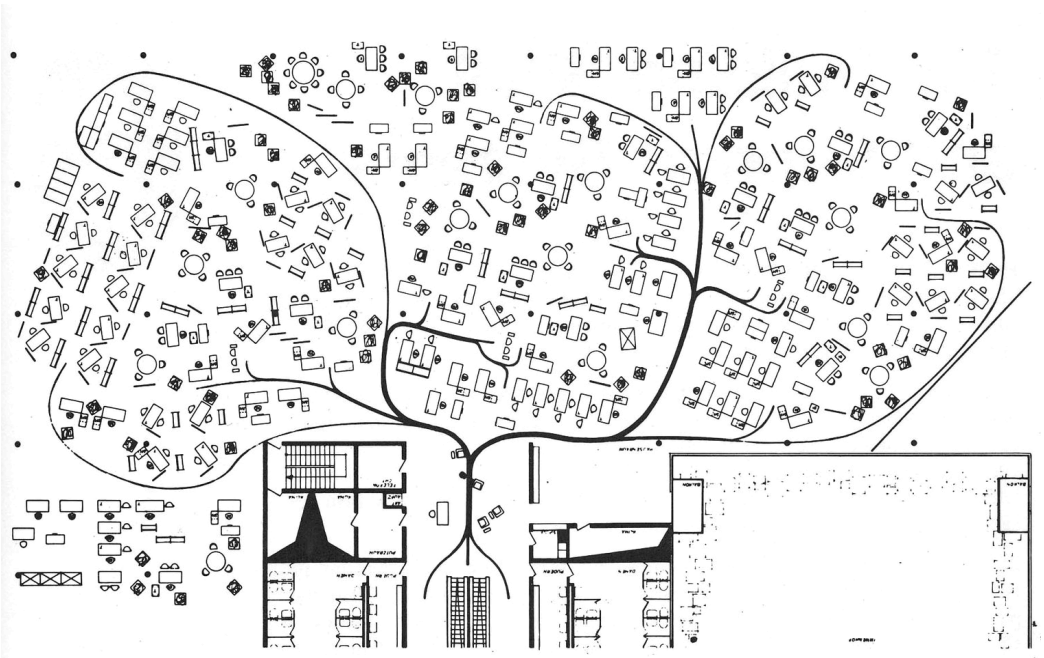

Fig 3.1 Organisation schemes for office space, with clusters of furniture and equipment homogenously arranged according to workflow "algorithms", based on major and minor traffic routes. Quickborner Team fur Planung und Organisation.

Parallel to this, the integration of marketing concepts for the understanding of social, aesthetical and cultural changes of contemporary lifestyles allows us to approach an inclusive phenomenon where design and technology have penetrated the world of production, consumption and culture: a period in which images and media provide a projection-representation of the body directly associated with ideas of production and consumption.

> Normally in the literature, the term 'post-Fordism' is associated with economic and institutional change, while the term 'post modernism' is associated with change in the arena of consumption, aesthetics, culture and lifestyle. However, for observers concerned with the totality of change today, not only are the two arenas representative of a single, overarching transition, they are also inseparable (Amin 1994: 30).

There are several concepts involved in this new structure. Ideas that appear with digital and information culture allow new operations that can be applied, not only within productive and industrial environments, but also considered as a base from where to understand social transformations today. The notion of feedback plays a key role in information culture, where the interconnectivity – especially based on networks as the Internet – has become a global cybernetic system that permits manipulation and monitoring of consumers' preferences. Within this context, consumers' behaviours are subjected to management decisions that are also determined by a seemingly permanent feedback loop. Hence, the manipulation, organisation, and utilisation of information "certainly coincides with the installation everywhere of feedback loops which monitor and regulate consumption, production and distribution" (Seymour 2011: 2).

This inherent process of measurement and quantification works as a flexible structure where bodies are transformed through patterns of behaviour, consumption and production. According to this logic, where everyday corporeality is tapped by machines and techniques, bodies have to assimilate instructions, adapt to timing, and behave efficiently in order to take part in a larger social scheme. That is to say, workers are bodily and mentally trained to be part of a production system that develops specific tasks.

> The challenge of efficiency extends from measuring and evaluating performance to creating and developing it. Organizational performance is produced at the level of individuals, teams, departments, organizations, and

> industries, and it takes place across a wide variety of sectors, including business, nonprofit, educational, and government organizations (McKenzie 2001: 59).

With the automation of everyday processes, movements and displacements are transformed into manipulation and control of details, "a system of distributed management that could not be dissociated from the material milieus whose particles and behavioural quirks were being managed"[48]. This can be understood as part of an even more precise idea: a process where the technical knowledge – based on information parameters – becomes a matter of everyday life; where technological performance – in terms of productive efficiency – is constantly measured and integrated into this feedback loop of management and surveillance.

Hence, distributed management, information networks and constant feedback loops not only generate a specific computational knowledge within social networks; it rather creates a more radical shift in the social sphere. As Alexander Galloway explains in his book *Protocol: How control exists after decentralization* "The 'information age' - a term irreverently tossed to and fro by many critics of contemporary life- is not simply that moment when computers come to dominate, but is instead that moment in history when matter itself is understood in terms of information or code" (Galloway 2004: 111). This process can be also comprehended within distributed society across social and cultural practices between 1950s and 1970s, when an extensive range of social and cultural practices attempt to shift its main focus from finished products to processes.

For Jon McKenzie, in his book *Perform or Else: From Discipline to Performance*, electronics, computers and telecommunications regulate technological performance in terms of social and cultural practices: a course of action where products shift to processes, and representation to presentation. In other words, technological performance is an extended social transformation where operations are quantified in terms of efficiency, translated, and then stored in digital databases.

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[48] Sandford Kwinter, "Introduction: War in Peace," in Branden Hookway, *Pandemonium: The Rise of Predatory Locales in the Postwar Period* (Princeton: Princeton Architectural Press, 1999), pp. 9-10. Also quoted in Alexander Galloway, *Protocol: How Control Exists After Decentralization* (Cambridge, MA.: MIT Press, 2004), pp. 111.

> The extent of technological performance within the computer industry must be mapped both in terms of its own specific operation there and in light of the computer's function as a virtual metatechnology, a technology used to design, manufacture, and evaluate other technologies.
> (…)
> The computer not only performs, it helps produce performances of other products and materials and thereby greatly extends the domain of technological performance, a domain whose reach into our own lives can be grasped by the ubiquity of bar codes (McKenzie 2001: 11).

Therefore, it can be said that distributed society regulates workers and non-workers, human and non-human, social and individual spheres opening an explicit perspective from where to observe economical, cultural, social and artistic processes. Digital technologies, programming languages, computer codes and protocols, non-hierarchical structures, and distributed networks have allowed the transformation of production into an intangible flow of immediate transactions. Thus, the massive social transformation derived from the insertion of information technologies within productive and social arena produces an historical moment that for Galloway is "when life is defined no longer as essence, but as code– is the moment when life *becomes a medium*" (Galloway 2004: 111).

The aforementioned works of Jon McKenzie, Alexander Galloway and Branden Hookway, among other contemporary theorists, offer a useful path from where to examine technological development as an inseparable transformation of the whole contemporary organisational milieu. Technical systems that surround the body bring together different factors in a very complex equation involving time, movement, space, technique and discipline. Therefore, I will now introduce some relevant concepts and events regarding the development of digital media and the explorative *field* of digital performance.

Digital Media

As I stated at the beginning of this chapter, the rise of personal computers and the emergence of digital networks, along with the massive introduction of information and digital technologies generated a constant transformation on the social idea of communication, interaction and entertainment in general. The new production paradigms based on networking and high technologies influenced the development and rise of digital cinema, multiplayer video games, and the creation of virtual environments for socialisation.

To approach some concepts related to new digital technologies, we enter into a controversial cultural field, which is associated with many myths and fears around the utilisation of technology. Science fiction is filled with stories and images about the colonisation of machines and the extinction of the human race, where robots, computers and intelligent cybernetic organisms subjugate and terrify people. The aforementioned film *Metropolis* (Fritz Lang, 1927) is one of the first examples that presents a cybernetic organism which begins a revolution to remove employees from the city, replacing them with robots. The film *Blade Runner* (Ridley Scott, 1982) portrays cybernetic human clones called "replicants" that rebel against humans, spreading terror among people in Los Angeles in a futuristic 2019. In *Terminator 2: The Judgement Day* (James Cameron, 1991) Terminator is sent back in time to prevent the construction of the first robot prototype in order to prevent the war between machines and humans; and *The Matrix* (Larry and Andy Wachowski, 1999) presents a whole world that becomes an illusion mediated by the Matrix, where humans become simple generators of energy, connected to a central machine that will create an artificial world. Consequently, it can be said that the film industry has been surrounded of examples that characterise the terror of losing human power and control, the fear of replacement of our bodies with super-powered organisms, capable of overcoming us widely in skills and productive capacities. "Here the anxiety of cybernetic systems on the workplace – fear of the worker's replacement – mutates into disturbed fantasies about the conscious automaton – fear of the body's displacement" (Lunenfeld 1999: 66).

Furthermore, traditional cinema logic is being redefined through the replacement of old cinema technologies with new digital possibilities, opening new ideas on documentation, manipulation of images and simulation. Digital cinema employs animation and computer effects in order to generate new possible images and, in some cases, utilises live footage as one of its elements, in a new integration of analogue and digital technologies. This new paradigm of images, data storage, databases and organisation unfolds a series of questions and concepts within digital tools, hence affecting a variety of aspects within social environments.

It is within this new context of man-machine interactions, where it is possible to analyse the development and connections of digital media in everyday life. Since the mass production and mass consumption of computers and digital devices, media have been a commonplace in social relationships, determining a specific way to approach contemporary social changes. It is, thereby, necessary to understand that these relationships are in no sense fortuitous; rather, they emerge from a complex net of concepts.

Virtual Reality (VR) is understood as interactive simulations where several devices such as gloves, helmets, and even the mouse, screen and keyboard offer us a certain degree of interaction. The amount of stimuli that we perceive from analogous reality compared with the number of stimuli perceived from VR determines the degree of immersion that each VR system presents. It is this perceptual relationship of exchanges and interrelations that determines the extent to which we are connected with virtual environments in ways of socialising, producing, organising, and entertaining. The different levels of immersion within virtual worlds and with technological devices can be analysed from different perspectives. Thus we have variable degrees of cultural penetration, transformations through technology in public and private fields, and the physical sensory immersion achievable through technology.

> Virtuality is not about living in an immaterial realm of information, but about the cultural perception that material objects are interpenetrated with informational patterns. What this interpretation mean and how it is to be understood will be our collective invention (Hayles 1999: 94).

This virtualisation of the body has permitted us to study new ideas about corporeality, space and movement, opening multiple possibilities for creative and theoretical disciplines to think the body in its contemporary environment. The current transformations and mutations allow us to think a new body transgressed on its own space of configuration that emerges from processes and is constituted as an hybrid space of intersections, a common place from where to display main cultural changes.

The concept of *hybrid* comes from biology, and refers to a product derived from the mixture of two or more organisms or entities from different species. However, to approach ideas about *hybrids* within this research means a space, environment, body, or device that establishes itself from a variety of referents: analogue – digital, body – machine, technological – mechanical, simulated – real.

> The cyborg or 'cybernetic organism' represents a radical vision of what it means to be human in the western world in the late 20th century. Although the word has an official history that dates from 1964, when it was coined to describe a special union of human organism and machine system, over the last decade it has gained a certain notoriety in both popular film culture and specialized academic circles (Tomas 1995: 21).
>
> A cyborg is a cybernetic organism, a hybrid of machine and organism, a creature of social reality as well as a creature of fiction. Social reality is lived social relations, our most important political construction, a world-changing fiction (Haraway 1991: 149).

By thinking of the body as a cybernetic organism, we are widening the possibilities to analyse what constitutes and determines it as an entity. It is possible to extend the notion of body simply by considering the limits of where the body starts and where it ends; where bones finish and prostheses start; which attributes and features compose it and which one have began to constitute it through time, surgical insertions, medical implants, etc.[49]

It is precisely this process of complexity that it is interesting to expose here: when the body is determined by technology the transformation is not only one of the image, implants, medical technologies and technical developments, but occurs in the whole environment, generating a new structure that challenges the notion of limits. New

[49] The work of the French artist ORLAN (http://www.orlan.net/) and her public surgeries, and the work of Cypriot-Australian performance artist, Stelarc (http://www.stelarc.net/), has explored ideas around the boundaries of the body in relation to technology from a variety of perspectives.

ideas about the body and technological subjectivity emerge, defining the way we are produced, the way we perceive ourselves, and the design of private and public spaces. For instance, David Cronenberg's film *eXistenZ* (1999) presents this point of view from the field of video games, showing an immersive system of such magnitude that we cannot differentiate the virtual from the analogue world, losing the sense of playing and amplifying the sense of parallel realities in an ongoing network structure.

Therefore, it becomes fundamental to analyse and to understand how digital media transformed the way networks work within social spaces; specifically focussing on digital networks and interactive virtual spaces as a mode of organisation and systematisation. Considering digital media basically as a series of values in the form of ones and zeros, digital social spaces – digital networks - can be conceptualised as participatory practices within a standard protocol.

> One can pose the question: Is a network a network if it is not being used? Is the Internet a network because of its fiber-optic cables, its usage, its data transfer, the standards for such use, or the concepts that inform the development of network technology itself? Likely all of these. With multiple local agencies and several interests at stake, information networks like the Internet are always about to do something.[50]

Eugene Thacker's quote unfolds a series of questions in relation to networks as a coterie of technological procedures for the defining, regulating, shaping, configuring, and distributing information throughout a flexible infrastructure. The process of concretising this flexible structure has emerged since the beginning of the ARPAnet, and evolved towards HTTP protocols and ".mil", ".ed", ".com", and "@" codifications. The implementation of highly complex codes of communication for the functioning of these networks have created a system where protocols are understood as digital messages that define the syntax and semantics of synchronised communication. As Alexander Galloway argues, "protocol is a system of management that only exists in a space populated by a multitude of independent, vital agents", and continues, "because protocol is agent-specific, it must always be connected to the particular material milieu inhabited by those agents – their spaces and their own material bodies" (Galloway 2004: 82). Galloway then offers the following criteria:

[50] Eugene Thacker´s foreword: "Protocol is as Protocol Does" in Alexander Galloway 2004 book *Protocol: How Control Exists After Decentralization*. Page xiv.

> Protocol is a system of distribution.
> Protocol facilitates peer-to-peer relationships between autonomous entities.
> Protocol is anti-hierarchy anti-authority.
> Protocol engenders localized decision making, not centralized.
> Protocol is robust, flexible, and universal.
> Protocol can accommodate massive contingency.
> Protocol is the outcome (not the antecedent) of distributed behavior (Galloway 2004: 82).

The integration of digital technologies in most aspects of everyday life has transformed the ways we understand social communication. The development of massively networked online video game platforms, the rise of virtual environments for socialisation – such as HabboHotel, a five star virtual hotel created by Sulake Labs in Finland launched in beta mode in 2001; or Second Life, a 3D virtual world completely built by its residents that opened to the public in 2003 – and the emergence of a new generation of cinema display a series of collective questions around the idea of social interactivity. Therefore, the social organisation of protocols – which intrinsically constitutes networks – is that of modulation, communication, participation and control: a political and technological transformation that moves between centralised and decentralised forms of interactivity. In other words, networks of information work as a series of interconnected nodes by relational links, providing users with the ability to create, manipulate and examine bits of information that will be processed as interactive actions.

Multiplayer video games work as a networking structure that defines the *nature* of the game and its possibility of interaction between several interconnected agents (players) that share the same game environment and time in a mutual social way of communication. Therefore, multiplayer video games require the use of networking technologies where players usually compete or cooperate sharing tasks, resources and goals in a common platform independent of geographical distances.

The first multiplayer real time video game was created based on the PLATO system, around 1973[51]. The PLATO system – Programmed Logic for Automated Teaching Operations – refers to the first widespread computer assisted teaching system developed at the Urbana campus of the University of Illinois in 1960s, two decades before the World Wide Web came on the scene. It started as an open computer-based

[51] The PLATO system was shut down in 2006.

educational system that basically connected students and teachers using the same high-resolution terminals, which were linked to a central mainframe. Its main repercussion is the creation of an online community engendered by its communication attribute. PLATO pioneered key on-line concepts such as message boards, chat rooms, graphics, instant messaging, screen sharing, forums and multi-player online games.

Due to PLATO access architecture, video games became increasingly common within this platform. Shared memory areas, standardised terminals, high-resolution graphics display, central computer processing, and the ability to abort display output were some of the crucial features that allowed game developers to design a series of multiplayer online video games that gained interest amongst students and teachers, and quickly spread to other social networks.

In the same way, the increasing development of social networking has provided a platform from where to share, play, entertain, and create virtual spaces for social interaction in unprecedented ways. Talkomatic, Notes, Personal Notes, and Term-Talk were some online chat systems introduced inside PLATO system. For instance, Talk, a chat environment created in the 1980s, is considered as a form of online virtual world where users are connected in real-time. After its creation, the introduction of new additions to the software infrastructure – such as simple multiplayer games and graph sharing – grew into an important online community. At first, it focused on students, academic and University staff, and then it widely spread to business, companies, governments and military purposes. The use of metaphoric concepts to refer to different forms and spaces for social interactions – such as "rooms", "residencies", "worlds", "domes" or "taverns" – were originally designated by network developers and are still in use in online video games and virtual worlds today.

This new sense of online community, in addition to the ongoing development of computer-based simulated environments – or simply virtual worlds – continuously determines a way of social interaction that opens up new possibilities to communicate. Users take the form of avatars as a way of interaction in 2D and 3D worlds, where they can manipulate and model elements and "worlds" from separate

terminals through perceptual stimuli,[52] thus significantly affecting the experience of the user or player.

These online collective spaces work through distributed networks where each "user", "player", or "node" establishes a direct link with another "node" without the need to pass through any kind of hierarchical mediator. This new communicational model is based on concepts of action, adaptation and interaction; responding to social and technological conditions; creating a network of interrelations that affect each of the network members simultaneously and continuously. The potential of these spaces – or "worlds" – is that they can still unfold dynamic behaviours in unusual ways, based on how users or participants use the spaces, against the fixity of predetermined programmed actions.

There are several concepts involved in the production and development of networks for social interaction. Some of the more relevant ideas are related to hypermedia, database, and virtuality. Hypermedia[53] refers to an integrated, programmable and dynamic language that provides graphic access to a diversity of contents – texts, videos, audio, computer graphs, and so forth. Thus, hypermedia opens new possibilities for communication and control of objects and information through hyperlinks in a contingent way. The World Wide Web is one of the most relevant examples of it.

Database is another relevant concept within digital media with big implications on social communications and access to information. The digitalisation of data has made it possible to store and organise information in a completely new way, generating a big transformation in the way we conceive access and means to approach. Accordingly, digital databases have broken with narrative and causal structures, opening alternatives toward non-linear distribution and management of information. Web pages, for example, consist of a large quantity of objects, fragments and samples, defined by html (hypertext mark-up language) programming language,

[52] Most Virtual Worlds present a highly graphic and sound sense of immersion, but is some cases is possible to interact through touch, voice command, and other kind of sensors that capture temperature, pressure, etc.

[53] The term hypermedia was coined in 1965 by Ted Nelson – an American philosopher and pioneer on information technologies – and it is used in relation to non-linear informatics structures.

where the sites are sequential lists of independent elements, images, text blocks, and links to other pages.

To analyse this context of emergence of new contemporary operations it is necessary to understand the diversity of organisational aspects within databases. Databases can be organised relationally or by objects in networks, hierarchies, indexes, and treelike structures, permitting different models of access to information. Video games, web sites, software, and CD ROMs present a variety of interfaces to approach databases, and global connectivity allows the production of complex texts and media objects unfolding exponential exchange and circulation of data.

> Once digitized, the data has to be cleaned up, organized, and indexed. The computer age brought with it a new cultural algorithm: reality → media → data → database. The rise of the Web, this gigantic and always changing data corpus, gave millions of people a new hobby or profession – data indexing (Manovich 2001: 224).
>
> As a cultural form, the database represents the world as a list of items, and it refuses to order this list. In contrast, a narrative creates a cause-and-effect trajectory of seemingly unordered items (events) (*ibid.*, 225).

This non-causal model of networks and interconnectivity unfolds a complex field of studies that can be approached from a post-disciplinary perspective. The concepts of feedback and networks have been widely explored within contemporary forms of art with huge implications in the global cybernetic systems associated to network societies. As I explained before, Internet and digital networks involve specific social and politic characteristics that have been applied from workplaces to a variety of aspects in contemporary life. Therefore, their application and utilisation in current art forms unfold a series of questions about the relationship between technological developments and the way artistic practices integrate technology as a core element for its creation.

Since the late 1960s, the amalgam of aleatory processes in artistic creation started a path of discovering new concepts related to algorithms and technical operations tightly connected to performing arts. Rather than being interested in creating finished art pieces, artists became interested in ongoing processes and feedbacks, as we can

see in the works of John Cage and La Monte Young, among others.[54] In 1966, the project *9 Evenings: Theatre & Engineering*, that took place in the 69th Regiment Armory between the 13th and the 23rd of October, was organised by a group of artists and engineers interested in the relationship between these two fields. In this event, a series of installations and performances were set up by a group of emergent minimalist dance artists (post-modern dance), visual artists and musicians. Robert Rauschenberg, John Cage, David Tudor, Yvonne Rainer, Deborah Hay, Robert Whitman, Steve Paxton, Alex Hay, Lucinda Childs and Öyvind Fahlström were some of the artists involved in the performance series together with a group of thirty engineers and scientists from the renowned Bell Telephone Laboratories in United States.

This experience was organised by the E.A.T. – Experiments in Art and Technology – a group founded in 1966 by Billy Klüver (1927 – 2004), Robert Rauschenberg (1925 – 2008), Robert Whitman (1935 –) and Fred Waldhauer (1927 – 1993), and presented to the press in 1967. Nevertheless, the origins of the E.A.T. are rooted between 1960 and 1965 as the starting point of a collaboration between Klüver – an engineer of the Bell Telephone Lab himself – Robert Rauschenberg and Jean Tinguely. Within this period, two art pieces were decisive in the creation of a truly non-hierarchical collaboration between artists and engineers: *Homage to New York* (Tinguely, 1960) and *Oracle* (Rauschenberg, 1965).

Jean Tinguely's *Homage to New York* was a self-destructive sculpture – a suicide-fated machine made out of a meteorological trial balloon, bottles, an upright piano, a go-cart, a bathtub, hammers and saws, 80 bicycle wheels and other items picked from New Jersey dumps – presented at the New York Museum of Modern Art's garden in 1960. Klüver designed the technical system for the creation of the piece and then continued working with Rauschenberg on the creation of *Oracle*, an interactive sculpture consisting of five pieces that generate a highly technical sound environment. This was considered a milestone in terms of a new relationship that divested the engineer from the role of technical assistant, opening a new model for artistic collaboration in relation to technological developments: a non-hierarchical

[54] Clearly, this new interest in aleatory processes is not strictly related to the utilization of technologies in artistic creation. However, the mass introduction of technical developments in everyday life determined a new way to understand certain processes and concepts that had repercussions on several artists at that time.

relationship between art and science. Another E.A.T. production that is worth mentioning was the Pepsi-Pavilion at the world's fair Osaka Expo '70 in Japan, under the theme of "Progress and Harmony for Mankind". For this occasion, the E.A.T. set up a multimedia project involving more than seventy-five artists and engineers.

Fig 3.2 David Tudor, *Bandoneon! (a combine)* Performance presented at the *9 Evenings: Theatre and Engineering*, New York, United States, 1966. Still from the factual footage shot in 16 mm film by Alfons Schilling.

Within the E.A.T. there were groups exclusively dedicated to the creation and adaptation of objects and technical devices such as amplifiers, decoders, sound and image controllers, screens and projection systems. The idea was to generate technical material to be able to experiment with the construction of wireless devices that could be assembled in series, generating a complex system specifically for each artist. Within this period, some relevant gadgets used in everyday life were developed, such as remote control for electronic equipments, wireless telephones with rechargeable batteries, and a series of body-machine interfaces for the controlling and interaction of

mechanisms. Some of these devices utilised new technologies available in the market such as electrodes to measure brain waves, or infrared cameras to see in the dark.

Therefore, it can be said that the E.A.T. proposed a series of elements that not only have been applied to specific performances or art pieces, but that have opened new ways to understand the relationship between bodies and machines, adapting technology to bodies' movements and vice versa.

It is precisely this alliance between art and technology which enabled changes in perception of new experiences in performing arts, thus helping to transform the way audiences approach artistic and performative creation. The press release for the *9 Evenings: Theatre and Engineering* festival states:

> MAINTAIN A CONSTRUCTIVE CLIMATE FOR THE RECOGNITION OF THE NEW TECHNOLOGY AND THE ARTS BY A CIVILIZED COLLABORATION BETWEEN GROUPS UNREALISTICALLY DEVELOPING IN ISOLATION. ELIMINATE THE SEPARATION OF THE INDIVIDUAL FROM TECHNOLOGICAL CHANGE AND EXPAND AND ENRICH TECHNOLOGY TO GIVE THE INDIVIDUAL VARIETY, PLEASURE AND AVENUES FOR EXPLORATION AND INVOLVEMENT IN CONTEMPORARY LIFE. ENCOURAGE INDUSTRIAL INITIATIVE IN GENERATING ORIGINAL FORETHOUGHT, INSTEAD OF A COMPROMISE IN AFTERMATH, AND PRECIPITATE A MUTUAL AGREEMENT IN ORDER TO AVOID THE WASTE OF A CULTURAL REVOLUTION.[55]

Therefore, it can be said that the relationship between performance, body and contingent technological developments directly affects the field of visual and performing arts, also influencing a variety of aspects of social communication and interactions. In order to analyse this relationship it is necessary to understand how the body is being modified, intervened and associated with technology, its uses, devices and operations. Words such as cyborg, cyberspace, hybrid, android or morphing have not exclusively stayed within the scientific or science fiction spheres; rather, they have permeated a context of influences in new fields of production in an objective and subjective way.

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[55] Robert Rauschenberg and Billy Klüver, (untitled) E.A.T. News 1:3 (November 1, 1967): 5. Reproduced in all- caps, as it originally appeared. Also quoted in *The New Media Reader* pg222. See also the catalogue *9 Evenings Reconsidered: Art, Theatre, and Engineering, 1966*, edited by Catherine Morris for the retrospective exhibition on the event at the MIT List Visual Arts Center in 2006. Cf. Johannes Birringer, *Performance, Technology and Science* (New York: PAJ Publications, 2008), pp. 75-83.

Ideas on Digital Performance

> Often it is precisely those places in culture that appear politically innocent that are at the end of the day the most politically charged (Galloway 2006: 95).

The hyper-mediatisation of social production through computers, digital technologies, and information networks has transformed the idea of performance, particularly in the field of performing arts. The incorporation of media technologies has allowed the emergence of a fertile site for experimentation and theorisation on the role of digital media within embodied practices. The articulation of a series of discourses about the specific relationship between performing arts and digital media serves as a starting point to study digital performance as an open sphere for experimentation rather than as a disciplinary artistic field.

There are a series of new viewpoints and approaches that have been exposed through journals, colloquiums, laboratories, and so on, thus generating an ongoing process of discussion and experimentation within the artistic field. Moreover, numerous authors, theorists and academics have written about new media and digital technologies, also generating a background from which to approach digital performance. Nevertheless, it is not possible so far to approach the field of digital performance from a close or partial viewpoint. Hence, I will present here some relevant ideas that more or less will give us a frame of reference with which to analyse digital performance.

Steve Dixon (Professor of Performance at Brunel University, London) in the introduction of his book *Digital Performance: A History of New Media in Theater, Dance, Performance Art, and Installation* (2007), states: "We define the term 'digital performance' broadly to include all performance works where computer technologies play a *key* role rather than a subsidiary one in content, techniques, aesthetics, or delivery forms" (Dixon 2007: 3). Dixon's definition comprehends a vast range of disciplines and aesthetics, such as:

> [L]ive theatre, dance, and performance art that incorporate projections that have been digitally created or manipulated; robotic and virtual reality performances; installations and theatrical works that use computer sensing/activating equipments or telematic techniques; and performative works and activities that are accessed through the computer screen, including cybertheatre events, MUDs, MOOs, and virtual worlds, computer games, CD-ROMS, and performative net.art works (*ibid.*, 2007).

Johannes Birringer (choreographer, media artist and Chair in Drama and Performance Technologies at Brunel University, London) in his book *Performance, Technology, and Science* (2008), contextualises digital performance as performances that rely on the use of digital interfaces for its creation. Chris Salter – a media artist and performance director – in his book *Entangled: Technology and the Transformation of Performance* (2010), explains that digital technologies "provided live performance the opportunity to incorporate the techniques of digitally augmented fin de siècle blockbuster cinema" (Salter 2010: 161). For Salter, new technical possibilities applied to performance display the degree of integration of digital technologies into contemporary performance practices.

Within this context, it can be said that even when a strict definition of digital performance has not yet been coined – and probably is not even necessary – the idea of creating performing art work that utilises digital technologies as a core element for its creation can be analysed and integrated to the digital performance pallet. A few years ago it was still appropriate to use the term "multimedia" to refer to performance pieces that utilise any kind of digital technologies. Nowadays, the specificity of those concepts and the diversity of uses of technologies on stage – such as sensors, MIDI signals, any sort of motion capture, digital cameras, digital projections, telematics, real-time streaming, online networks, among others – do not strictly refer to interactive or multimedia processes, inscribing digital performance as the best way to index these kinds of art pieces.

This openness of the *field* allows us to understand that digital performance is not yet a closed cluster of theories that pretend to conform a new institutional discipline; rather, I prefer to think of digital performance as a *field* of tensions and wide discussions, where any possible analysis is integrated into an ongoing net of knowledge regarding the relationship between a performer body and the utilisation of digital technologies.

The path established in this research highlights the introduction of technology as a common place in performance spaces. Therefore, with the introduction of computers and digital tools, this course becomes one strictly related to digital media.

Scientific developments, informatics, computers, virtual worlds, artificial intelligence, and robotics are only a few aspects that play a key role in the establishment of a strict

relationship between artistic practice – in this case performing arts – and scientific and technological methods. The utilisation of new media in contemporary art allows us to emphasise the idea of a massive cultural transformation.

It is my belief that nowadays is necessary to reflect on the idea of disciplines and the blurring of the boundaries between technological and scientific development, labour studies, and artistic practices. Large-scale nets, such as the Internet, permit a new degree of connectivity, playing a particularly significant role in the unfolding of new conceptual questions regarding the limits and new possibilities within art creation and communication. “Finite distinctions apply less and less” (Dixon 2007: 3) and the possibilities to integrate new media to performance art grow in diversity adjusting new technologies to performance aesthetics. This ongoing process of adaptation configures a complex dialogue where the position of the performer in relation to technologies is increasingly problematised.

One central question regarding this process is the dematerialised presence of the body, where the performer is extended through technical devices, specifically referring to the use of avatars, online streaming, virtualisation, and motion capture. Another relevant aspect is how technological devices can affect or determine the movements and gestures of the performer. The utilisation of sensors, cameras, and devices for motion capture (MoCap) such as image, optical, inertial, acoustic and magnetic sensors, exo-skeleton and LEDs utilised to track different aspects of performer movements can amplify, simulate and define the movements of the dancer, transforming them into encoded digital data: virtual bodies. “The idealised virtual body does not eat, drink, urinate or defecate; it does not get tired; it does not become ill; it does not die” (Lupton 1995: 100). Furthermore, I will present some examples of the introduction of technical devices within performing arts since the 1960s, in order to establish a historical basis that will be develop in a future PhD research. Therefore, this chapter is not a conclusive one, it rather proposes a historical ground from where, under my perspective, it is possible to introduce new analytical ideas on the development of digital performance as a field of study and experimentation.

Fig 3.3 Members of Merce Cunningham troupe dance around Moog's antenna during performance, still from video *Variations V* (1965).

Since the 1960s, research on movement appears again as a new possibility of composition for electronic musicians. The collaboration between musicians, technicians, painters, sculptures and dancers opened up exciting explorations that at the time generated a new artistic avant-garde, specifically in United States. Merce Cunningham, Gordon Mumma, David Tudor, and John Cage created a piece in 1965 that is considered a milestone in terms of capturing the movements of the dancer through sensors on stage that controlled sounds and images. Cunningham's collaborations unfolded a completely new form of exploring the body as a generator of data that can be associated with the production of sound, music, images, lighting, volumes, or any other controllable aspect.

> It would not be an exaggeration to say that *Variations V* and subsequent experiments from Cunningham, Cage, and their tight–knit collaborators set up the foundations for much contemporary work in dance and technology that so many today feel is unprecedented. Described by collaborator Gordon Mumma as 'a superbly poly': –chromatic, –genic, –phonic, –meric, –morphic, –pagic, –technic, –valent, multi–ringed circus (Salter 2010: 237).

During the 1980s and early 1990s David Rokeby – a Canadian electronic, video, and installation artist – designed a system to compose music by capturing images through a video camera. This system was called Very Nervous System (VNS), "a hardware- and software-based tool incorporating infrared, camera-based sensing and computer vision techniques together with a set of corollary interactive installations that deployed the system" (*ibid.*, 328). This video tracking system enables the detection of the body through its pixelated image, focussing in mathematical analysis of contrasted shapes and movements. VNS helped to indicate the existing complexities and differences between the utilisation of sensors that capture physical conditions (weight, position, pressure, rotation, etc.) and the capturing and retaining of the image of the body, to then decide which aspect of the image will be used as data to control and generate media. Therefore, VNS has been very important for the later development of possibilities for dance and motion capture tools, particularly transforming the idea of how to gather information from the body, and how to amplify the possibilities and amount of data that can be generated through movement.

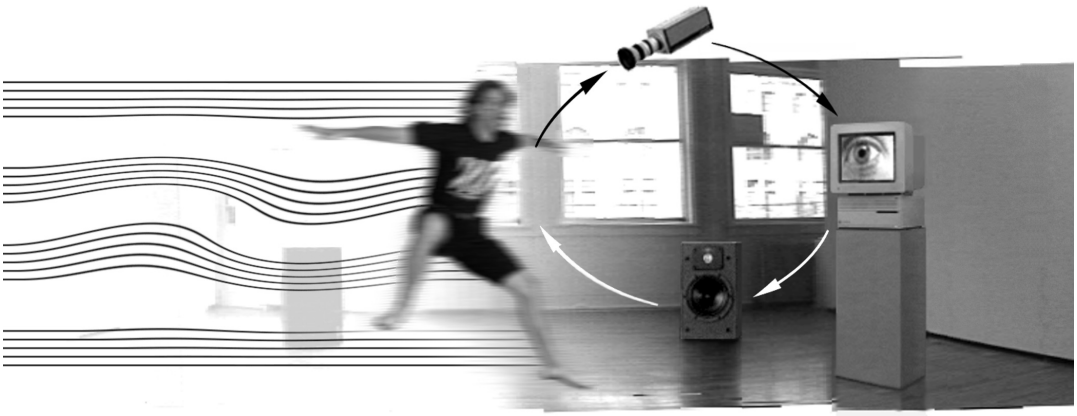

Fig 3.4 David Rokeby, Scheme of Very Nervous System. Copyright 2000 David Rokeby.

> While the 'sound' of the system and the 'dance' of the person within the space are of interest to me, the central aspect of the work is neither the 'sound' nor the 'dance'. It is the relationship that develops between the sounding installation and the dancing person that is the core of the work (Rokeby 1990: n.p.).

At the same time, Merce Cunningham continued his explorations with a group of designers, programmers and dancers that focussed on the development of a 3D

animation software for dance performance.[56] The idea was to integrate a 3D modelling environment in a timeline-based structure in order to create, visualise and store movement and choreographic sequences, thus facilitating and broadening dance creation and its technological applications. This process allowed the generation of digital set of movements that, at the beginning, intended to improve the way choreographies were taught.

During the design of Life Forms, the team of developers realised that the software did not only serve as a tool for notation – in the way Laban comprehended the concept – rather, the software allows analysing and understanding movement, and even extends the documentation of movements through completely digitalised body images. Then, the physical possibilities of muscles-and-bones dancers that respond to pre-determined physical influences such as weight and gravity within a concrete space, can be compared to the capacities of virtual dancers that move through digital environments capable of an infinite – and humanly impossible – variety of postures and movements. Hence, within a discipline that historically has dealt with aesthetic implications involving dexterity and virtuosity, the limits of an analogue body are contrasted with the capabilities of a digital one. Thus, as Johannes Birringer agues in his article "Dance, the Body and the Internet" (2003), it established a new problematisation within the field of dance.

> This is no longer the modernist notion of composition; rather, the programming of an environment resembles a kind of postproduction of recording/recorded data, since interactivity uses the input from the tools of connection and manipulates, mixes, and remixes the samples, which in the case of dance includes bodily movements, gestures, sensations. The emphasis has shifted from the object of representation to the emergent situation, and the materialization of technology, itself (Birringer 2003: n.p.).

In a context of scenic and performatic creation with integration of new technologies one of the most well known programming environments is MAX/MSP: A software utilised for audiovisual applications in real time. MAX/MSP is a highly modular visual programming language created at the IRCAM by Miller Puckette – and named after the computer music pioneer Max Vernon Mathews (1926 – 2011) – and was later developed further by the software company Cycling '74 in San Francisco, United

[56] The team was composed by Zella Wolofsky, a kinesiologist; Tom Calvert, a computer scientist and engineer; and the dancer and computer media artist Techla Schiphorst.

States. MAX/MSP is a software that gives composers access to interactive computer systems through patch construction. Other softwares have been designed following a similar system than MAX/MSP. For instance, Pure Data (Pd) is another programming environment also developed by Miller Puckette and a group of programmers at the IRCAM. Hence, Pd stands as a refined open source version of MAX/MSP that allows a more freely connection to MIDI and audio applications. Another example, now widely used within digital performance, is the software Isadora (named after the dancer Isadora Duncan). Initially created by Mark Coniglio, co-director of the media dance company Troika Ranch, Isadora is a graphic programming environment to control interactive digital media, with special emphasis on real-time manipulation of digital video.

> We can look at the MAX/MSP software as an example of interactive systems and encounter specific design features that organize the relational architecture in the dance environment. MAX is a graphical programming scenario for patchbays that allow the building of controllers for real-time media performance such as sound. MSP is a set of powerful audio extensions to MAX that allows us to design our own real-time synthesis and signal processing algorithms with MAX's programming interface. We can use MAX to build intricate control structures that exploit the potential of interactive audio. On the one hand, then, the MAX environment implies setting up what Richard Loveless and John Mitchell describe as a 'global media controller' which -- linked to a video/computer-controlled movement sensing system -- organizes the sonic and graphic output for the sensing system (*ibid.*, 8).

Another relevant aspect within the field of digital performance is the possibility to auto-analyse the dancer's movement, in other words, to keep a propioceptive relation with the body and its movements through technological environments. The Brazilian dancer Ivani Santana in her book *Corpo Aberto: Cunningham, Dança e Novas Tecnologias* (2002), reflects upon an "open body" (a corpo aberto), establishing an aesthetic that arises from the utilisation of sensors, cameras, digital video, lasers, scanners, and specific software and hardware on stage, co-existing and co-developing a specific language of the body, presenting a new approach to performance art creation.

Fig. 3.5 Visiting avatars walking around the virtual UKIYO © 2009 Courtesy of Kabayan/Inetdance.

The interactive use of digital media, in addition to new available devices, allows a series of changes that directly affect the perception of a mediated body, thus establishing a state of constant possibilities in the way the body is captured, converted into data, and presented within the field of digital performance. The utilisation of live and recorded data of – and from – the body in performance is, therefore, versatile and mouldable, where, in some cases, can generate a sense of virtual corporeality that is entangled to the media apparatus. In other words, we are facing a body that allows changes, a body that transforms and it can be transformed, that can be adapted to different velocities of variations, permitting a constant and permanent state of alteration.

It is precisely this variety of possibilities within digital media for data transfer, connectivity, networking, and the establishment of protocols and flexible systematisation that allows the appearance of a mediated body connected and entangled to exogenous digital machines. The emergence of a different organisational paradigm that find its roots in the establishment of work-science and performance management, is now augmented with digital media, opening up a variety of ideas on art creation and, thus, integrating a whole analysis on how contemporary arts relate to

contingent processes. As I explained in the first part of this chapter, the new productive paradigm of post-Fordism relies on digital devices and computational operations, The development of technology, the introduction of computers, robotics, software, networks-based organisations, information and communication services, in addition to the team-based organization of workers that solve problems and look for new solutions created a substantial change of productive paradigm, thus, establishing flexible patterns of production and consumption.

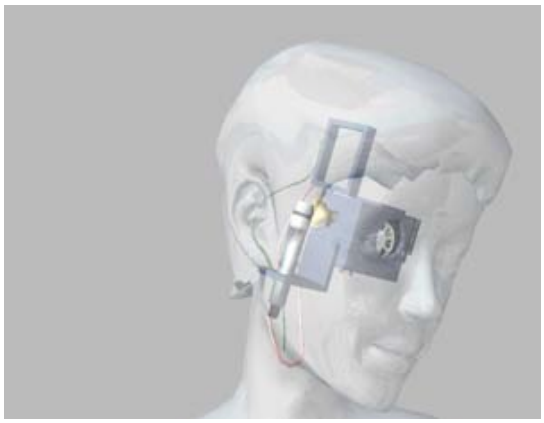

Fig 3.6 and 3.7 Virtual dancer prototype, *Quartet* Project, London © 2007, Quartet Project.

Rifkin's statement: "A new era of production has begun" (Rifkin 1995: 81), can not only be applied to the massive transformation within industrial and economical production, but also manifests a change in the productive paradigm for art creation that should be analysed from a new model of behaviour closer to digital operating than to classical techniques of presentation and creation. Consequently, post-Fordism can be acknowledged as an emergent signature for the contemporary age presenting some relevant concepts from where to unfold further analysis in relation to performing art creation.

Conclusion

In a time when technological developments produce constant transformations in our environment, it becomes necessary to analyse the implications of this phenomenon within the social and artistic arena. Developments in informatics have transformed communication interfaces, organisational systems, management standards, spatial and temporal relationships, thus establishing a distributed system of protocols and codes held to the methods by which we socialise, create and produce. The impacts of technological and economic forces shape the way we relate to labour efficiency, creative production and communicational infrastructures. Consequently, throughout this thesis I have examined a variety of aspects that open up questions regarding the relationship between technical developments for labour efficiency and the introduction of *new* technologies within performing arts.

Since the late eighteenth century, technical and scientific development related to thermodynamics, mechanics, motors and vast engineering procedure established a particular perspective on work-science as an analytical tool, as a method to promote efficiency and welfare, and as a coordination element that can be analysed as an epitome of a vast cultural process of technological adaptation. Nevertheless, the analysis aforementioned does not intend to establish a fixed viewpoint from which it would be possible to read this mass phenomena; rather, it introduces some relevant concepts from where to trace the relationship between performing arts and work-science studies, mainly focusing on two different historical periods: Taylorism and Fordism. This thesis also introduces some ideas on current digital technologies, the development of post-Fordism and an experimental field of digital performance.

In the first part of this thesis I present the work of Loïe Fuller and Marie Leyton as a reference to understand the introduction of electricity and early photographic experiments within performing arts at the turn of the century. The work of the "electric dancers" establishes a direct link to Taylor's time-and-motion studies where the capacities of the workers was strictly measured in relation to economy of gesture and productivity. The implementation of technical developments within work-science and music hall spectacles unfolds new paradigms regarding movement, efficiency, and the utilisation of time and space. Hence, it can be said that since the late

nineteenth century a process of rationalisation of technical developments led to a double-sided adaptation between movements, gestures and technical devices, particularly in the field of performing arts, music hall, entertainment culture and labour studies.

In the second chapter, my analysis shifts to the aesthetical implications of Fordist mass production systems and the idea of dynamic assembly lines during the twentieth century. In this case, the performance of the Tiller Girls in Europe and the United States stands out as a vast cultural exponent of serialised production in a fully harmonised organisation of movements. In a time when technical developments allowed a continuous upgrading of the social sense of rhythm, speed and coordination, the analysis of movements and gestures in time and space became essential for the establishment of a vast transformation of the organisational apparatus behind productivity. The film *Metropolis*, directed by Fritz Lang, has been introduced to complement the analysis on hierarchical organisations of Fordist industries, thus integrating a cinematic perspective on the idea of the body within social hierarchies for work. Therefore, the main idea within this second part was to establish a correlation between Fordist approach to mass production and hierarchical organisation to one within entertainment culture in both cinema and the performance of the Tiller Girls.

The last chapter of this thesis presents some general ideas on Post-Fordism's systematisation and the emergence of new productive and coordination paradigms based on digital media, networks, protocols and time-diminishing technologies, specifically focusing on organisational structures. Particularly relevant for this chapter is the introduction of digital performance as an experimental field in which it is possible to examine the utilisation of digital media, video game technologies and social network structures. This chapter does not conclude with a specific correspondence between these two fields of study, it rather unveils a possible perspective for a deeper analysis.

Nevertheless, the relationship between embodied performance practices that integrate technological aspects for its creation, and the constant development of technical and technological devices, has become a heterogeneous field of production. It is now possible to approach the relationship between performing art and technology from a variety of perspectives, focusing on how this relationship has constantly affected

embodied practices in a wide sense. That is to say, technological developments applied to performing arts at different historical moments have unfolded new ideas regarding the body and its surrounding environment; explicitly determining a specific conception of the productive body within industrial environments and the performer body within embodied art practices. It is my belief that the relationship established between work-science studies and performing arts has allowed a process of complementary adjustments, where the extreme forms of rationalisation applied to industrial labour have shaped the development of performing arts. Physical interrelationships in addition to experiments and measurements of a body's capacities permit a critical approach to artistic experimentation regarding human-machine interaction. This vast field of exploration tends to comprehend the body as an incorporated and active element within a system that largely surpasses human capabilities, questioning the limits of embodied experiences in a constant re-conception of the body.

Since this research does not attempt to create a close perspective on the study of performing arts that utilises technology as a core element for its creation or aesthetic, I present an analytical context from where it is possible to understand the correlation between technical development for labour and its aesthetical implication in embodied art creation. Therefore, the introduction of labour studies within artistic practices open up a particular field of analysis; a place from which one can build a series of relationships in order to construct a critical approach to the role of performance practices, the organisational system, and the understanding of human-machine interfaces.

Finally, I would like to highlight that although technological transformations have had a vast cultural impact, what is relevant for this research is the way technologies are inscribed within artistic realms. Technological developments have determined a conceptual and aesthetical reconfiguration of performing arts in different periods, thus opening new experimentations within physical, mediated and virtual spaces. Therefore, it can be said that the integration of technologies within these practices allows, not only an analysis of facts, but also a more conceptual and philosophical approach that focuses on constant technological transformations as a reflexive axis to understand how the body is produced within technological environment. Consequently, this thesis stands as a basis from where to unfold further analysis, in an

attempt to establish a solid framework from where to reflect upon the field of performing arts and digital performance.

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