‘MEMES’ AND ‘MEMETICS’ IN INDUSTRIAL PRODUCT DESIGN

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ABSTRACT

The main purpose of this study is to introduce and explain the terms ‘meme’ and ‘memetics’ with a brief description of the principles of natural selection and survival of the fittest rule in Biology. It also shows that memetic and genetic evolution are subjected to the same basic principles. With the help of memes, the study focuses on the idea that the principles of evolution of Industrial Product Design ideas work similar to the principles of natural selection in Biology and analyses the world of Industrial Product Design from a Darwinist point of view. Therefore, design ideas are presented as memes, mostly built on previous ones within the case study of *typing* including keyboards, keyboard layouts, and some functional keys. As a conclusion, the study suggests Biology and memetics to be put to practical use in Industrial Product Design world beside other sciences.

ÖZET

Bu çalışmanın temel amacı ‘mem’ ve ‘memetik’ kavramlarını tanıtıp açıklamaktır. Biyolojik evrim ve doğal seleksiyon prensipleri hakkında da kısaca bilgi verilerek memetik evrim ve genetik evrimin temel prensiplerinin benzerlikleri üzerinde durulmuştur. Memlerin yardımıyla Endüstri Ürünleri Tasarımı evriminin organik evrimle benzerlikleri gösterilmiş ve Endüstri Ürünleri Tasarımı dünyası Darwinist bir bakış açısıyla incelenmiştir. Bu nedenle, tasarım fikirleri genellikle kendinden öncekilerin üzerine kurulan memler olarak sunulmuştur. Örnek olarak ise, *klavye ile yazı yazma* (*typing*) davranışı incelenmiştir. Bu davranış oturmuş ve çağlar boyunca aktarılmış memetik bir model olarak değerlendirilmiş ve yazı klavyelerinin – klavye dizilimi ve bazı özel tuşlar da dahil olmak üzere – mekanik, elektronik ve dijital evreleri incelenmiştir. Sonuç olarak çalışma, tasarımcıların ve araştırmacıların, hem teoride hem de pratikte, diğer bilimlerin yanında faydalanabilecekleri disiplinler olarak Biyolojiyi ve memetiği öne sürmektedir.

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CHAPTER 1

INTRODUCTION

The main themes/topics discussed within this study are the terms ‘meme’ and ‘memetics’, memetic behavioral patterns in Industrial Design and the analogy between biological evolution and the evolution of design ideas/industrial products. The Darwinian principle of natural selection is expanded, and is regarded as working not only on genes but also on memes, thus design ideas.

The term meme was invented and introduced by Richard Dawkins - a Darwinian zoologist - in 1976; today it is being used in many different disciplines for finding out memetic patterns of that discipline in order to analyse and improve its current and future conditions. That is, the importance of memetics in evaluating products and/or systems has been realised. For example, it is being used as a tool in understanding semiotics of evolution of knowledge, social system dynamics, models of consciousness, art and other areas. Since the evolution of industrial products and the evolution of design ideas behind those products are analogous with biological evolution and the principles of natural selection, it is possible that memetics could be the most beneficial to Industrial Product Design, because memes are also analogous with genes as replicators. Here, evolution of industrial products is not a progression of designs from primitive and simple structures into advanced ones or into new technologies. It is a co-evolution of the products and their environment within changing circumstances. Thus, memes and memetics are useful patterns to be considered by product designers through their design processes and by design history researchers.

Dawkins started off by accepting the fundamental principle that all life evolves by the differential survival of replicating entities, such as genes, and then expanded this fundamental principle to include not only genetic transmission, but also cultural transmission. A lot of debates have been made on the definition of meme and its concept since Dawkins’ suggestion of the idea of memes. Sometimes they are mentioned in this study as proponent and opponent ideas as to light the way through memes in Industrial Design.

Since the main terms of the study is analogous with biology the study is sometimes directly sometimes indirectly related to it, but never stuck into biology. While analysing the evolution of behavioral patterns in industrial design, the study makes use of biology. Whether Darwin was right or wrong, principles of natural selection are true or not, memetics is a science or not are out of this study. Principles of natural selection just have a complementary contribution to design practices and to analysing behavioral design patterns, thus they are discussed. Apart from those, while introducing memes and memetics it is assumed that memes are replicated only by imitation between humans and again it is assumed that only human beings have memes, the discussions of animals having memes are out of the limits of this study.

Although the terms are introduced in 1976, some important studies are recently being done about it in Industrial Design. Especially among the Industrial Design thesis in Turkey, there is a gap of memetics point of view. The reason to pick such an unknown topic is to present and explain it to Industrial Design world and to show how industrial product designers can benefit from memes and memetics.

The expected contribution of the study to industrial design discipline is showing how to find out industrial design memes with an example of behavioral patterns of typing. Memetics could be useful for product designers in practical. For example, being aware of the behavioral patterns that shaped a product will also help to shape its future. A designer should analyse why a product is designed like the way it is. Memetic patterns are helpful for the designers to understand the reasons and the conditions that have given the product its form. For this reason, to evaluate a product memeticly is important for its future, it is necessary to realize the settled behavioral patterns of the users about the product. In addition, in theoretical, it is necessary for the design history researchers and design evolution studies too.

1.1. Aims of the Study

1. Introducing and explaining the terms ‘meme’ and ‘memetics’ with a brief explanation of the principles of natural selection and survival of the fittest rule in Biology, and looking over the requirements for biological evolution. Thus, showing where ‘meme’ as a replicator derives from.

2. Memetic and genetic evolution are subjected to the same basic principles of blind variation and natural selection based on survival of the fittest rule. With the help of memes, there is the aim of showing that the principles of evolution of Industrial Product Design ideas work similar to the principles of natural selection in Biology.

3. Natural selection is not just a law of Biology but pertained to all sciences, including the mind. Therefore, another aim is, explaining Universal Darwinism and revealing the advantages of looking and analysing Industrial Product Design world and its history with a Darwinist point of view. That is to say, suggesting Biology as a helpful and useful science for Industrial Product Design to be put to practical use beside other sciences.

4. Presenting design ideas as memes, mostly built on the previous ideas and inventions of others. Which memes spread and which ones die reflects the dynamics of the society of individuals hosting them.

5. Analysing *typing* as a transmitted and settled behavioral pattern and analysing some designs (keyboards, keyboard layouts, functional keys) that this pattern formed for years with a memetics point of view.

1.2. Methods of the Study

One of the methods used during the overall study is *documentary review*, which has the advantage of getting comprehensive and historical information about the topic. Critical reading is done through the existing information in books, articles, online articles, online journals, proceedings of international conferences, lecture notes etc. This method is used in order to review all the possible information and present the topic without interrupting it.

Secondly *observation* method is used which has the advantage of viewing operations of the topic as they are actually occurring and has the advantage of adapting to events as they occur. It is used in order to gather accurate information about how the subject of the study actually operates, particularly about processes.

Finally, *case study* is done in Chapter 3. Related keyboard examples are examined since the case is typing. Its purpose is to understand and depict user's experiences and customs in typing and conduct comprehensive examination through cross comparison of cases. It has the advantage of describing user's experiences in subject input, process and results, and it is a powerful method to portray the subject to outsiders.

1.3. Outline of the Study

This thesis is organised in two chapters throughout the aims:

Chapter 2 provides a theoretical outline at first before going in to the specific focus of the research. It consists of seven parts. First, memes and their analogy with genes are explained broadly, giving brief information about the theory of biological evolution. Also referring to some discussions about memes, some assumptions are made as to be practical throughout the study. Then, referring to Salingaros and Mikiten, modernist architecture is analysed from a memetics point of view. Afterwards, Langrish's objection to the definition of memes as units instead of patterns is revealed and different types of memes are introduced according to Langrish. Then, the eight principles of natural selection thus biological evolution are explained and the similarities between biological evolution and product design evolution is emphasized utilizing the term Universal Darwinism. Finally, memetics is explained and the online journal called Journal of Memetics - Evolutionary Models of Information Transmission (JoM-EMIT) is introduced.

Chapter 3 consists of four parts. Through the first three parts, theoretical information about design evolution is given by referring to many authors. The main idea is: designers or inventors generally build on what other designers have designed, in practice they can not start from scratch generally. With this claim, step by step evolved products and/or co-evolved products are being suggested as better designs in general. Within this context, the word design is questioned. In the last part, typing is chosen as memetic behaviour. The memetics of QWERTY keyboard layout and the Shift key meme is put into practice, analysing the mechanical, electric and digital phases of these memes.

CHAPTER 2

MEMES AND MEMETICS

A meme is a self-propagating unit of cultural evolution having some resemblance to the gene (the unit of genetics). The difference lies in the replicative potential and minimal resources required for replication. Memes can represent parts of ideas, languages, tunes, designs, motifs, skills, moral and aesthetic values, theories, practices, habits, dances and moods or anything else commonly learned/absorbed and then passed on to others. The science memetics has emerged as the study of evolutionary models of information transfer.

Memes have as their fundamental property evolution via natural selection in a way very similar to Charles Darwin's ideas concerning biological evolution. Because they are subject to replication, mutation, survival and competition, one can speak of memes evolving. For example, while one idea may become extinct, others will survive, spread and mutate - for better or worse - through modification. This happens through the meme's ability to keep *attention* focused on itself. In this way, memes appear to 'compete' for survival. The 'fitness' of a meme generally relates to its ability to have attention focused on it, because attention maintains the meme in discussion and allows it to propagate, spreading to new minds and other media. Characteristics that can give longer 'life' to memes may include interest (the ability to pique curiosity) and relevance to given situations.

The conception and study of memes is memetics which consists of the formal study of memes. Memetics takes concepts from the theory of evolution (especially population genetics) and applies them to human culture. Memetics also uses mathematical models to try to explain many very controversial subjects such as religion and political systems.

Memeticists generate much memetic terminology by prepending 'mem(e)-' to an existing, usually biological, term or by putting 'mem(e)' in place of 'gen(e)' in various terms like meme pool, memotype, memetic engineer, meme-complex etc.

2.1. Introduction to Memes

The term *meme* was invented and first introduced by Richard Dawkins -a Darwinian zoologist- in his book *The Selfish Gene* in 1976. Briefly, Dawkins explains biological evolution which does not happen for the good of the species, nor for the group or the individuals. It is purely for the benefit of the genes themselves. Although selection takes place largely at the individual level, it is the information in the genes that is copied. They are the replicators and it is their competition that drives the evolution of biological design (Dawkins 1989). As a true replicator, genetic competition drives the evolution of biological design: "A replicator is something that copies itself, though not always perfectly. The environment must be one in which the replicator can create numerous copies of itself, not all of which can survive" (Blackmore 2000a: 114). The DNA coded 'selfish' gene is not the only replicator on this planet according to Dawkins; he introduces in the last chapter of his book the other 'selfish' replicator; the *meme*:

> Examples of memes are tunes, ideas, catch-phrases, clothes fashions, ways of making pots or building arches. Just as genes propagate themselves in the gene pool by leaping from body to body via sperms or eggs, so memes propagate themselves in the meme pool by leaping from brain to brain via a process which, in the broad sense, can be called imitation (Dawkins 1989: 192).

Dawkins derives the term from the word 'mimeme', a Grecian-derived word. Then he abbreviates mimeme to *meme* that sounds a bit like 'gene': "… it could alternatively be thought of as being related to 'memory', or to the French word *même*. It should be pronounced to rhyme with 'cream'" (Dawkins 1989: 192).

Susan Blackmore is one of the significant proponents of memes, memetics and evolutionary theory; she contributes to the spread of *the meme meme* with her books, academic articles and her website:

> By 1998 the term had entered the English language and first appeared in the *Oxford English Dictionary*, defined as follows; ***Meme*** (mi:m), *n. Biol.* (shortened from *mimeme* ... that which is imitated, after GENE *n.*) "An element of a culture that may be considered to be passed on by non-genetic means, esp. imitation". This means that whatever is copied from person to person is a meme. Everything you have learned by copying it from someone else is a meme; every word in your language, every catch-phrase or saying. Every story you have

> ever heard, and every song you know, is a meme. The fact that you […] wear jeans and a T-shirt to work are memes. The style of your house and your bicycle, the design of the roads in your city and the colour of the buses - all these are memes. [...] They are the very behaviours and artefacts that fill our lives. They are whatever is copied (Blackmore 2002).

2.1.1. Definitions of Memes and Memetics

The definition of memes varies widely, from very broad to very specific and with these technical accounts:

The Oxford English Dictionary defines memes as: "meme /mi:m/ n. L20.(f. Gk mimema. that which is imitated, after GENE.) Biol. An element of a culture or system of behaviour that may be considered to be passed from one individual to another by non-genetic means, esp. imitation" (qtd. in Blackmore 1999a).

The meme - whatever form it may take - is passed on by imitation. It is tempting to consider memes as simply 'ideas', but more properly, memes are a form of information according to Blackmore (2000a; 1999b: 56).

It is an observable cultural phenomenon, such as a behaviour, artefact or an objective piece of information, which is copied, imitated or learned, and thus may replicate within a cultural system. Objective information includes instructions, norms, rules, institutions and social practices provided they are observable (Gatherer 1998).

An idea or information pattern is not a meme until it causes someone to replicate it, to repeat it to someone else. All transmitted knowledge is memetic (Grant 1990).

It is an information pattern, held in an individual's memory, which is capable of being copied to another individual's memory. Memetics is the theoretical and empirical science which studies the replication, spread and evolution of memes (Heylighen 2001).

According to Moritz, a replicator is anything of which copies are made. A meme is an informational replicator whose principal attributes are pattern and meaning (Moritz 1995).

A meme is the least unit of sociocultural information relative to a selection process that has favourable or unfavourable selection bias that exceeds its endogenous tendency to change (Wilkins 1998).

At some point in our history, biological evolution provided our ancestors with a capacity to imitate behavior. This meant that when humans observed the behavior of others, their brains would create the neural wiring needed to imitate the same behavior.

Such neural wiring patterns are actually lists of instructions, which can be translated into other mediums such as written language, outward behavior, or computer code. A list of instructions that produces behavior is the thing that spreads into the minds of others. A list of instructions that produces behavior is a meme. A memetic 'unit' can be described as a self-contained information packet that reproduces itself. The most important feature of memetic transmission is that the instructions transferred are new, and do not already exist in the mind of the receiver. In this way, we can say that the acquisition of a meme gives rise to a new, non-innate behavior (Silby 2000a; 2000b).

Memes offer a way to understand psychology and the evolution of thoughts, technology, artifacts, music, and art. They can be defined as small sets of instructions that produce behavior (Silby 2000c).

2.2. Memes as Replicators

At first glance the idea of a meme seems trivially true says Silby and adds: "Of course ideas spread, what's the big deal? Well, the big deal is that memes behave in similar ways to genes, and in this way their behavior and development can be described in terms of evolution" (2000a). To start to deal with evolution it can be said that everything started with Charles Darwin's theory of evolution by natural selection which he explained in his work O*n the Origin of Species by Means of Natural Selection* in 1859. Darwin's simple principle 'natural selection' briefly states:

> He [Darwin] reasoned that if living creatures vary (as they certainly do) and if, due to their geometric increase in numbers, there is at certain times a struggle for life (which cannot be disputed), then it would be most extraordinary if there were not some variation that was useful to a creature's welfare. The individuals with these characteristics will then have the best chance of being 'preserved in the struggle for life' and will produce offspring with the same characteristics (Blackmore 1999b: 10).

Darwin's principle requires three main features; *variation*, *selection* and *retention* (heredity). If there is 'variation' among the offspring then not all the creatures would be identical, second not all the offspring can survive, there must be an environment in which some varieties do better than others, what is called 'selection'; and finally the survival offspring having some special characteristics is passed on to the next generation which is called 'retention (heredity)'. Then it returns to the start again

full circle. According to these features, any characteristics that are positively useful for the survival in an environment must tend to increase, then evolution simply must occur; it is inevitable under such circumstances (Blackmore 1999b). Evolution does not require a designer, it happens without a need of a designer as Dawkins explains in his book *The Blind Watchmaker* (1996). "All this creativity depends on replicator power. The 'selfish' replicators get copied…They just get copied. In the process some do better than others – some obliterate others – and in this way evolutionary design comes about" (Blackmore 1999b: 13). (Figure 1 and Figure 2 show some Nokia mobile phone keypad 'variations' and Figure 3 shows the 'selection' and the 'retention' of today's mobile phone keypads).

Figure 1. Keypads of Nokia 3650 (2002), Nokia 7600 (2003), and Nokia 6630 (2004), left to right
(Source: http://www.gsmshop.nl/shop/shopimages/Nokia_3650_cover_SKR324.jpg
http://www.gsm4u.ru/img/phones/Nokia_7600.jpg
http://www.mundosemfio.com.br/images/jorge/Nokia6630.jpg)

Figure 2. Nokia 7280, NaviSpinner controller - keypadless design (2004)
(Source: http://www.3dnews.ru/documents/news5/20040910_nokia7280_2.jpg)

1	2	3
4	5	6
7	8	9
*	0	#

Figure 3. Today's selected layout and an example to its retention on the right; Nokia 6270 (4th quarter of 2005)
(Source: http://www.nokia.com.tr/id75912.html)

The three main features, variation, selection and retention, leading to evolutionary algorithm – Dennett describes evolution as a simple algorithm that is, a mindless procedure which, when followed, must produce an outcome (qtd. in Blackmore 1999b: p.11) - are to count something as a replicator. The replicators mentioned here are the genes whose competition drives biological evolution. "Genes are instructions for making proteins, stored in the cells of the body and passed on in reproduction" (Blackmore 1999b: 17). Can memes also be considered as replicators?

If memes are also replicators and can sustain an evolutionary process, those principles must be valid for them too. As it is mentioned in the previous paragraphs, for something to be counted as a replicator it must maintain the evolutionary algorithm based on variation, selection and retention (heredity). Memes have *variation*, for example, stories are rarely told exactly the same way twice or no two lemon squeezers are absolutely identical or every typewriter is unique which means when a meme passed on, the copying is not always perfect. Hence, the replication turns into resemblance sometimes. Secondly, there is memetic *selection*, some memes are good at being copied, they are carefully remembered and passed on, some do not even grab attention and fails to get copied between people. For instance, for some reason some designs in industry may be insufficient in attracting enough attention in the society and they are forgotten in the course of time, but some are quickly accepted and are spread between people and even between generations. Finally, there is *retention* of some of the ideas in

the memes that are passed on; something of the original meme must be retained. It can be called imitation, copying, or learning by example. The meme therefore fits into Dawkins's idea of replicator and the evolutionary theory (Blackmore 1999b: 14).

2.2.1. Successful Replicators

In the same way not all genes can replicate successfully, some memes are more successful in the meme pool than others. This is an analogue of the natural selection in biology. Being a successful meme means being a successful replicator. There is no requirement like being true, useful, ergonomic, esthetic, practical or functional. It only requires three characteristics:

1. Copying-fidelity: the more faithful the copy, the more will remain of the initial pattern after several rounds of copying. For example, there would be possible slight differences between the same products that an artisan/craftsman produces, but there would not be any differences between the products that an industrial machine produces for the sake of mass production.

2. Fecundity: the faster the rate of copying, the more the replicator will spread like an industrial printing press churning out many more copies of a text than an office copying machine, or like an industrial machine producing the same product 1000 times faster than a craftsman.

3. Longevity: the longer any instance of the replicating pattern survives, the more copies can be made of it; a drawing made on the sand is likely to be erased before anybody could have photographed or otherwise reproduced it. For instance, an advanced vacuum cleaner in a house would possibly live longer than a broom made by a craftsman, which means it will possibly meet with the next generations.

In other words, a good replicator – let us say a meme – has to be copied accurately, many copies must be made and the copies must last a long time (Heylighen 2001; Dawkins 1989; Blackmore 1999b). For example, e-mails go for high fecundity, low fidelity and low longevity (people send out lots, do not bother to write carefully or correct mistakes, and throw them away). Letters go for low fecundity, high fidelity and high longevity (people write fewer letters, construct them carefully and politely and often keep them). Books are high on all three (Blackmore 1999b).

Apparently, there have always been countless competing memes - whether religions, political theories, ways of curing cancer, clothes fashions, interior designs or musical styles - the point about memetic evolution is that the ones around us now are those that survived in the competition to be copied. They had what it takes to be a good replicator (Blackmore 2002).

2.3. The Lifecycle of a Meme

Memes have a lifetime; they can 'die' when they cease to be of interest to the population for whatever reason and/or they can 'reborn'. If memes die, then in a given collection of them, one can speak of the survival of some and the death of others (Salingaros & Mikiten 2002). The lifecycle of a meme is roughly its replication process. Heylighen (1998) explains clearly these replication conditions as a memetic lifecycle which consists of four stages. These are the stages that a meme must pass successfully in order to replicate itself:

1. Assimilation by an individual, who thereby becomes a host of the meme:

A successful meme must be able to 'infect' a new host, that is, enter into its memory. Let us assume that a meme is presented to a potential new host. 'Presented' means either that the individual meets a meme by chance or that he/she independently discovers it, by observation of outside phenomena or by thought, i.e. recombination of existing cognitive elements. To be assimilated, the presented meme must be respectively noticed, understood and accepted by the host. Noticing requires that the meme vehicle be sufficiently salient to attract the host's attention. Understanding means that the host recognizes the meme as something that can be represented in his or her cognitive system. The mind is not a blank paper which any idea can be written down. To be understood, a new idea or phenomenon must connect to cognitive structures that are already available to the individual. Finally, a host that has understood a new idea must also be willing to believe it or to take it serious. For example, although someone is likely to understand the proposition that his/her car was built by little green men from outer space, he/she is unlikely to accept that proposition without very strong evidence. Therefore, he/she will in general not memorize it, and the meme will not manage to infect him/her.

2. Retention in that individual's memory:

By definition, memes must remain some time in memory; otherwise, they can not be called memes. The longer the meme stays, the more opportunities it will have to spread further by influencing other hosts. So the new idea must be retained by the host through memory which defines selection. Just like assimilation, retention is characterized by strong selection, which few memes will survive. Indeed, most of the things people hear, see or understand during the day are not stored in memory for longer than a few hours. Retention will depend on how important the idea is to you, and how often it is repeated, either by recurrent perception or by internal rehearsal. All learning paradigms agree that experiences are encoded more strongly into memory by frequent reinforcement.

3. Expression by the individual:

In order to be transferred to other individuals, a meme must emerge from its storage as memory pattern and enter into a physical shape that can be perceived by others. This process may be called ‘expression’. The most obvious means of expression is speech. Other common means for meme expression may be text, pictures, designs, and behaviour. Expression does not require the conscious decision of the host to communicate the meme. A meme can be expressed simply by the way somebody walks or manipulates an object, or by what he or she wears. Some retained memes will never be expressed, for example because the host does not consider the meme interesting enough for others to know, uses it unconsciously without it showing up in his or her behavior, does not know how to express it, or wants to keep it secret. On the other hand, the host may be convinced that the meme is so important that it must be expressed again and again to everybody he or she meets.

4. Transmission of the meme to one or more other individuals.

To reach another individual, an expression needs a physical carrier or medium which is sufficiently stable to transmit the expression without too much loss or deformation. Speech, for example, uses sound to transmit an expression, while text will be transmitted through ink on paper or electrical impulses in a wire. The expression will take the form of a physical signal, modulating the carrier into a specific shape from which the original meme can be re-derived. This physical shape may be called the meme vehicle. For example, meme vehicles can be books, photographs, catalogues,

artifacts or CDs. Selection at the transmission stage happens through either elimination of certain memes, when the vehicle is destroyed or gets corrupted before it is perceived by another individual, or through differential multiplication, when the vehicle is reproduced into many copies. For example, a manuscript may be regarded as garbage or it may be turned into a book which is printed in thousands of copies. A radio communication may get lost because of noise, or it may be broadcasted to millions of listeners.

This last stage may be followed again by stage one, thus perpetuating the replication loop. This simple four-stage model helps us to analyse the mechanics of meme replication, and the different requirements a meme must satisfy to spread successfully. At each stage, there is selection, meaning that some memes will be eliminated some will be passed on. The human being acts both as the replicating machinery, and as the selective environment for the memes.

2.4. Meme – Gene Analogy

It is important not to forget where the idea of memes come from; genes. But it is also more important not to confuse them. It is a significant matter of memes having an analogical relation with genes. But they are only related by analogy, specifications about memes should not be regarded as exactly the same as genes. Though memetic and genetic evolution are subjected to the same basic principles of blind variation and natural selection on the basis of fitness, memetic evolution is basically a much more flexible mechanism. Genes can only be transmitted from parents to offspring (vertical transmission) while memes can be transmitted between any two individuals (horizontal transmission or multiple parenting). For genes to be transmitted, a generation is needed. Memes only take minutes to replicate.

> […] memetic evolution will be several orders of magnitude faster and more efficient than genetic evolution. It should not surprise us then that during the last ten thousand years, humans have almost not changed on the genetic level, whereas their culture (i.e. the total set of memes) has undergone the most radical developments. In practice the superior "evolvability" of memes would also mean that in cases where genetic and memetic replicators are in competition, we would expect the memes to win in the long term, even though the genes would start with the advantage of a well-established, stable structure. This explains why sociobiological models of human behavior can

> only be partially correct, as they neglect memetic factors (Heylighen 1992: 78).

The memes are equivalent to genes in a way but that does not mean that memes can only work if they are like genes in every way (Blackmore 1999b). And she adds: "-evolutionary theory describes how design is created by the competition between replicators. Genes are one example of a replicator and memes another. The general theory of evolution must apply to both of them, but the specific details of how each replicator works may be quite different" (Blackmore 1999b: 17).

Beside their resemblances and differences, memes and genes are sometimes being put in a relation which is irrelevant to the 'replicator' characteristics. Dawkins criticize his colleagues for always going back to 'biological advantage' to try to answer the questions about human behaviour and culture, he agrees that our brain provides some biological advantages for us but "Now we have them a new replicator has been unleashed and it need not be subservient to the old. In other words, memetic evolution can now proceed without regard to its effects on the genes…" (1989:193). That is, if the entity of a new replicator is accepted then it should not be expected them to act somehow for the benefit of the genes or the species or anything but for the benefit of themselves. That is what it means to be a replicator.

Dennett (1991: 203) says: "The first rule of memes, as it is for genes, is that replication is not necessarily for the good of anything; replicators flourish that are good at replicating! The important point is that there is no *necessary* connection between a meme's replicative power, its "fitness" from *its* point of view, and its contribution to *our* fitness (by whatever standard we judge that)". Of course, memes could only come into existence when the genes had provided brains that were capable of imitation and those brains must have influenced which memes took hold and which did not. However, once memes had come into existence they would be expected take on life of their own. (Blackmore 1999b).

Blackmore (1999b) gives a clear example for the *coevolution* of genes and memes, in fact, some might call it meme driven evolution. She gives the example of how language evolved and restructure the human brain and vocal system for its own propagation. She calls it meme-gene coevolution. She assumes that people will both preferentially copy and preferentially mate with the people with the best memes – in this case the best language. These people then pass on genetically whatever it was about

their brains that made them good at copying these particularly successful sounds. Thus, brains gradually become better and better able to make just these sounds. She claims that grammatical language is not the direct result of any biological necessity, but it is a result of the way that memes changed the environment of genetic selection by increasing their own fidelity, fecundity and longevity.

As a conclusion, using the gene analogy and relying on the essential principles and features of evolutionary theory would be useful to define the working principles of memes in industrial design but a close comparison to genes might be a waste of time.

2.4.1. Memes as Viruses

Replicators vary in their usefulness. It is tended to name something a virus when it is clearly acting for its own replication by stealing the replicating resource of some other system, and especially when it does harm to that system. The same can be seen in the world of the mind. The 'selfish' replicators sometimes act like viruses; like viruses that make people get cold or break down the system of a computer, as a matter of fact some authors call *memes without a benefit to people* 'viruses of the mind' like Dawkins (1993; 1989) and Brodie (1996). It might just be regarded as a helpful metaphor: "Memes that spread without benefiting the people who hold them, are often compared with viruses. This metaphor helps us to understand the parasitic or 'selfish' nature of the meme's tendency to spread" (Fog 2003: 3). Blackmore gives chain letters (both hard copy and e-mail) consist of little bits of written information, including a 'copy-me' instruction backed up with threats or promises as examples for *viral* memes. They have an internal structure that ensures their own propagation (Blackmore 2000b). But she also adds that it should not be thought as all memes are viruses:

> Memes such as religions, cults, fads and ineffective therapies, have been described as viruses of the mind because they infect people and demand their resources in spite of being false. Some authors have emphasised these pernicious kinds of meme and even implied that all memes are viral. However, memes can vary across a wide spectrum. As a general principle we can say that some memes succeed because they are good, true, useful or beautiful, while others succeed even though they are none of these things. And some just pretend to be good or useful. Towards one end are the viruses, religions, cults and false beliefs. Towards the other are our most valuable tools for living (such as our languages, technology and scientific theories). Without memes we could not speak, write, enjoy stories and songs, or do most of the things we associate with being human. Memes are the tools

> with which we think and our minds are a mass of memes (Blackmore 2002).

2.4.2. Memes as Memeplexes

"Like genes, memes are in competition with each other. While genes compete for representation in the genepool, memes compete for representation in the memepool - the huge collection of ideas that are currently circulating the world" (Silby 2000a). Throughout this competition, it is always easier for memes to survive in groups like genes group for mutual protection, leading to the creation of organisms. This group of memes working together is called 'co-adapted meme complex' or 'memeplex' (Blackmore 2002). Memeplexes are groups of memes that hang around together for mutual support and thereby survive better than lone memes could do. Today there are many memeplexes on the internet. For example, imagine two memes, one 'visit the website of x' and another 'win lots of money'. The former instruction is unlikely to be obeyed just on its own. The latter is tempting but includes no instruction on how to. Together, and with some other suitable *co-memes*, the two can get people to obey and copy the whole package. "The essence of any memeplex is that the memes inside it can replicate better as part of the group than they can do on their own" (Blackmore 1999b: 20). As an example, Blackmore (2002) gives the internet world again:

> […] the common sort of email virus that urges you to pass on an urgent warning to all your friends. These messages often warn of a non-existent threat, such as a virus that will destroy everything on your hard disk. If you believe them, and pass on the message, this little memeplex can go on to be copied many more times. In fact the message itself is the virus. Not only have such viruses clogged up whole systems, but when people realise their mistake they often send out new messages telling people *not* to believe it, and so clog up the system again.

Some examples from the real world might be artistic movements, languages, cults, scientific theories and paradigms, political ideologies and alternative belief systems. Dawkins (1989: 197) gives an organized church, with its architecture, rituals, laws, music, art, and written traditions as a huge memeplex example. It is important not to forget that successful memeplexes were not deliberately designed by anyone, but were created by the process of memetic selection.

Figure 4. An example to memeplexes; metal music with its long hairs, clothes, accessories, fonts, tattoos, make-up etc.

2.5. The Structure of a Meme

Both the unit of a meme and the size of a gene is still an enigma since they are not specified. The question is often asked, by people who are opponents of meme theory beside people who also work with memetics. Opponents of meme theory generally claim that it is meaningless dealing with memetics while can not define the unit of a meme (Blackmore 1996; 1999b). Blackmore disagrees: "I have heard people dismiss the whole idea of memetics on the grounds that 'you can't even say what the unit of a meme is'. Well that is true, I cannot. And I do not think it is necessary. A replicator does not have to come neatly parcelled up in ready-labelled units. Since genes are our most familiar example we should look at the same issue for them" (Blackmore 1999b: 53). She gives genetics as an example and says that geneticists do not abandon genetics, biology and evolution just because they could not decide what the unit of the gene is. Silby (2000a) agrees with that idea too: "A similar problem arises when scientists talk about genes. There is no real gene 'unit'. Genes are packets of information that are encoded in DNA. Distinct genes can vary markedly in length. The same goes for memes. Memes are best thought of as packets of information that can be encoded in a number of different mediums".

Its *inventor* Dawkins is almost regarding memes as living structures, not just metaphorically but technically (1989). Dennett (1995) defines the units of memes as the smallest elements that replicate themselves with reliability and fecundity although the interpretation of 'the smallest' differs from person to person.

Everyone who wrote something about memes and memetics had mentioned this problem; what really is the unit of a meme? Different answers occur of course but none of them is certain. This or that; throughout the way for this thesis, beside all the arguments of the specifications of memes, it would not be useful to refuse the whole idea of memes in terms of evolution of culture, technology or something else just because it is not possible to determine exactly what the meme is.

2.5.1. Unit or Pattern

With all those specifications of a meme unit, there is an objection directly related with its definition. Langrish (1999) brings forward the idea of memes' to be

patterns instead of being '*units of cultural transmission'* (Dawkins 1989). He also argues that the transmission of memes might not be restricted to 'culture' in the same article; he claims that beside culture, some other forms of transmission are possible as different types of memes occur.

2.5.1.1. B View vs. P View

The reason why Langrish considers memes as patterns is his leaning on to 'biological view' (abbreviated to B) of the world as opposed to 'physics view' (abbreviated to P). B is based on Darwinian evolution which welcomes diversity and different types of things. P is based on Newtonian mechanics which gives importance on the essence of things rather than their differences which means P expects one theory of everything. He adds: "'Real' Physics and Biology are not quite the same as P and B" (1999). Anyone who is interested in evolution should adopt the B. He gives some certain features of the B to provide a background for the B view of memes, which are:

1. There is no such thing as a single cause for any event or process in biology. For example Rose (1997) gives five different explanations for a frog jumping away from a snake. These range from its evolutionary history to the biochemical properties of its muscles. The processes by which ideas are transmitted are surely more complex than the reaction of a frog to a snake.

2. Subdivisions: while P mathematically precise concepts and wants to reduce the number of concepts, B consists of subdivisions since its concepts are fuzzy patterns. Regarding to that feature he suggests that advances in memetics could also be made by regarding concepts as mixtures or patterns rather than by attempting precise definitions.

3. Biology used to be sneered at as one of the descriptive sciences. Its higher status today has partly come from adopting a P approach, sometimes referred to as reductionist molecular biology. There is a need for descriptive studies and it is important for memetics to advance. Some detailed studies of competing and survival memes are required.

4. The nature of evolution: from the P view, evolution is 'unfolding' but biological evolution is not a gradual unfolding of a predetermined pattern. The growth of an embryo is an example of unfolding development. Physicists tend to believe that everything in principle is predictable. One can not predict the human being from seeing

a fossil record of million years old. The development of an embryo is quite a different process from the changes that led from the life represented by the fossil record to our present existence. In biological evolution at any stage, the number of possibilities is much. The survival variety - which selected between several varieties - is just lucky and its survival is just happened by coincidence, it advances the environmental changes that are also not predictable. B view can make classification system providing prediction. What Darwinian evolution can not do is predict the future results of change; it is not an unfolding development.

5. The importance of variety (of whatever kind): if there is no variety, there is no competition. Without competition there is no evolution. Without evolution there is no biology. But the P view likes things to be the same; it counts varieties as 'deviation' from the 'norm'. In other words, variety is to be embraced and not regarded as something that gets in the way of prediction. Different kinds of memes having different methods of propagating and altering have to be the starting pattern for advances in memetics. B advances from a pattern; only P has a starting point. Armed with a B view of the world, a fresh look at Dawkins original statement on memes can be taken.

Briefly, Langrish (1999) concludes that P has units that are predictable but B does not. B has patterns and varieties. An atom of sodium is the same sodium all around the world but an elephant is not, it is unique. This kind of point of view (B) is useful for both a memeticist and an industrial designer. With the considerations of all those features, Langrish does not count memes as units. They are patterns. The idea of a meme is a complex concept meaning different things to different people. He gives the example of building a railway. It is like Russian dolls. It is not a unit. It consists of different types of knowledge like suspension systems, signaling, finance etc. meaning different things to an observer, a user or to an operator. His last objection to Dawkins's definition of a meme ('units of cultural transmission') is its restriction to cultural transmission. Different types of memes have their own transmission types like a representation, a symbol or a description. It should not be thought as 'culture includes everything'. For an industrial designer and for this thesis to reach conclusion the way Langrish shows is more helpful than counting memes as units of cultural transmission.

2.5.1.2. Different Types of Memes; Recipemes, Selectemes and Explanemes

According to Langrish (1999) a biological perspective (B view) allows for different types of memes with different transmission mechanisms. He suggests three types of memes and gives the names recipemes, selectemes and explanemes. Their use is illustrated by the evolution of technology in which black box systems are used to do things requiring recipemes - ideas about how to do it - and selectemes - ideas about what is a desirable output. Explanemes are ideas about the inside of the 'box'. He explains those different kinds of memes:

Recipemes are competing ideas of how to do things. Successful recipemes are replicated - sometimes with modification or addition. Recipemes have a different method of transmission from the other memes. Knowing how to do something often involves 'finger tip' knowledge which can only be obtained through doing. It can not be told someone how to ride a bicycle, when the clay for a pot feels right, how to play the piano or how to knap a flint. The recipe for a cake can be written down but this will assume some shared practical knowledge. Once to have different ways of doing different kinds of things, there will be ideas of success and betterness. Some things and some ways are *better* than alternatives. He uses the word *selecteme* to mean ideas that form the basis of selection. *Selectemes* are competing ideas of betterness. They provide the mental environment in which other memes compete for selection (Selectemes also compete with other selectemes). The transmission of selectemes is closely bound to something that might be called a society. Many people, of course, do not accept all the selectemes that are offered them. Some have Friday night selectemes that are different from those that are present on Monday morning. So selectemes are selected. He supposes that P-type thinkers would see an infinite regression of minor selectemes being selected by higher order selectemes, but in a B world, things form non mathematical patterns. A selecteme is a Russian doll type pattern which forms a whole.

> When we feel that something is wrong, we do not think, "I will not do that because it would be stealing and stealing is against my religion which I have chosen to abide by even though I do not believe in God and in any case I might get found out and that would bring shame which I do not like..." No, we either just feel it would be wrong or we feel it is worth the risk. Either way that feeling can be described as a pattern of selection which the pattern of proposed

> action either fits, does not fit or is repelled by. When a pattern of action fits a pattern of selection, we have a 'click' which Maria Abu-Risha (1999) calls *Purposive Pattern Recognition*. An important point is that patterns are not units nor are they always made of the same units. The pattern of the letter A can be constructed out of many things including a hole (Langrish 1999).

Recipemes and selectemes can be combined in black box systems. A black box can be a rubber tree, a chemical reaction, a loom, a bow and arrow or anything that has inputs and outputs under some degree of control. Recipemes are ideas about inputs into boxes (raw materials, energy and conditions) and about alternative boxes. Selectemes are ideas about outputs and their relative desirability. Since boxes can be connected - the output from one being the input to another - there can be long chains of recipemes and selectemes.

Langrish (1999) gives a simple example to recipemes and selectemes chains; the loom maker makes a loom using selected materials made elsewhere; the weaver selects a loom to make cloth from selected yarns made elsewhere; the tailor turns the cloth into clothes and the clothes are purchased and worn. At each stage, there are recipemes - ideas about how to do things - and selectemes - ideas about what sort of loom, yarn, cloth and clothes might be desirable or undesirable. Different inputs give different outputs some of which are judged to be desirable or more desirable than existing outputs. Different black boxes can be tried out. Ideas about inputs and boxes are recipemes. Ideas about desirability of outputs are selectemes. These ideas compete firstly in one mind and then in the world and then in the minds of other people. Recipemes do get copied and ideas of what is good can be changed.

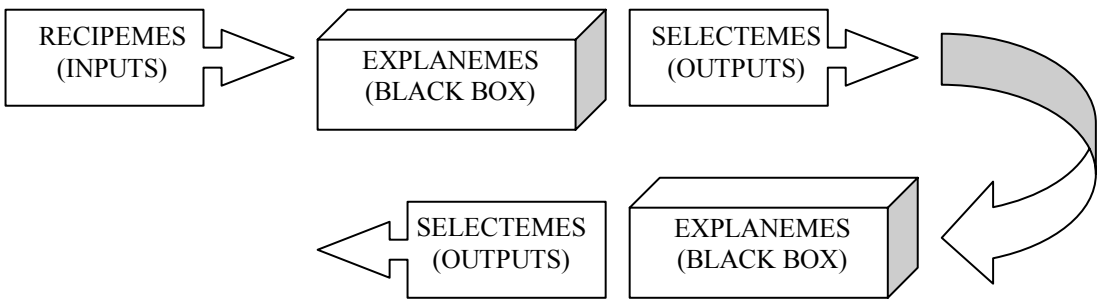

Figure 5. The relation between recipemes, explanemes and selectemes

The third type of meme is to describe ideas about what is happening inside the black box which Langrish (1999) calls such ideas explanemes. *Explanemes* are competing ideas that are used in answering questions about why things work or work better. Selectemes associated with both curiosity and communication enable the survival of ideas about the insides of the black boxes. These 'inside' ideas are explanemes. Some explanemes lead to suggestions for new black boxes or improvements in existing boxes. Some are 'just – so' stories. Some provide words to enhance communication. Some are highly sophisticated and live in special institutions. Explanemes are competing ideas that are used in answering questions about why things work, work better or do not work. Recipemes just tell how to make something. Explanemes provide a story about what is going on. The transmission of explanemes always requires a specific language. Stories do translate from one culture to another and so do special symbols such as algebra which moved from an Arabic origin to a European usage (Langrish 1999).

Those three types of memes change and evolve over time. Selectemes (ideas about what is best) evolve and other memes have to adapt to their changing environment. As an example, Langrish gives the design process of Concorde. Concorde was planned to be the fastest; those times the fastest means the best selecteme was seemed right to the designers and the worlds first supersonic civil air travel became possible. However, the selecteme for fast lost out to other selectemes to do with both economy and noise. Different selectemes compete for the mental space marked 'the idea of the best' and different recipemes compete to supply ways of achieving the desired result.

As a conclusion, Langrish (1999) says that memes are needed for evolutionary explanations of human activities. They compete, replicate and vary. The concept of memes becomes more sophisticated and powerful when broken down into different types of memes with different ways of competing and being replicated. Different memes have different variety production mechanisms while sharing the common features of an evolutionary system. New explanemes sometimes result in a Nobel Prize. New recipemes can be patented in the name of their inventor. New selectemes are rarely associated with a named individual but many new ideas seem to crop up simultaneously. Evolution and memes need a B view of the world.

2.6. Imitation and Memes

There are different opinions on how memes get copied, but Dawkins and Blackmore for example, defends the idea of imitation. In fact, Blackmore (1999b) certainly insists on memes can just be passed on by imitation. Everything that has been learned by imitation from someone else and got passed to someone else is a meme she says. She is trying to be clear what is meant by the word imitation, because she thinks that the whole understanding of memetics depends on it. Like Dawkins, she uses the word imitation in the broad sense. A friend tells you a story and you remember the main point and tell it to another friend and then someone else, but not by imitating your friend's every action and word, yet something like the theme of the story has been copied to you and then to someone else; this is the term 'imitation' in the broadest sense. Imitation is a kind of replication or copying, and that is what makes the meme a replicator and gives it its replicator power. Imitation includes any kind of copying of ideas and behaviours from one person to another.

It is important not to confuse the 'not meme thoughts' with memes, for example immediate perceptions and emotions, kinds of learning except learning by imitation, like individual learning (classical conditioning; association and operant conditioning; trial and error) and social learning (stimulus enhancement, local enhancement and goal emulation) (Blackmore 1998; 1999b). Of course social learning includes true imitation, but there are other kinds of social learning as well. Imitation means learning something about the form of behaviour through observing others, while other kinds of social learning are learning about the environment through observing others (Heyes 1993).

> The whole point of the meme is that it is information copied from one person to another. Therefore a great deal of what goes on in the human mind is nothing to do with memes. First, perception and visual memory need not involve memes. You can look at a beautiful scene, or taste a delicious meal, and remember them in detail without any memes being involved (unless you put words to your experience). Second, not all learning involves memes. What you learn by yourself through classical conditioning (association) or by operant conditioning (trial and error) need not be memetic (Blackmore 2002).

Some writers imply that almost everything we know or experience can count as a meme, whether acquired by imitation or not. According to Brodie (1996), operant

conditioning and indeed all conditioning are memetic. Gabora (1997) also does not limit meme with imitation: "…anything that can be the subject of an instant of experience, to be a meme". She thinks that the category meme includes not only obviously transmittable ideas, but everything from a particular experience of vibrant `redness', to a realization of a shorter route to work, to a feeling of dread associated with a teacher's posture or facial expression. With this she claims that, a bridge that connects memetics with phenomena like perception, body language, planning, deductive reasoning, emotion, categorization, analogy etc., the stuff of the social and cognitive sciences is gained. According to Blackmore (1998), if Gabora was right then a garden frog would have a mass of memes, even though it is totally incapable of imitation or any kind of culture, because it has perceptions and emotions, and is capable of many kinds of learning and she continues:

> I shall argue that these broader definitions are deeply confusing. They take away the idea of the meme as a replicator (which was the original reason for its invention, and provides its context within evolutionary theory), ignore the idea that memes must be passed on by some kind of copying, and merely add confusion to the already difficult problem of understanding consciousness. I suggest we are better to stick to the original definition of the meme as transmitted by imitation.

Another counter definition is from Reader and Laland (1999). They do not agree that imitation is a linchpin of meme transmission and they argue that imitation should not be defined as a feature of a meme; starting out from that point of view, they claim that animals also do have memes.

Among those different views of how meme get copied, 'imitation' will be adopted within this thesis since designing objects is also related with imitation (it will be explained in the next chapter). Opposite views would not be helpful to realize the industrial design memes. Therefore, it would be practical to cling on to the 'imitation' feature of memes while studying on memes and memetics in this thesis.

2.7. From a Memetics Point of View

If one agrees with all these ideas, principles and theories, then it would be plausible to look from a memetics point of view. Then, everything becomes clearer

about memes, memetics, and evolution of culture etc. For example, the question of why some memes manage to get copied into many brains or artefacts while others can not would be replied easily from a memetics perspective; as it is mentioned in previous divisions some memes succeed in getting copied because they can. There is no rule stating; the copied memes are 'always' good, useful, true or beautiful. If a meme can survive and get replicated it will. The meme survives if it is good at it, not because it is useful or true, that is why it is 'selfish'. Looking from a memetics point of view means asking for example, not how inventions benefit human happiness or human genes, but how they benefit themselves. In fact, some of the successful memes (here successful means survived and get copied) are not good for the mankind.

2.7.1. An Example; Modernist Architecture from a Memetics Point of View

A good example to the survival of harmful memes is discussed by Salingaros and Mikiten in their article *Darwinian Processes and Memes in Architecture: A Memetic Theory of Modernism* (2002) telling how modern architecture does not answer the physical and psychological needs of humans in spite of its announcement and acceptance as being perfect.

Salingaros and Mikiten apply the theory of memes to the field of architecture by arguing two main points: 1. Darwinian processes (combining variation and selection) are important to architecture. 2. The specific case of modernist architecture corresponds to a 'parasitic' meme, which has spread in spite of its being non-adaptive for the people that make use of modernist buildings.

The first thesis is about design and decision process in the architecture's mind, it deals with the memes in the designer's mind; each design idea competes in the mind of the designer with other conceived possibilities, and the fittest ones (those that partially solve the problem as posed) survive to the next generation. Designs that are more detailed generate further alternatives, which are culled by the selection in the subsequent round. The cycle starts with the creation of variants, which then get culled by using a set of selection criteria; the survivors are used to create a new generation of variants, which get culled in turn; and so on. This represents a typical Darwinian process. Visual inspiration can fix the entire gestalt of a project in a single initial image.

Often, it is precisely such a *conceived* image that, through the emotional feedback it generates in the mind of the architect, sustains the design and drives it towards completion.

The second thesis is about the survival in the outside world rather than the Darwinian process in the mind of the architect. It is more controversial, and is discussed in greater depth explaining the unlikely success of modernism. It deals with the success in the spread of social memes which is measured by how far they establish themselves as basic beliefs in a society. They claim that a group of memes achieves its greatest success when it becomes part of the establishment; i.e., it is institutionalized. Therefore, they try to reveal those factors that increase the spread of memes, and thereby help in their chances for institutionalization. They use seven factors affecting meme propagation (which Heylighen [1993; 1997] had identified) while studying how architectural memes spread in a society, and how competing memes are selected; *simplicity*, *novelty*, *utility*, *formality*, *authority*, *publicity* and *conformity*. They claim that with the exception of *utility*, none of these factors serves actual human needs. And they argue, therefore, that the spread of a design style occurs in a society more because of mass media than for practical reasons. They even show that *utility* is to obey memetic transmission, as often the mere 'promise' of *utility* is responsible for the success of an architectural style that creates buildings impractical in actual use.

Furthermore, they propose an eighth factor that aids meme propagation; *encapsulation* describes how memes link with other memes. This concept has generally mentioned with different names by different writers, but even though the names are different the meanings are more or less the same; it is 'memes embracing each other for mutual benefit', for example Dawkins calls them *mutually-assisting memes* (1989: 197) while Blackmore calls *memeplexes* (1999b: 19) as it is mentioned in the previous titles. According to Salingaros and Mikiten, an encapsulated meme has an advantage because: (a) it increases the meme's virulence by making it appear more attractive; and (b) it protects the meme from external challenges by insulating it inside a complex of other, beneficial memes. They try to find out encapsulated memes examples of architecture; an encapsulated architectural meme manipulates our emotions in order to propagate. Encapsulation embeds a meme or collection of memes into a meaning structure. Through this mechanism, visual memes acquire an emotional and physical basis. At that point, they cease to be regarded as mere ideas open to debate, but assume the fundamental character of beliefs defining one's consciousness. So sometimes, it is also

possible to condemn an architectural style by deliberately encapsulating it within a shell of negative associations. By using encapsulation as a weapon to discredit competing styles, a useful idea can be tainted whether there is any basis for that association or not. A society's collective unconscious from that point on automatically rejects such an idea or style without question, even though it may offer excellent solutions to urgent problems. They give an example: "In contemporary architecture, destructive encapsulation is used to discredit new buildings in the Classical and Nineteenth-century styles. This has happened despite the fact that earlier buildings in those styles are among the most comfortable and best adapted to human needs" (Salingaros & Mikiten 2002).

They explain how once memes have been encapsulated and institutionalized they acquire a rigidity that makes them extremely difficult to remove. From that perspective they bring forward some strong explanations for the remarkable persistence of modernist architecture and urbanism in spite of their negative aspects. Taking the meme's eye view on, they review modernist style of architecture - otherwise called the *International Style* - that has been the overriding building style from the 1920s until now. The style is easily recognisable by its geometry of cubes and rectangular slabs; flat plain surfaces; the lack of thick connective boundaries; the use of steel, glass planes, and concrete panels; and in many cases the elimination of color and structure on the human range of scales 1mm-1m (Salingaros 1995). Representative buildings and architects include the *Bauhaus building* (1926) by Walter Gropius; the *Pavillon Suisse*, *Cité Universitaire* (1932) and *Carpenter Center for the Visual Arts* (1961) by Le Corbusier; the *Casa del Fascio* (1936) by Giuseppe Terragni; the *UN Headquarters* (1950) by Wallace Harrison and Max Abramovitz; the *Seagram building* (1958) and the *Neue Nationalgalerie* (1968) by Ludwig Mies van der Rohe; and the *National Theatre* (1967) by Denys Lasdun (Figures 5 – 11).

Figure 6. Bauhaus building (1926) by Walter Gropius
(Source: http://www.bc.edu/bc_org/avp/cas/fnart/fa267/gropius/bauhaus02.jpg)

Figure 7. Pavillon Suisse, Cité Universitaire (1932) by Le Corbusier
(Source: http://www.sciences-sociales.ens.fr/hss2001/logement/galerie/leCorbusier.html)

Figure 8. Carpenter Center for the Visual Arts (1961) by Le Corbusier
(Source: http://www.worldandi.com/newhome/public/2003/august/arpub.asp)

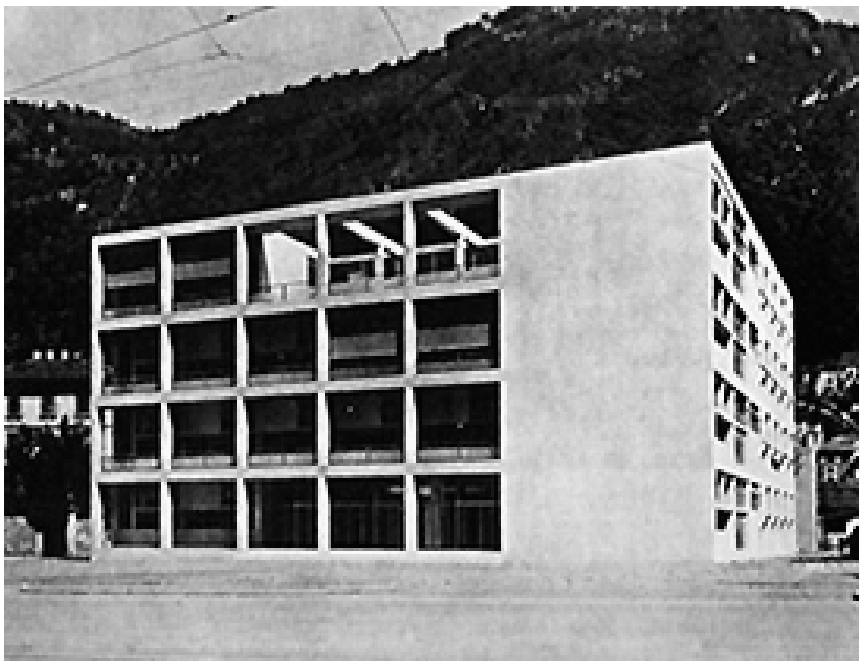

Figure 9. Casa del Fascio (1936) by Giuseppe Terragni
(Source: http://www.architetturaamica.it/Biblioteca/recens/Terragni.html)

Figure 10. Seagram Building base (1958) by Ludwig Mies van der Rohe
(Source: http://www.bluffton.edu/~sullivanm/mies/seagrambase.jpg)

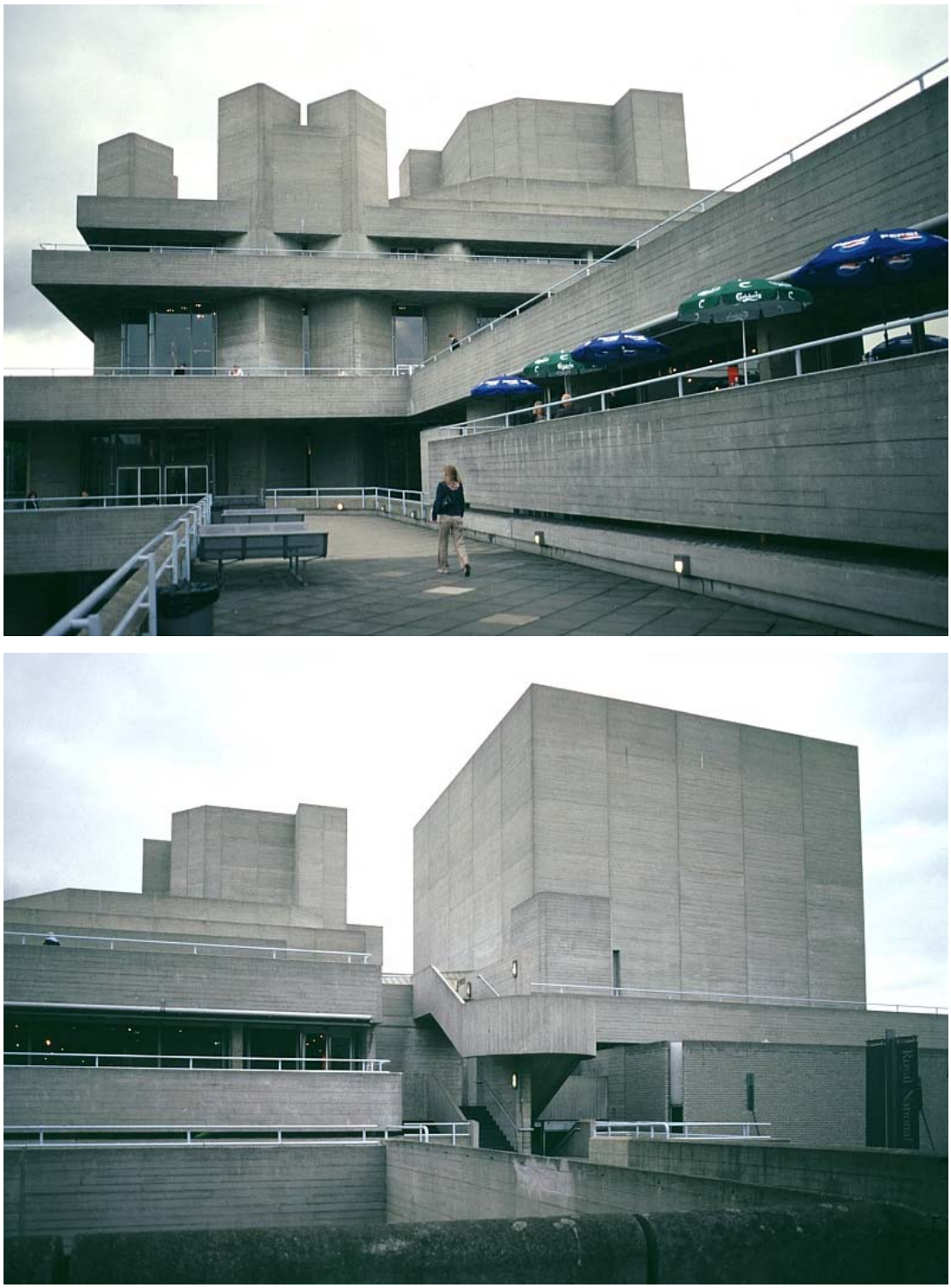

Figure 11. National Theatre (1967) by Denys Lasdun.
(Source: http://www.bluffton.edu/~SULLIVANM/england/london/lasdun/theatre.html)

Figure 12. Neue Nationalgalerie (1968) by Ludwig Mies van der Rohe
(Source: http://www.bauhausart.de/bilder/architektur/neue_nationalgalerie2.jpg)

Figure 13. Faculty of Architecture, Middle East Technical University (1962-1963)
(Source: http://www.archmuseum.org/galeri_resimler.asp?fotoid=9&id=6&exid=6)

Figure 14. Dover Castle, England
(Source: http://keep3.sjfc.edu/students/fmw7062/unitplan/dovercastle.htm)

Figure 15. Dover Castle (closer view), England
(Source: http://www.dover-castle-friends.org/fodc/Home.htm)

Figure 16. Gosford Castle (1850s), England
(Source: http://www.gosford.co.uk/castle6.html)

Figure 17. Gosford Castle – closer view (1850s), England
(Source: http://www.gosford.co.uk/castle8.html

Figure 18. Inside of a prison in Green Haven, New York
(Source: http://whyfiles.org/176prison_psych/3.html)

Figure 19. Inside of a prison
(Source: http://www.shadowspawn.net/temp/tc_prison.jpg)

Figure 20. The entrance and the inside of the building of Faculty of Architecture in Middle East Technical University

Although modernists claim their buildings to be 'functional', Salingaros and Mikiten disagree, they first start to analyse the ‘look’ of the buildings; they are simply looking like a machine from the 1920s. Those machines were housed in smooth metal shells, following cubist aesthetic principles, so their ‘look’ had nothing to do with their function; it merely conformed to a passing artistic fad according to them. They compare military and modernist architecture and show some obvious stylistic similarities between them: defense installations and castles (experienced from the outside), and dungeons, prisons, crematoria, etc. (experienced from the inside) have been built in order to construct deliberately uncomfortable environments throughout the ages. Such environments lack texture, color, and decoration, preferring damp, grey surfaces that are usually punishing for human beings. Their forms and surfaces are meant to oppress and frighten people; they communicate danger and evil directly through architecture. Where possible, a grandiose scale dwarfs the role of a human being in the environment. To achieve a forbidding, hostile exterior, a building must reveal a minimum of information. This makes sense when defensive fortifications protect against attack by infantry. Since many modernist buildings look forbidding, ominous, stark, alien, faceless, and present a generally hostile appearance they utilize some of the same typology from military and prison architecture. Here they present a paradox: how could society select an architectural style for human use that has a similar typology as the military style, which was developed specifically to make people feel uncomfortable? Their explanation is that; “… modernist architecture is a 'parasitic' meme group that is non-adaptive to human use and sensibilities. At the same time, however, the group of memes defining the modernist style of architecture has memetic advantages that helped it to take over. It is for this reason that modernism won out over competing styles” (Salingaros & Mikiten 2002). Memes help them to understand and explain why architectural styles that give emotional satisfaction were replaced by those that do not. They explain this paradox by examining how *simplicity*, *novelty*, *utility* and *formality* factors are relevant for the initial spread of modernism and how *authority, publicity* and *conformity* contribute to the propagation and eventual institutionalization of modernism memes. Here is how those factors helped modernist architecture memes spread:

Simplicity: A simple idea is easier to reproduce and has a competitive edge over ideas that are more difficult to grasp; it poses a lesser burden on our cognitive system. Therefore, an architectural style that is simpler to encode will propagate more successfully than one that is difficult to encode. In an analogy with life forms, viruses

reproduce much faster than more complex organisms because of a reduced structural investment. The modernist vocabulary of plain, featureless surfaces in a flat geometry of cubes and rectangles eliminates substructure; eliminates borders; eliminates contrast and color in design by using only plain white or gray; and finally, tries to eliminate the building material itself through its replacement by glass panes. Design richness and complexity in other architectural styles was eliminated in the drive to reach forms with minimal information content.

Novelty: This criterion standing out and thereby attracting one's attention facilitates a meme's assimilation. New, unusual, or unexpected ideas arouse one's curiosity. Twentieth-century architecture used novelty of a deliberately shocking kind. The early modernist prototypes looked strange to people used to Nineteenth-century architecture. Indeed, the modernist style is arrived at by reversing elements of previous traditional styles. The spread of those novel images occurred primarily through the media before any significant number of examples was actually built.

Utility: This criterion plays a double role. First, the architectural media declare (without justification) that a minimalist structure is somehow more efficient or is better adapted to the functions it is supposed to house. The opposite is true: many modernist buildings are dysfunctional because their imposed form and impractical materials hinder human activities. Criticisms of modernist buildings and their materials include the impossibility of effective temperature control in a glass-walled structure; the tremendous energy waste in attempting to do that in a sealed building; the 'sick building' syndrome; the social damage of living in skyscrapers (most severe for children and the elderly); the dangerous wind shear created on the ground by smooth-faced skyscrapers; flat roofs that invariably leak; the staining or cracking of large, plain surfaces; a general problem of joints when connective interfaces are eliminated in the interests of style; psychological alienation produced by dead gray surfaces and concrete slabs, which give an unpleasant ‘hard’ echo; etc. Second, the modernist style represents a genuine advantage for the construction industry that can build cheap, minimalist box-like structures without having to worry much about either structural quality, or accommodating human physiological and psychological needs. A visually simplistic architectural style thus offers a commercial benefit via utility that counts as a major factor in its propagation. Modernist memes found a ready environment after the Second World War, when buildings had to be produced in large numbers and at low cost. Never before in history had such building efforts taken place. This was also in the period that

the industrialization process was at full speed, penetrating more and more economic sectors of society. The construction industry eagerly embraced the utility offered by modernist memes.

Formality: The more formally an idea is expressed, the more likely it survives in transmission. The intention of modernist design is to be context-independent. Adaptation requires selection based on local climate, materials, culture, and relationship to adjoining buildings and specific human needs. Since its inception, however, modernism has been 'universal' because it is based on a small set of simple images. Different individuals in different contexts can interpret modernist rules in the same way. A modernist building can be put up anywhere in a city, anywhere in the world, because the style is independent of locality or particular circumstances. Materials of choice are pre-formed panels, glass, steel, and reinforced concrete; these are industrial materials that are detached from any region. Modernism imposed the universal visual language of abstract cubism to come up with '*one single building for all nations and climates*' (Blake 1974).

Then they list seven encapsulations for modernist memes:

- progress and economic prosperity from technology
- freedom from class oppression through new design
- social equality and housing opportunities for all
- moral superiority from using honest materials that express the spirit of the age
- improved health and hygiene through smooth surfaces
- the mathematical principles of pure form
- cost benefits resulting from modular production

Authority: Authority from famous architects and their sponsors legitimizes design memes in people's minds. The backing from a recognized expert or institution boosts the acceptance of a particular idea. After the Second World War, the United Nations built its headquarters in New York City as a validation of the modernist style. Several progressive governments reinforced this example by building new capital cities in a modernist style: India (Chandigarh); Brazil (Brasilia); Bangladesh (Dacca); and Australia (the post-war buildings in Canberra). The U.S. Government adopted modernism for its international trade missions and exposition spaces, projecting images of prosperity from a superpower, while corporations competed to outdo each other in

occupying modernist headquarters. People conveniently forgot that modernism was the official architecture of Fascist Italy.

Publicity: It is the effort to spread an idea; often an ideology includes explicit injunctions that believers should engage in propaganda. In architecture that is taken care of by a wealth of picture-filled books and architectural magazines, films, television documentaries, and the press; all of which promote modernist memes. These offer a platform from which often confused ideas are endowed with visual legitimacy. The 1932 'International Style' exhibition was conceived as a publicity campaign for modernist architecture, and its catalogue as a propaganda tool for disseminating the new style in the United States (Colomina 1994). Modernist architectural memes spread though advertising techniques coupled with proselytizing in architecture schools. Since its inception in 1979, the Pritzker architecture prize has been awarded to architects who best embody the latest trend in design; such prestige and accompanying publicity in turn helps to perpetuate those fashion trends. The same is true for numerous other architectural prizes of lesser prestige. Those prize-winning built examples are publicized by the media, and influence the design of new buildings.

Conformity: This criterion guarantees that newcomers into a group will be infected by an accepted meme, even though it rejects sound knowledge and contradicts established beliefs. Conformity pressure establishes and maintains an invariant belief over a group of people. Peer pressure from the architectural community maintains approved architectural images, with the threat of ostracism for apostates (Watkin 2001). Many cases are known of ridicule heaped upon architects who stray from the official design style. Architectural magazines tend to publish only articles featuring buildings that maintain the *status quo*. Architecture students are infected with modernist memes by their teachers, and are under pressure to conform to the accepted style. The teaching of architecture has changed since most architecture schools adopted the Bauhaus concepts, so that today design is almost entirely image-driven according to Salingaros and Mikiten.

As a conclusion, they clarify how memes serve well to explain why architectural fashions survive and propagate. In particular, memes explain why the modernist style has achieved such remarkable success in displacing traditional architectural styles.

2.8. Universal Darwinism and Memes

Up to here, replication in biology and natural selection and - which all bring about – the requirements of biological evolution are briefly explained based on Darwin. Silby (2000a) praises evolution because of its simplicity and its portability to a number of domains; he adds that if the working of the system (evolution) is understood well then it will be applied to several different fields of enquiry. This is simply called 'Universal Darwinism'. Again, it was Dawkins first introduced the idea of Universal Darwinism. He suggested that "all life evolves by the differential survival of replicating entities" (1989: 192).

Darwin's logic of evolution can be easily applied to any system that has variation, selection and heredity. The fundamental principle of Darwinism is this: *if living things vary in ways that affect how well they can survive, and if they produce more offspring than can possibly survive, and if the few survivors pass on their characteristics to the next generation, then the characteristics that helped them survive will be more common in the next generation. That is, the members of the next generation will have evolved in some way compared with the previous one; they will be better adapted to the environment in which the selection took place*. This, as Darwin saw, is an inevitable process that simply must occur if the conditions are fulfilled (Blackmore 2002).

If some words here are to be replaced with the suitable terms of memes or design, there forms a plausible paragraph about memes: *if memes/designs vary in ways that affect how well they can survive, and if they produce (produced via people) more copies (variations) than can possibly survive, and if the few survivors pass on their characteristics (little modifications on memes/designs) to the next generation, then the characteristics (the little modifications on memes/designs) that helped them survive will be more common in the next generation. That is, the memes/designs of the next generation will have evolved in some way compared with the previous one – they will be better adapted to the environment in which the selection took place*. They fit perfectly since the *memetics system* or *industrial design system* is evolutionary; they both have variation, selection and heredity.

There are some premises which evolution is based on:

1. In ideal circumstances (limitless resources), populations will grow exponentially.
2. Resources are limited.

3. Individuals within a population have unique characteristics.

Figure 21. Different typewriter keyboards having different characteristics

4. An individual's characteristics are passed on to its offspring (inheritance).

Corona 3 (1912)

Corona 4 (1924)

Smith Corona Electric (1959)

Smith Corona XD 6700 (1980s)

Figure 22. The inheritance of the QWERTY keyboard layout within Corona typewriters and word processors

5. Change can occur, and this sometimes results in offspring having slightly different characteristics to their parents.

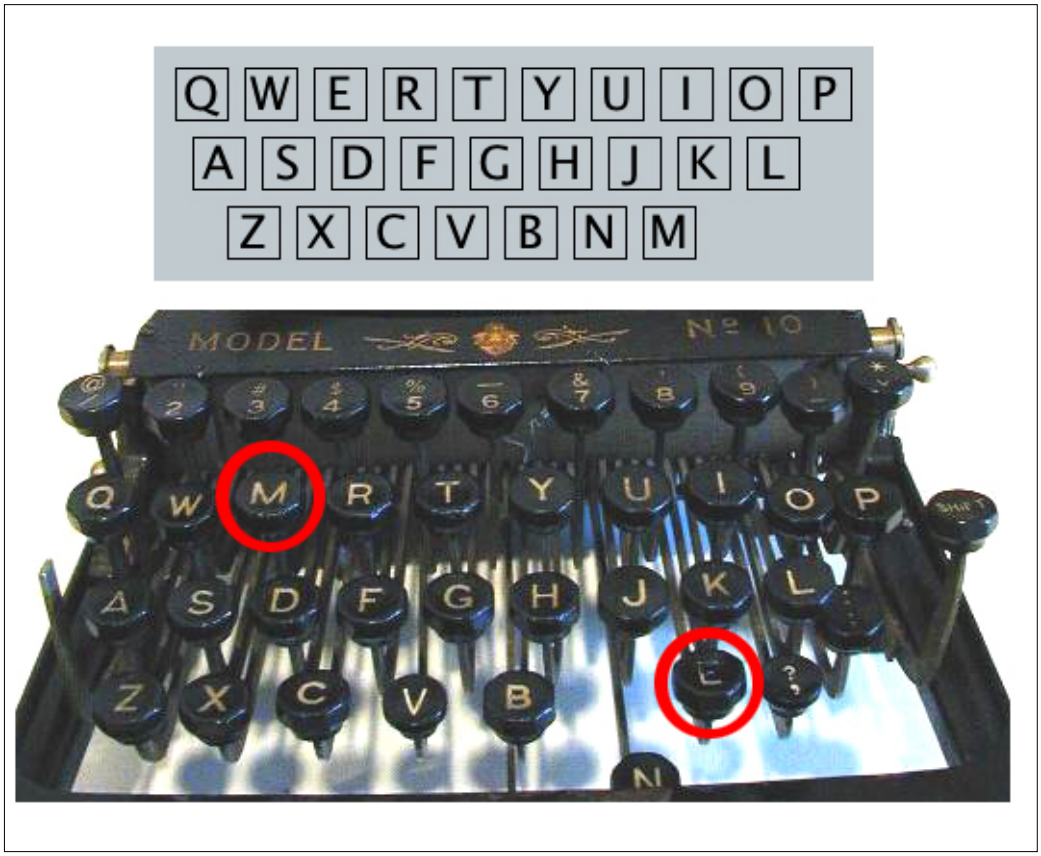

Figure 23. Pittsburg No.10 typewriter (1898) presenting the QWERTY keyboard (which was first introduced in 1874 by Remington) with a slight change.
(Source: http://ednixon.com/pix/2003/typewriters/Pa136415.jpg)

6. Given the fact that individuals have varied characteristics, it is reasonable to suppose that some individuals will have characteristics that give them a better success at acquiring resources and reproducing.

Figure 24. The huge keyboard of a mechanical typewriter having both capital and small letters on its keyboard and another mechanical typewriter keyboard - similar to today's PC keyboards - having only one type of letter on its display but presenting a shift key (in white circle) in order to 'shift' between upper and lower cases. It is clear here which type of keyboard was successful at acquiring resources and reproducing.

7. Characteristics that enhance an individual's survival and reproductive success will be passed on to subsequent generations – 'survival of the fittest' – natural selection.

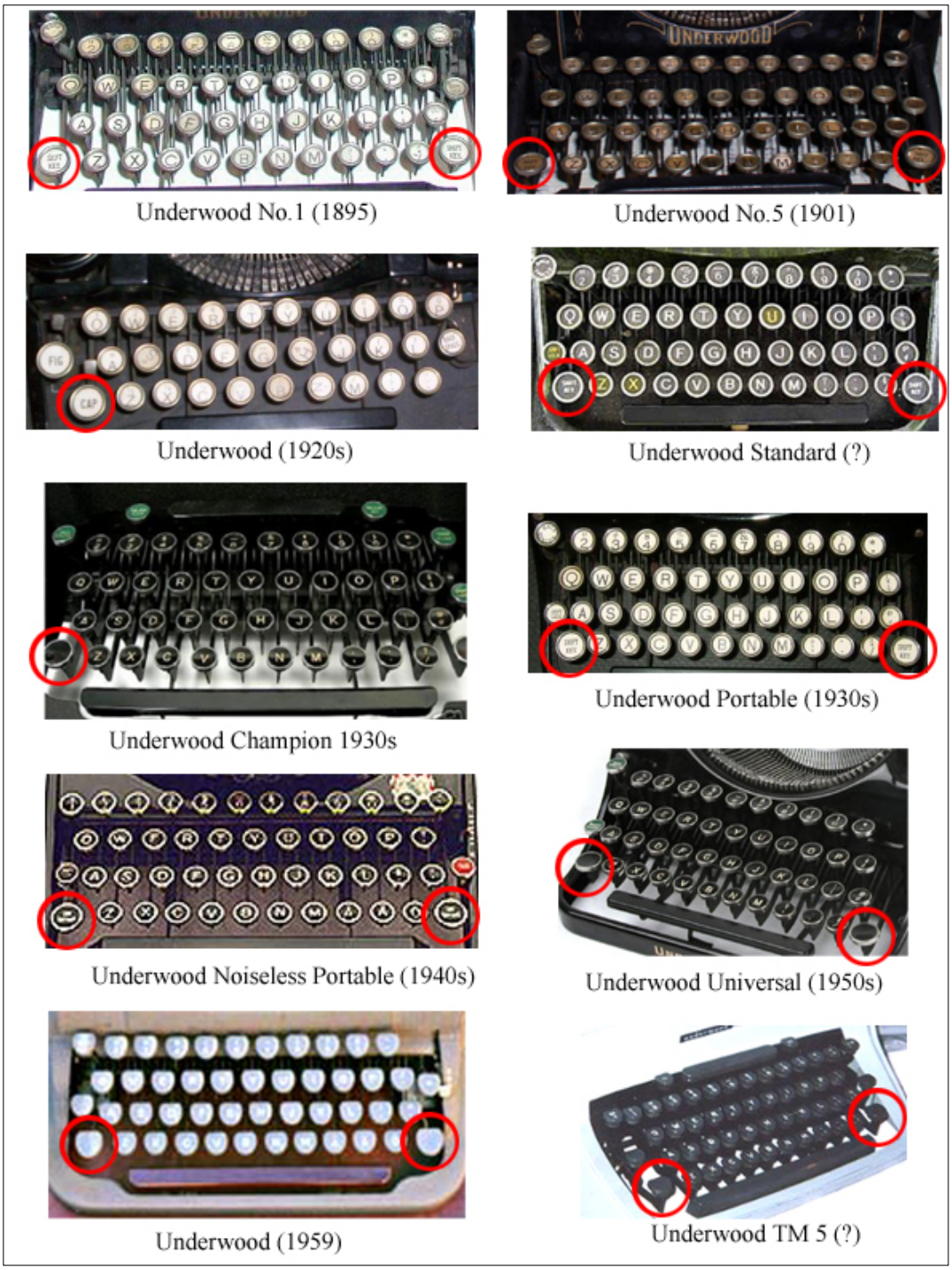

Figure 25. The keyboards of Underwood Typewriters; Shift key was an important characteristic that enhanced the typewriters' survival and reproductive success that had been passed on to subsequent generations.

8. Populations that possess above characteristics will evolve from simple to complex and from homogeneous to heterogeneous characteristics (Silby 2000a; Herbert 2000).

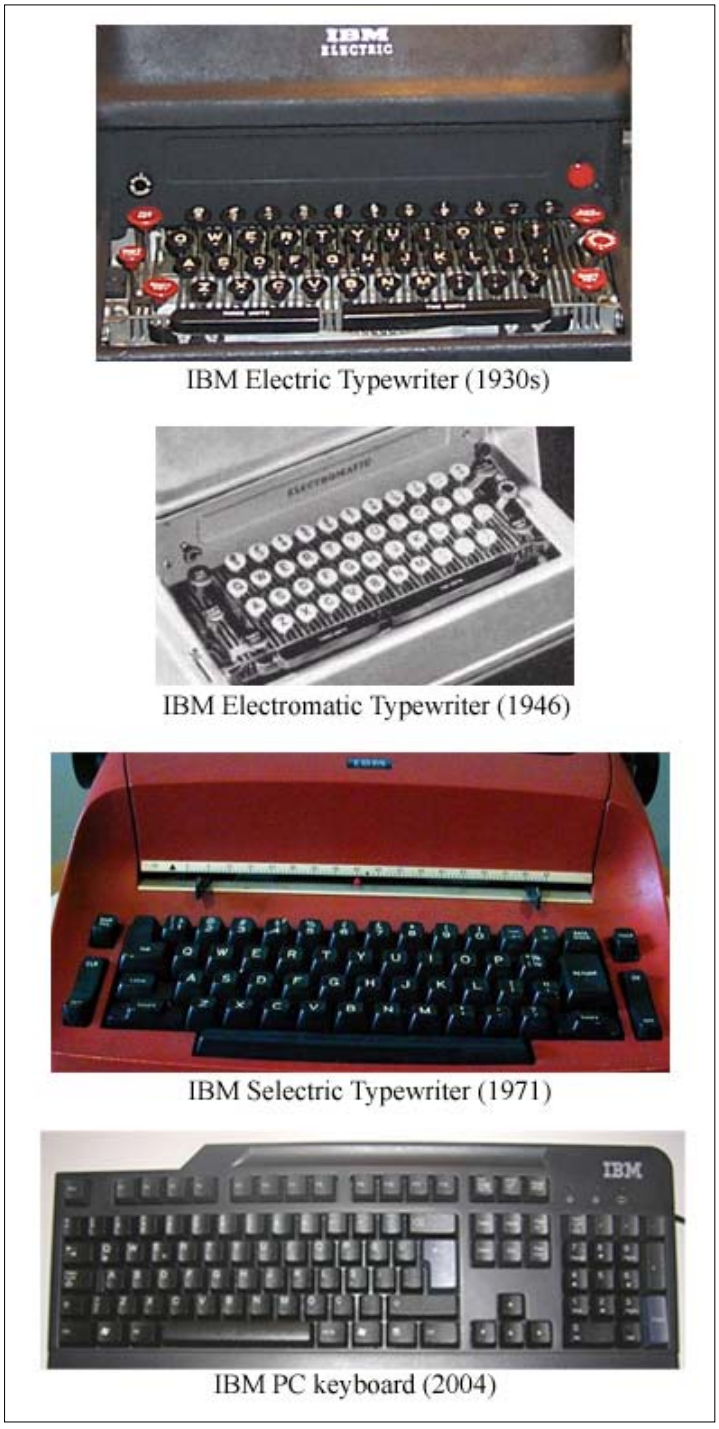

Figure 26. The evolution of IBM keyboard

To apply the system to any population a biological entity is not necessary, it just should:

- compete for resources
- have unique characteristics
- can reproduce
- produce offspring that inherit their characteristics, and
- whose offspring might be different. This is to say that the offspring may find themselves with characteristics that their parents did not have (Silby 2000a).

If all those evolution premises are considered and applied to memetics, it will be seen that the evolution of memes (ideas, designs, inventions...) is plausible. If a comparison between memes and those premises is done like Silby (2000a) a conclusion might take place easily, which will lead to for example the understanding of the evolution of Industrial Design and technology: like biological entities, memes will grow exponentially in ideal circumstances which is unlimited population of communicating minds. An idea appears in one mind and transmitted through the other minds; an exponential growth in replication of that meme. However, resources are limited, which are minds, texts, pictures, objects etc. Some memes are similar some are distinct, some are attractive but some are boring, which means every meme has its unique characteristics. An idea or let us say a design (a meme) is reproduced mind to mind by imitation which provides the characteristics of the idea to be passed on, but during this transmission some little changes may occur maybe because of imperfect copying or because of the conditions, which may give rise to new ideas or designs. These ideas which have characteristics that give them a better success at acquiring resources and reproducing will survive according to survival of the fittest principle that leading to natural selection. For example; if ‘mind’ is considered as a resource it can be thought that an idea of design is get stuck there but never finds a way for some reason, it will degrade and die there, it could not compete with other design ideas or completely the opposite. The idea of that design would be successful at getting reproduced and would survive until a better survivor appears.

2.9. Memetics

Memetics is the study of memes and their social effects (Grant 1990). Memetics tries to deal with evolutionary models of information transmission. “Memetics is all about why some memes spread and others do not” (Blackmore 1997: 45). To find the answers for success of memes it is useful to remember some simple rules that are also important throughout the way for finding out the industrial design memes:

> First**,** remember that memes (like genes) do not have foresight!
> Second, consider only the interests of the memes, not of the genes or the organism. Memes do not care about genes or people - all they do is reproduce themselves. Short-hand statements like "memes want x" or "memes try to do *y*" must always be translatable back into the longer version, such as "memes that have the effect of producing *x* are more likely to survive than those that do not."
> Third, memes, by definition, are passed on by imitation. So learning by trial and error or by feedback is not memetic, nor are all forms of communication. Only when an idea, behaviour or skill is passed on by imitation does it count as a meme. (Blackmore 1997: 50)

It might be useful to quote from Brodie (n.d.) here in order to express the importance of memetics. He answers the question of why it is called memetics, but not ‘cultural evolution’, ‘behavioral psychology’, ‘sociobiology’ or something else: the breakthrough in memetics is in extending Darwinian evolution to culture. There are several *exciting* conclusions from doing that, one of which is the ability to predict that ideas will spread not because they are ‘good ideas’, but because they contain ‘good memes’ such as danger, food and sex that push our evolutionary buttons and force us to pay attention to them.

Memetics is the theoretical and empirical science that studies the replication, spread and evolution of memes. Its core idea is that memes differ in their degree of ‘fitness’, i.e. adaptation to the socio-cultural environment in which they propagate. Because of natural selection, fitter memes will be more successful in being communicated, ‘infecting’ a larger number of individuals and/or surviving for a longer time within the population. Memetics tries to understand what characterizes fit memes, and how they affect individuals, organizations, cultures and society at large (WEB_1, 2005).

The memetic perspective is complementary to the traditional social science perspective, which focuses on the characteristics of the individuals and groups

communicating rather than on the characteristics of the information being communicated. This does not imply a 'memetic reductionism', which would deny individual control over what is communicated. It just notes that in many cases the dynamics of information propagation and the ensuing evolution of culture can be modelled more simply from the 'meme's point of view' than by analysing the conscious or unconscious intentions of the communicating agents (WEB_1, 2005).

Under the guidance of all those principles and characteristics, memetics and selection theory may account for some aspects of social behaviour and practices that are transmitted from person to person. Other aspects, like individual decisions and motives concern psychology and other disciplines (Fog 2003).

There is an e-journal on memetics on the internet, which is worth to mention here, called *Journal of Memetics – Evolutionary Models of Information Transmission* (*JoM-EMIT*). It had been a useful resource even throughout the study of this thesis. It is a peer-reviewed scientific journal without subscription fee. It is the first and the only scientific e-journal on memes and memetics, and it is an important place for scientists and professionals to discuss their views and research in memetics. The first issue is scheduled for May 1997. On the website, they explain their scope and aims as to develop the memetic perspective, with space devoted to relevant evolutionary issues and other related topics and to discuss issues concerning memetics such as:

- Mechanisms involved in evolutionary processes. Comparisons of different models of evolution are especially welcome.
- Philosophical or theoretical issues concerning epistemology and evolution
- Boundaries of the evolutionary approach
- Empirical research
- Fundamental approaches aiming at structuring the field of memetics as a science

The topics addressed by the journal include, but are not restricted to, the following:

- *Empirical observation,* e.g. of the spread of institutional structures, theories, ideas, fads, or prejudices in social groups or communities.
- *Experimental approaches,* e.g. from simple manipulation of story elements to test which ones are best transmitted from person to person, to complex interventions such as trying to influence a online forum community with specific input.

- *Case studies,* e.g. of the historical diffusion of a particular chain letter, legend, scientific principle, invention, or religion.
- *Computer simulations,* e.g. of the dynamics of information propagation among agents.
- *Mathematical models* of the dissemination and evolution of knowledge, culture and information.
- *Theoretical analyses,* aimed at clarifying fundamental concepts and mechanisms and developing solid foundations for the field of memetics or adjacent fields.
- *Philosophical and scientific implications* of the memetic perspective, e.g. for epistemology, consciousness, or the origin of the human mind.
- *Practical applications,* e.g. in marketing, management, public education, or combating the spread of dangerous habits or rumors.

Like other journals, the journal of memetics only publishes papers after they have been approved by peer-review. In order to organize this they have an editorial board with reviewers, and an advisory board. Advisory board consists of Susan Blackmore, Gary Cziko, Richard Dawkins, Daniel Dennett, Liane Gabora, and David Hull. It is a board composed of editors coming from different disciplines which can assist a broad range of authors, and select the most interesting contributions with an emphasis on scientific quality.

As it is written on the journal's information page there was a lack of a general framework about memetics discussions and there was a need for a journal. The journal meant to solve such problems offering a forum where theories and the philosophy of memes and evolution are in the centre, not just at the edge of the issues journals want to cover. Many scientists would benefit by such a focused and lasting dialogue. This can lead to a more rigorous connection of memetics with established theories, with clarifications as to what memetics can contribute to science, and what it can not. It enables the construction of a common evolutionary memetic framework, including views on how to compare different evolutionary views.

In addition, it offers the possibility for an interdisciplinary approach, which is needed to yield the full range of possibilities memetics offers. On one hand the confrontation of evolutionary models from different disciplines will clarify pitfalls caused by looking at evolution in only one discipline. Moreover, the development of a common language and terminology may be stimulating and enable workers from

different disciplines to discover more readily possible analogies between phenomena in their field of interest and other fields of research. JoM stresses that, according to their point of view, the only way to develop memetics into a solid science is through interdisciplinary collaboration. JoM-EMIT particularly welcomes cross-disciplinary perspectives, where e.g. biological analogies are applied to understand cultural evolution, or computer simulations are used to model the spread of languages. However, in spite of its roots in evolutionary biology and computer simulation, they see memetics in the first place as a (new type of) social science, focusing primarily on the spread of information within human society. They therefore particularly welcome approaches that integrate memetic ideas with observations, concepts and methods from the social sciences and humanities, rather than being restricted to formal models that have little connection with the behavior of real individuals, groups or cultures.

Additionally the journal gives some useful links about meme and memetics like a brief overview and history of memetics, a bibliography of memetics, a lexicon of memetics at the Principia Cybernetica Project, links to sites related to memetics and other on-line publications on memetics.

CHAPTER 3

DESIGN IDEAS AS MEMES

In the previous chapter, memes are introduced as replicators. Now the design ideas will be introduced as memes. This means design ideas, and/or the human behaviour that formed that ideas will be evaluated as the replicators, which made humans create the surroundings around them. Design ideas generally act like memes. Therefore, the explained principles of replication in biological evolution and the principles of natural selection can be applied to design ideas too.

3.1. On the Origin of Design Ideas

The definition of design goes like this in the book *Toothpicks and Logos* by Heskett:

> To address the first point: design, stripped to its essence, can be defined as the human capacity to shape and make our environment in ways without precedent in nature, to serve our needs and give meaning to our lives (2002: 7).

In order to find out the origin of ideas such a question can be asked; how did that 'shaping' start and continue? In a more defined sense, the question can turn into this; how did design start? What was the relation between human nature and artificial objects that they have created? To answer those questions first of all the relationship between humans and natural 'objects' should be analyzed since human beings first began 'to design' by means of changing their environment.

The crucial instrument of the prehistoric ages was the human hand of course. Hand was flexible and capable of doing lots of functions. The origin of first tools is the extensions of these functions of the hand. By imitating the movements of the hand, mankind started to use natural objects as tools. For example, while the hand can be cupped to drink water, a deep shell also forms the same shape more effectively without leakage. Like the hand can dig soil out but a digging stick can do the same job reducing the damage to fingers. Human beings started to adapt, and understand the relationship between forms and functions. They used a piece of stone as an axe, a cave as a shelter;

they transformed a mass of mud into a bowl etc. Beyond those, they started to transform natural materials into forms without precedent in nature (Heskett 2002). Imitation, adaptation and transformation opened the endless ways of design for humankind.

3.2. Re-design

"… every picture owes more to other pictures painted before than it owes to nature." (Gombrich 1978).

It may seem to be odd but, designers, in practice, can not start from scratch generally. On the contrary, it can be said that designers start off where other designers (or they themselves) have left off which means design is also something about improving earlier products, and that designers are thereby linked to earlier objects, or actually to their own or their colleagues' earlier solutions - and thus to yesterday. This is how it was in biological evolution:

> As evolutionists we presume that what mankind's design activities and nature's developmental processes have in common is that neither of them begin, or can begin, from scratch. Because they build on previous solutions, both new individuals and new products retain also a number of earlier solutions that were optimal in contexts no longer existing. Neither organisms nor artefacts can therefore ever be distinguished by perfection but are rather a mixture of optimal and sub-optimal solutions (Michl 2002: 14)

George Basalla argues this deeply in his book The Evolution of Technology (1988). Basalla sheds light on evolutionary history of design and technology emphasizing on: "Any new thing that appears in the made world is based on some object already in existence" (45). And similarly he continues: "each new technological system emerges from an antecedent system, just as each new discrete artifact emerges from antecedent artifacts" (Basalla 1988: 49). He builds an evolutionary explanation of how steam engines, hammers, trucks and transistors have come about. He emphasises the slow progressive process of change through imitation and variation. For example, many features of wooden buildings were reproduced in stone by the Greeks, the first iron bridge built in the late 1770s was modelled on woodworking practices, and even the plastic bucket often still shows signs of its origins in metal. Transistors were only gradually miniaturised and radio signals very gradually transmitted further and further. Basalla questions the idea of technology progressing towards grand goals such as 'the

advancement of humanity' or the 'the overall betterment of the human race'. So he refutes the idea that technology advances with the efforts of a few heroic individuals who produce revolutionary inventions. He depicts the relation of evolutionary perspectives and artifacts which are included in the design domain.

In public perception, design is typically regarded as the pursuit of pretty forms by talented individuals. Design is not always just an individual's creative activity, but creativity with a collaboration of the past and the future. To redefine design, it can be focused on the word 'design' itself. The word itself is lack of some perspective which is the collective, cooperative and cumulative dimension of design.

> …it [the word design] neglects the fact that all new products and solutions, and all their designers, are deeply in debt to earlier products and solutions, and to earlier designers. To put it differently, the word design accommodates neither the co-operative, cumulative character of the design process nor the supra-individual, evolutionary nature of designed objects (Michl 2002: 11).

When the word 'design' is used to express a sole designer's creative activity leading to an ultimate solution, it is in fact holding back the entire cooperative and past-related dimension of designing. Design generally contains a collective and cumulative element. Maybe it would be better to consider the word 'redesign', which has the advantage of containing the word 'design' already. If the redesign perspective is adopted, if it is taken for granted that, functionality of artifacts is always the result of step-by-step improvements to the tools available at any time, then the origin of any intelligent contrivance becomes easier to understand (Michl 2002).

3.3. Design as an Evolutionary Process

The role of evolution in design is significant. There are numerous successful design examples which result from an evolutionary process, by making successive slight modifications over a long period of time, not through a feverish insistence on making frequent obvious changes for the sake of offering something which looks 'really new and different'. Just like the evolution of organisms, the evolution of devices is a natural process too (Pye 1978). For example bicycle; it has diverged and converged in a non-linear way, which is a general characteristic of co-evolving adaptive systems like it

is in the evolution of typewriters, keyboards, computers and its peripherals, TVs, cars, most of the electronic devices etc.

It is crucial that design should -mostly- be regarded as a gradual, step-by-step process of adaptation of already existing solutions; it can be said that it is more like modification than innovation. However, this process should not be confused with 'copying'. Producing identical copies does not suffice to generate the diversification and variety which is necessary for selection to be applied.

Since the prehistoric ages till today, design has always followed an evolutionary process. For example; let us say one of the first human beings finds a stone in order to use as a weapon or a cutting tool because of its sharp edges, some others see that stone and find stones similar to that and sharpen its edges more by the help of another stone, someone from another tribe maybe, take that sharpened stone and ties it up on the end of a stick and that goes on like that. It is not possible to say that in the end of that imitation and interaction, the perfect weapon will be invented. This is not what happens when it is said *evolution of design*. The ideal form or the perfect form has nothing to do with evolution; evolution brings about change and adaptation, but it does not necessarily lead to progress or advancement, and it does not necessarily leads to perfection (Yagou 2005). The circumstances of the environments people live in always change and the requirements for survival also alter through these influencing factors, so according to those changes, suitable solutions are produced. Some of these solutions survive and some of them not because of some other reasons. The survived solution does not have to be successful by means of design; but it has to be successfully repeated, like genes in biology. This is how memes work also [See Chapter 2].

In her article *Rewriting Design History from an Evolutionary Perspective* (2005); Yagou also adds a different perspective to the various theories which have been applied over the course of time to explain the evolution of artifacts under the influence of multiple factors. She discusses the role and the potential of an evolutionary perspective on design history; artefacts are manifestations of ideas which are replicated and propagated, in other words they may be considered as memes. Such memes replicate and propagate in the mental space of human understanding through a complex process involving imitation, modification, and competition. "In this sense, design history is viewed as a history of ideas on how to live and interact with others, rather as a succession of forms and styles. Good designs are not ideal forms, but fitting forms which have evolved through adaptation processes within particular social, economic,

and technological contexts" (2005: 1). Therefore, history of design would be a history of ideas and therefore of culture. A good history uses the work of designers not just as bright spots on the page but as examples of the social, political, and economic climate of a given time and place.

3.4. Evolutionary Design Practices on Typing

One of the examples for the *replicating behaviours* through generations is typing. When the subject is typing the main product to be mentioned is the *keyboard*. Today keyboards are commonly seen as auxiliary equipments that are connected to computers. It is the device used to enter information and instructions into the computer. The keyboard allows for user input and action with the computer. Most keyboards have all the letters of the alphabet, numbers 0 - 9 and additional special operational keys. Most of the keys, their functions and locations derive from the antique mechanical typewriters which are not used today. A typewriter is a mechanical, electromechanical or an electronic device with a set of keys that, when pressed, cause characters to be printed on a document, usually paper. It has a keyboard, with keys for the characters in its font.

3.4.1. The Memetics of the QWERTY Layout and the Shift Key

The QWERTY layout is a typical visual memetic pattern, which had been active since 1874. It is the first six letters of the keyboard layout of the first commercial mechanical typewriter. It has been accepted as the universal or the standard keyboard design in English-speaking countries around the world today.

The QWERTY layout was first seen on the Sholes typewriter by Remington in 1874 (Figure 27) and it still lasts today. Before 1874, while Sholes was working on typewriters, there were some problems with the printing mechanism; the key slugs would easily get jammed when a key was pressed before the previous one had returned. Sholes solved this problem by experimenting with the most common English two-letter sequences and assigning the most frequent couples to opposite sides of the keyboard. This resulted in the QWERTY layout (Figure 11), which was optimal in avoiding key jamming (Buzing 2003).

Figure 27. Keyboard of Sholes typewriter by Remington; the first QWERTY keyboard, 1874 (Source: http://www.precision-dynamics.com.au/typewriters/sholes.html)

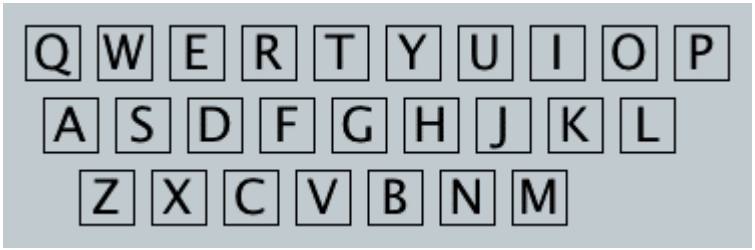

Figure 28. The QWERTY layout

3.4.1.1. The Mechanical Phase

The Sholes typewriter (1874) was not the first typewriter design in the typing world. The evolution of the *writing machine* from early eighteenth-century concepts to the modern electronic typewriter represents a rich history of innovative efforts by many individuals in several countries. Until 1874, there had been different ideas of typing apart from the *keyboard type* used today. The idea of the typewriter can be traced to the early eighteenth century.

The two basic categories into which all writing machines can be placed is 'keyboard' and 'index'. The keyboard category comprises all of what known as a typewriter, one in which a keyboard is used to select the character wanted and the key depressed to print the character. An index typewriter has a chart on which all the characters appear, and a pointer or wheel that is used to select the desired one. Depression or manipulation of another lever or device prints the character. Through the evolution of typewriters, generally, the first attempts were part of the 'index' category

(Figure 29 shows an index typewriter with its circular keyboard reminding those days' telephone keyboards).

Figure 29. An index typewriter with a circular keyboard
(Source: http://en.wikipedia.org/wiki/Typewriter)

In 1714, the first known patent for a typewriting device was granted to Henry Mill in England. Mill's invention was described as 'an artificial machine for the impressing or transcribing of letters singly or progressively one after another as in writing'. There are no surviving details to prove its existence as a working machine (Beattie & Rahenkamp 1981).

In 1829, the first U.S. Patent for a writing machine (Typographer) was granted to William A. Burt, it is also considered to be the first typewriter capable of practical work (Figure 30). It lacked a keyboard, however, and an operator caused type to be moved to the printing point by turning a wheel.

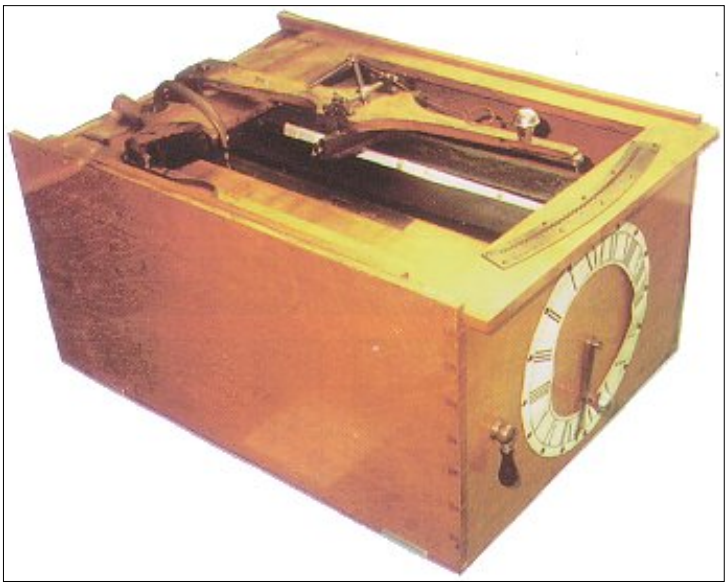

Figure 30. William A. Burt, Typographer 1829
(Source: http://www.precision-dynamics.com.au/typewriters/burt.html)

In 1833, the first machine to utilize individual typebars which converged at a common printing point was conceived and built by Xavier Progin (Figure 31).

Figure 31. Xavier Progin - Machine Kryptographique - 1833
(Source: http://www.precision-dynamics.com.au/typewriters/projran.html)

But it was The Beach Typewriter (Figure 32) c. 1856, which introduced the universal typing bar that is familiar today.

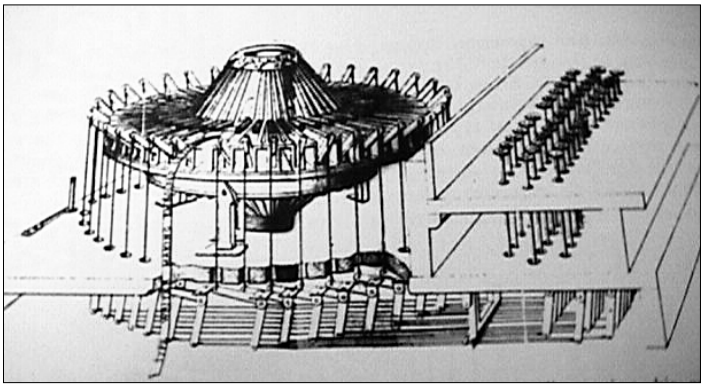

Figure 32. The Beach Typewriter c. 1856
(Source: Buzing, *Comparing Different Keyboard Layouts*)

Another interesting example to the first typing machines is the Writing Ball introduced in 1870 by Malling Hansen (Figure 33). It was a commercial success on the European continent, where it won several awards during the 1870s (Mares 1909).

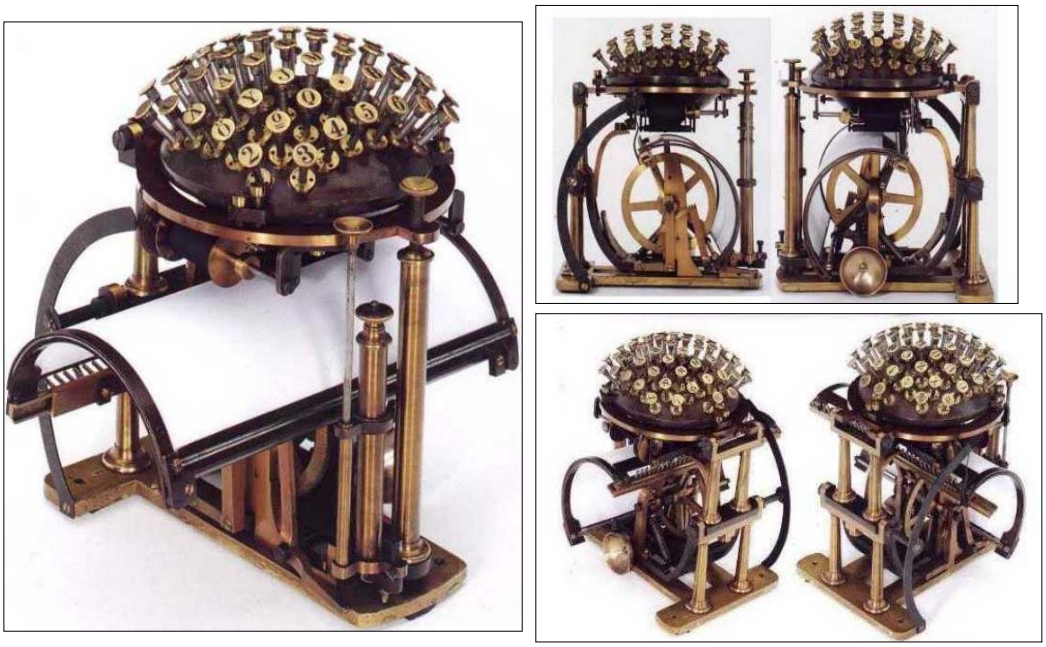

Figure 33. Writing Ball – 1870 - Malling Hansen
(Source: http://www.officemuseum.com/typewriters_hansen_writing_ball.htm)

The period that followed saw many inventive efforts of varying significance; however, throughout this period of early development the commercial possibilities of the typewriter seemed to elude inventor after inventor. Many, in fact, were motivated to find a way to assist the blind or handicapped.

The first commercial typewriter was evolved from the unit invented and built by Christopher Sholes and Carlos Glidden in 1867. Introduced to the U.S. market by Remington in 1874 (Figure 34) as the 'Type Writer', the unit proved to be neither very reliable nor commercially successful and was soon to be replaced by Remington No.2 (Figure 35). It was heavily influenced by the workings and the appearance of the sewing machine, which was also produced by Remington. This early typewriter had its limitations; it typed nonvisibly (the operator could not view the result while typing) and printed only in capital letters (Shift key appeared on the keyboard of Remington No.2) (Beattie & Rahenkamp 1981). Maybe the most important point about Sholes Typewriter was the presentation of the QWERTY layout to the market. The QWERTY keyboard was present on the first typewriters that entered the business offices and the Remington Company trained many typists for this keyboard. This provided the QWERTY layout a great initial advantage (Buzing 2003).

Figure 34. Sholes Typewriter (no shift key) - Remington, 1874
(Source:
http://www.officemuseum.com/IMagesWWW/1874_Sholes__Glidden_NMAH_SI_OM.jpg)

Figure 35. Remington No. 2 Typewriter (with its shift key), 1878
(Source: http://www.officemuseum.com/1878_Remington_No._2_front_OM.JPG)

Throughout the typewriters evolution, the Shift key was the first special key added to the keyboard layout. To avoid increasing the number of keys to print both upper and lower case letters, two typefaces were placed on each typebar. When a letter key was operated in combination with a platen-shifting mechanism, either the upper or the lower case version of the letter could be chosen to print. It was in 1878, Remington No.2 Typewriter used a shift key on the left bottom corner of the keyboard and since that model, nearly all the mechanical and electric typewriters had a shift key (Figure 35-36). It was a real ease to write both lower and upper cases with one layout, otherwise there had to be a doubled keyboard (Figure 38).

Figure 36. Shift key on Remington No.2 keyboard, 1878
(Source: http://www.officemuseum.com/1878_Remington_No._2_front_OM.JPG)

Caligraph No.1 was the second typewriter appeared on the U.S. market in 1880. Its No. 2 model had a giant keyboard that featured both lower and upper cases rather than the shift key used on Remington No.2 (Figure 37). Both models were using a different keyboard layout rather than QWERTY (Figure 38).

Figure 37. Caligraph No.1 and No.2, from left to right
(Source: http://www.maquinasdeescreverantigas.com.br/fotos/caligraph%201.JPG
http://www.maquinasdeescreverantigas.com.br/maquinas/Caligraph%202%20famc.jpg)

Figure 38. Caligraph No.1's keyboard layout 1880
(Source: http://www.maquinasdeescreverantigas.com.br/fotos/caligraph%201.JPG)

Hammond in 1884 used a type-shuttle design and had a curved keyboard with its own unique key arrangement called 'Ideal' (Figure 39). Hammond type-shuttles were made in numerous different typefaces and languages. Hammond later produced the

Varityper, a standard office-typesetting machine that was the antecedent of today's desktop publishing.

Blickensderfer of 1893 introduced its so called 'scientific' keyboard (Figure 39-40) and it used yet another typing mechanism known as type-wheel.

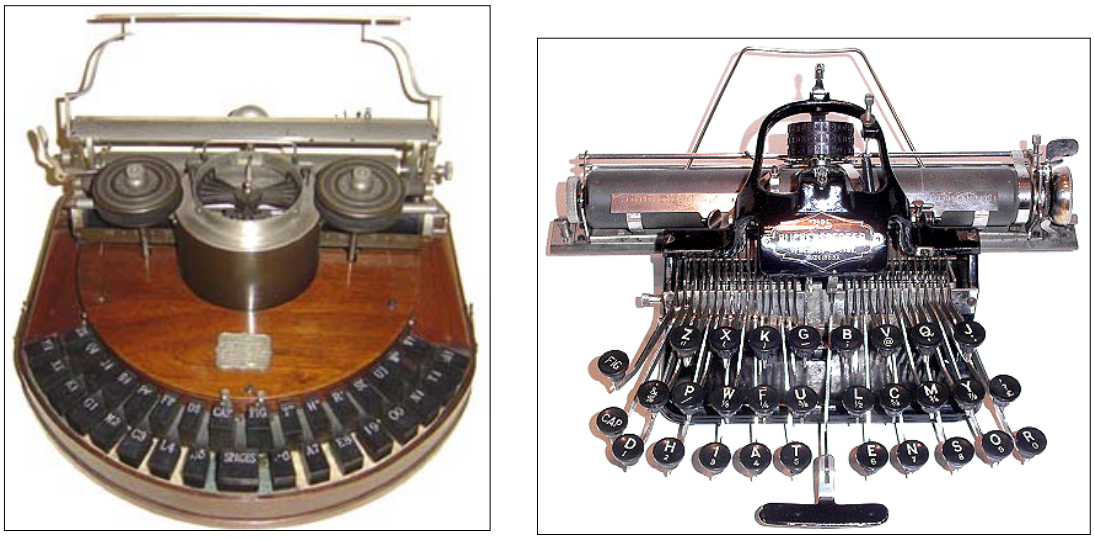

Figure 39. Hammond 1884 and Blickensderfer No.5 1893, left to right
(Source: http://www.maquinasdeescreverantigas.com.br/fotos/hammond%201.JPG
http://www.portabletypewriters.com/blickensderfer_front_closeup.gif)

Figure 40. Blickensderfer No.7 keyboard layout 1897
(Source: http://ednixon.com/pix/2003/typewriters/Pa136411.jpg)

Like the *variety* in biological evolution, there had been various designs of typewriters in the market. For some reasons typewriters like Hammond and Blickensderfer (Figure 39-40) failed to seriously endanger the market-leading position

of Remington. Maybe it was because Blickensderfer did not have the production capacity that Remington had, or the early QWERTY market penetration gave Remington a slight but decisive advantage. In addition, the Remington typewriter had won some important typing contests. These competitions were very common those days, for example the famous Cincinatti contest in 1888, which was won by Remington's star typist Frank McGurrin. The New York Times stated that this victory made clear that the Remington machine (with its QWERTY keyboard) was technically superior. This was the best kind of advertisement that Remington could wish for and it put many competitors out of business. In fact, it is said that the performance differences were rather small (Buzing 2003). This way or that way *selection* was made through variety; some ideas have died some have survived. Remington was selected so was the QWERTY.

During 1880s, many different types of typewriters were designed, but the one which developed the style known today was the Underwood No.1, invented by F. X. Wagner and produced by the Wagner and Underwood Company in 1895 (Figure 41). This was the first modern typewriter with a writing area facing the user and type bars that stay out of sight until a key is struck. Unlike early Remington models and many other standard machines at the time, Wagner's frontstrike design finally made the type fully visible as it was being typed (for type bar definitions see Appendix A). These features, shared by all subsequent typewriters, made it easy for the typist to see and if necessary correct the typing as it proceeded. Apart from that, Underwood No.1 was put on the market with its QWERTY keyboard and a shift key on it. This can be called as the *retention (heredity)* of the QWERTY meme and the shift key meme. It is simply Darwinian (for principles of natural selection see chapter 2) and of course it is analogical to biological evolution; characteristics that enhance an individual's survival and reproductive success will be passed on to subsequent generations – 'survival of the fittest' – natural selection.

Figure 41. Underwood No.1, 1895
(Source: http://www.makingthemodernworld.org.uk/everyday_life/work/1880-1939/TL.0376/)

After being the dominant one in 1890, many alternative layouts continued to appear against QWERTY claiming to be more efficient and faster thus superior. The most famous alternative was the Dvorak's Simplified Keyboard (Figure 42) patented in 1932. Nevertheless, whatever had been claimed, the QWERTY meme has always been the fitting meme through the design of typewriters and keyboards after a certain time. The QWERTY layout is not yet proved to be the most efficient keyboard layout possible. However, the QWERTY layout, as a meme, - efficient or not, ergonomically correct or not (these are not the cases here) - had been a successful replicator and gained success through the meme pool against the other memes (layout designs). It was

successful because it managed to replicate itself; this increased the possibility of being the *fitting meme* under the conditions of the existing environment.

Figure 42. Dvorak's Simplified Keyboard; the most popular alternative to QWERTY keyboard (the small letters in the corners represent the QWERTY layout)
(Source: Buzing, *Comparing Different Keyboard Layouts*)

This case is similar to the competitions between recording systems of VHS and Beta. There were no real technical differences initially between Beta and VHS even though some claimed Beta is better. The major differences were the size of the cassette, the threading of the tape, and the tape speed. This similarity in technical specification was due a prior patent-licensing agreement between Sony and Matsushita (creators of Beta and VHS respectively), who had previously cooperated in selling a professional video recorder called the U-matic (Lardner 1987). Within two years of VHS's introduction, the market was full of VHS videos and everyone believed that VHS is superior. VHS was chosen as the VCR format among the users whether it is superior or not. This is also a similar case to the contention between the operating systems of Macintosh and Microsoft-DOS.

Most of the people consider what the people around them choose or likely to choose. This helps memes spread also. Economists have coined a term to connote this; *network externality*. Economists define the concept like this: "There are many products for which the utility that a user derives from consumption of the good increases with the number of other agents consuming the good." Elaborating they add, "[T]he utility that a given user derives from a good depends upon the number of other users who are in the same network." (Katz & Shapiro qtd. in Liebowitz 1994). It means the value of the good depends in part on how many other people it can connect to.

Changes in the mechanical typewriter design have evolved over time. Through many innovations, these limited mechanical devices were to evolve into sophisticated electronic typewriters with improvements. Some of the important improvements were the shift key mechanism, visible writing and portable typewriters. With the development of the portable typewriter, further opportunities for the writers have been created. The production of a lightweight machine allowed typing to occur outside the normal workplace. One of the first portable machines was the Blickensderfer in 1893 (see Figure 39). There were numerous different designs; but whatever has changed the QWERTY and the shift key have never changed. They were successful memetic patterns. Following figures (Figure 43-49) show different times' mechanical typewriters with their QWERTY keyboards and shift keys, and also a French and a Turkish typewriter with their shift keys. Shift key was such a successful meme; its location and its mission were the same even though the layout of the keyboard was different from QWERTY.

Figure 43. Williams No.6 (1904) and below Franklin (1891)
(Source: http://ednixon.com/pix/2003/typewriters)

Figure 44. Remington No.6 (1894) and below Wellington No.2 (1896)
(Source: http://ednixon.com/pix/2003/typewriters)

Figure 45. Underwood No.5 (1901) and below Oliver No.5 (1906)
(Source: http://ednixon.com/pix/2003/typewriters)

Figure 46. Corona 3 (folding) (1912) and below Bing (1927)
(Source: http://ednixon.com/pix/2003/typewriters)

Figure 47. Above Torpedo (1920s) with its French keyboard layout and below Patria (?) with its Turkish keyboard layout different from QWERTY and with their shift keys placed the same as most of the typewriters.

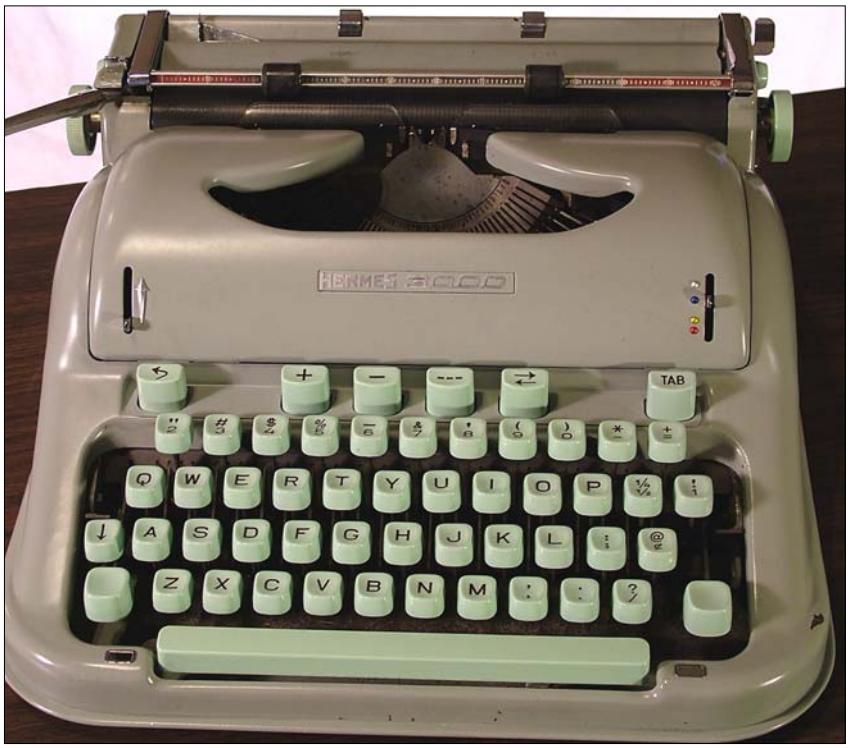

Figure 48. Underwood Universal Portable (1930s) and below Hermes 3000 (1960s)
(Source: www.typewriter.com
http://www.charkes.com/photos/view/Hermes3000/DSCF0987.JPG)

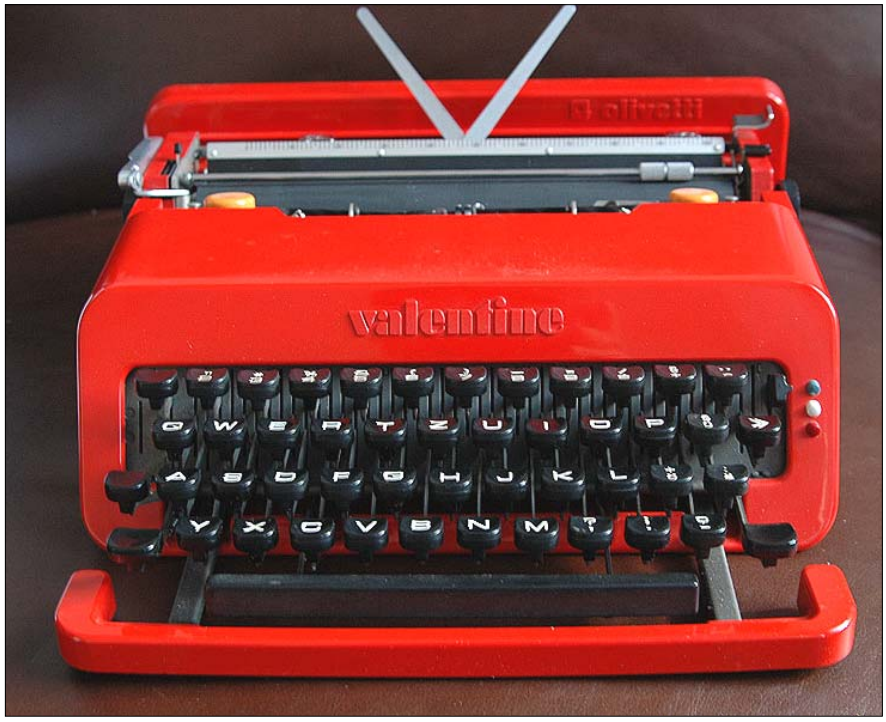

Figure 49. Olivetti Valentine (1969)
(Source: http://www.zachklein.com/hello/264/994/1024/typwriterClose.jpg)

3.4.1.2. The Electronic Phase

Another advance in typewriters came with the development of the electric typewriter. The advantage of an electric machine was greater speed and legibility. Blickensderfer produced the first electric model around 1902 (Figure 50). Although Blickensderfer decided not to market the electric typewriter, a colorful brochure had been prepared. Typing was achieved by means of a single element 'golf ball', it essentially shared the same principles as the IBM Selectric, which came in the market more than a half century later (WEB_2, 2005). Blickensderfer Electric's keyboard layout was not QWERTY, but the first commercially successful electric typewriter put in the market had presented QWERTY layout on its keyboard, like mostly used mechanical typewriters. It was marketed by IBM as the Electric Typewriter Model 01 (Improved) in 1935 (Figure 51).

Figure 50. Blickensderfer Electric; the first electric typewriter, not marketed, c1902
(Source: http://www.precision-dynamics.com.au/typewriters/blickensderfer.html)

Figure 51. IBM Electric Typewriter, Model 01 - improved, (1935)
(Source: http://www-03.ibm.com/ibm/history/exhibits/modelb/modelb_milestone.html)

The modern powered typebar typewriter traces its roots to the invention of James Fields Smathers in 1912. Taking inspiration from the rollover cam action of a hay-raking machine, he devised a rollover cam driven by a rubber power roll to impart

power to the typebar action. Evolving from the initial concept of a belt-operated bank of typewriters driven by a common motor, the electric typewriter soon employed a small motor and mechanically operated clutching device to power various functions of the machine. These machines were slow in developing and had little effect on the market until the mid-1930s when IBM entered the picture. In the late 1920's, Electromatic Typewriters, Inc. was manufacturing an electric typewriter and making a modest amount of money in the process. In 1933, International Business Machines Corporation purchased the tools, patents and production facilities of the firm. IBM markets the first commercially successful electric typewriter, the Electromatic in 1935. IBM would produce electric typewriters until 1990 (WEB_3, 2005).

The shift key meme and the QWERTY layout meme were again successful at replicating themselves in the era of electric and electronic typewriters and word processors. As the shift key was located on the left bottom of the mechanical typewriter's keyboards, it was also commonly located on both the left and right hand side of the electric and electronic typewriters too; below the *caps lock* and *enter*/*return key*. The shift keys were still using for typing capitals and special characters. Following figures (Figure 52-57) are some examples to this electronic era of the QWERTY and shift keys.

Figure 52. IBM Electric Typewriter Model 01 (1935) and below IBM Electric (1930s)
(Source: http://www.etypewriters.com/1947-01.jpg
http://patrickweb.com/gallery/ibm_chq_gallery/early_ibm_electric_typewriter?full=1)

Figure 53. IBM Model 04 (1947) and below a prototype of IBM Model A (1940s)
(Source: http://www.etypewriters.com/1947-04.jpg
http://ednixon.com/pix/2003/typewriters/Pa136452.jpg)

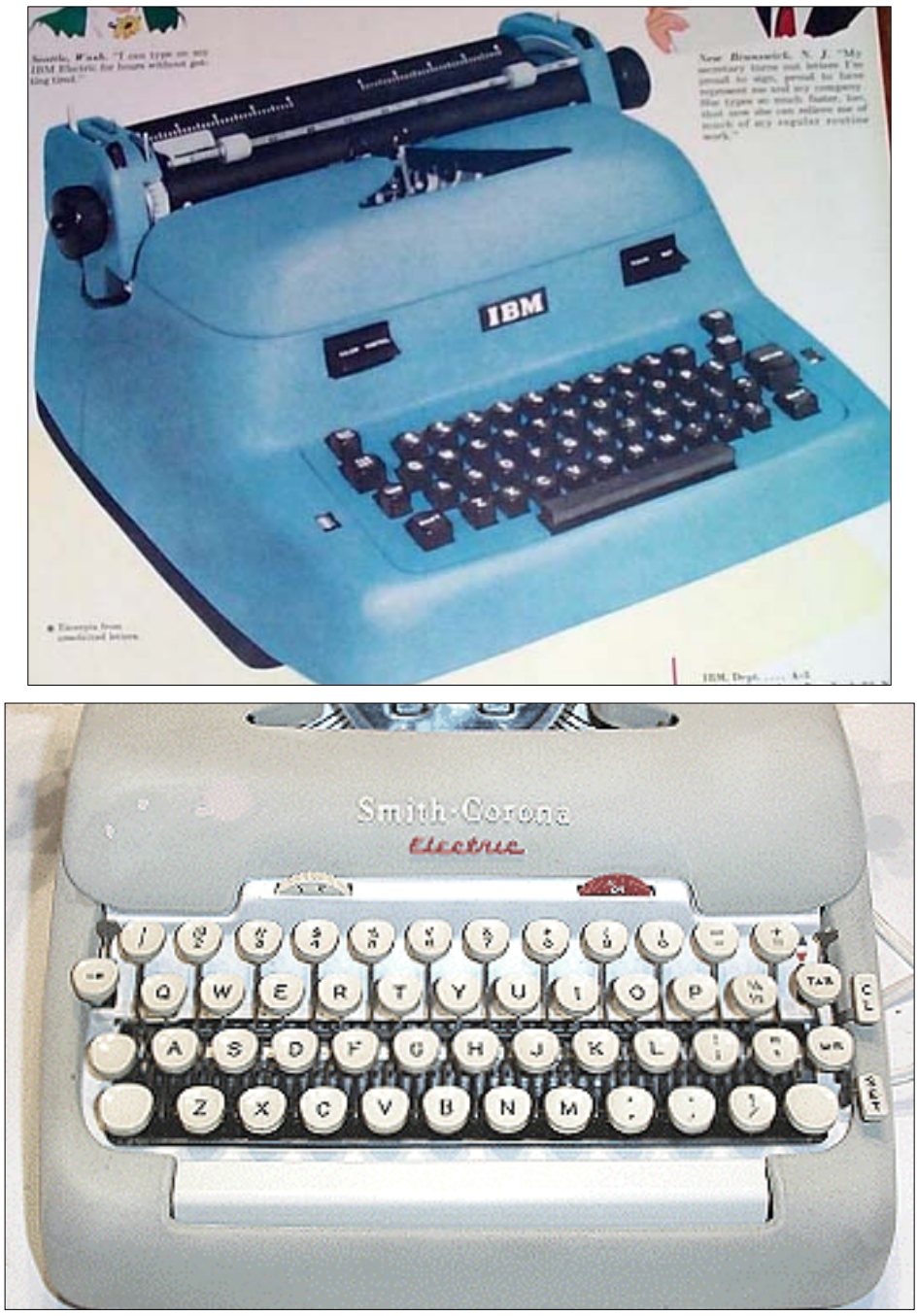

Figure 54. IBM Model A (1950) and below Smith Corona Electric (1959)
(Source: http://www.etypewriters.com/1950-a-1.jpg
http://www.portabletypewriters.com/smith_corona_5le_htm.htm)

Figure 55. IBM Selectric 1961 and below 1971
(Source: http://teclasorg.coolfreepage.com/col_IBM_Selectric.htm
http://ednixon.com/pix/2003/typewriters/Pa136444.jpg)

Figure 56. Brother AX-100 (?) and below Brother AX-325 (?)
(Source: http://www.bestoffer.com/pages/General/IDetail.jsp?Item=15495)

Figure 57. Smith Corona XD 6700 (?) and below Canon S200 (1980s)
(Source: http://mggolden.com/equip_for_trade/Electric_Typewriter/Electric_Typewriter.htm
www.ebay.com)

3.4.1.3. The Digital Phase

After the keyboards of the mechanical, electric and electronic typewriters, the QWERTY layout and the shift keys also had been 'transferred' to the computer keyboards with other keys. Computer keyboards have changed very little in layout since their introduction. In fact, the most common change has simply been the natural evolution of adding more keys that provide additional functionality. As a gained characteristic which enhance the keyboard's survival (one of the basic premises of evolution), the presence and the location of the shift keys did not change; on the left and right hand side, below the *caps lock* and *enter*/*return key* (Figure 58).

Figure 58. IBM PC Keyboard (2005)

Changes in the keyboard design have evolved over time (e.g., the split left/right layout, adding a ten-key pad), but the QWERTY letter arrangement still continues to be used. Following figures (Figures 59-79) show some keyboards of different periods and the evidence of the heredity of QWERTY layout and shift keys through the evolution of technology in digital era.

Figure 59. Apple I (1975); the first PC
(Source: http://www.apple2.org/aboutimages.html)

Figure 60. Apple II Enhanced (between 1979-83)
(Source: http://computermuseum.50megs.com/images/collection/apple-IIe.jpg)

Figure 61. Apple ADB Keyboard
(Source: http://commons.wikimedia.org/wiki/Image:Apple_ADB_Keyboard.jpg)

Figure 62. Apple Extended Keyboard II (1990s)
(Source: http://upload.wikimedia.org/wikipedia/commons/3/37/Apple_Keyboard_II.jpg)

Figure 63. Apple Adjustable Keyboard (1992)
(Source: http://www.farclip.com/hardware/images/Apple_AdjustableKeyboard-M1242.jpg)

Figure 64. Fountain Hills FH201 PC keyboard
(Source: http://tim.griffins.ca/gallery/keyboard/all.html)

Figure 65. The MyKey PC keyboard
(Source: http://tim.griffins.ca/gallery/keyboard/all.html)

Figure 66. The Kinesis Advantage Pro PC keyboard (2003)
(Source: http://www.atpm.com/9.01/kinesis.shtml)

Figure 67. ErgoMax PC keyboard
(Source: http://tim.griffins.ca/gallery/keyboard/all.html)

Figure 68. IBM PC keyboard (2004)

Figure 69. Apple Pro keyboard (2000s)
(Source: http://www.cc86.org/~hofmann/mm-tastaturen.html)

Figure 70. Apple USB keyboard (2000s)
(Source: http://commons.wikimedia.org/wiki/Image:Apple_USB_Keyboard_B.jpg)

Figure 71. The Matias Tactile Pro Keyboard (2003)
(Source: http://www.applelinks.com/reviews/gifs/tactilepro.jpg)

Figure 72. Logitech Cordless Desktop LX keyboard (2000s)
(Source: http://www.yenra.com/cordless-keyboard/cordless-keyboard.jpg)

Figure 73. Dell Inspiron 3200 Notebook Keyboard

Figure 74. A Palm PC Keyboard

Figure 75. A Folding Palm PC keyboard
(Source: http://www.foldingkeyboards.com/Palm%20Keyboard%20W_400.JPG)

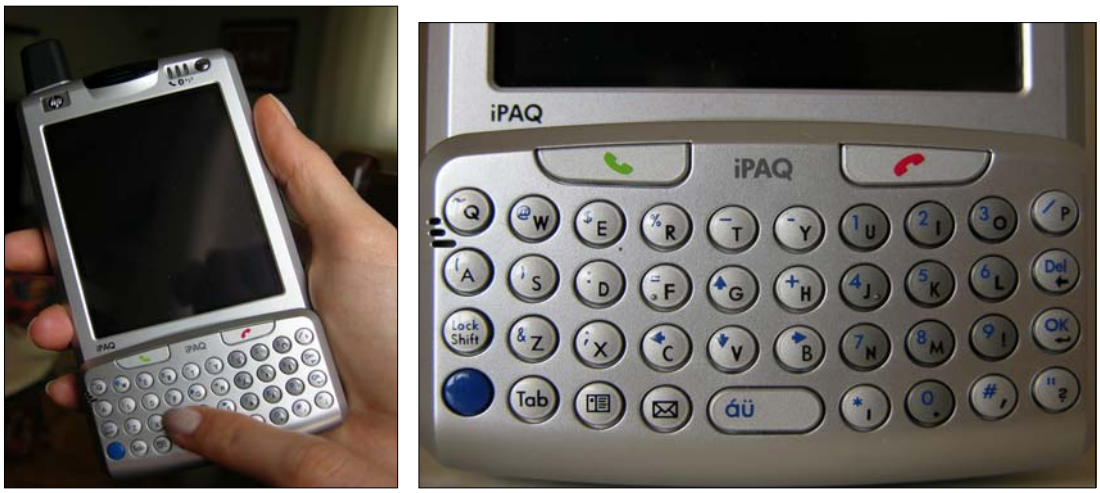

Figure 76. HP iPAQ Pocket PC - mobile phone (2004)

Figure 77. Nokia 9300 SmartPhone (2004)
(Source: http://www.mobiletracker.net/archives/images/9300_3.jpg
http://www.gizmodo.com/archives/images/nokia_9300_large.jpg)

Figure 78. A virtual keyboard of a special PC (2000s)
(Source: http://www.nec-design.co.jp/showcase/img/2003products/pism02.jpg)

Figure 79. Examples for virtual keyboards; a Palm PC and below a Siemens mobile phone (2000s)
(Source: http://blog.livedoor.jp/kanta6489/archives/158855.html
http://asia.cnet.com/i/r/2004/hp/39019980/virtual_keyboard_600.jpg)

As it is seen in the above figures the shift key still keeps its location and its importance, in fact it has been doubled. It still offers an important ease because it allows combination with other keys in order to type special characters beside its function of writing in capitals. This means, combinations with the shift key allow some special features in most of the computer programs. In the time of mechanical typewriters and

electric/electronic word processors, shift keys was there just to write capital letters and special characters, but due to the changes in the *environment*, the shift key had to take on some other missions in order to survive in the system. Its mission had been transferred beyond writing capitals through the system itself. Here are some examples of the usage of the shift key within the system apart from word processing:

1. The keyboard is not the only device in the system of interaction with the computer; there is also the mouse. If there is no mouse then a touchable screen is needed. Therefore, the shift key also has a relation with the mouse beside other keys. For example, within Internet Explorer (the default web browser that is shipped with Windows Operating System) while a web page is viewed, if it is clicked on a new link with the left mouse button the new page will be viewed in the same window. But if the new link is wanted to be viewed in a new window then the right mouse button is used and 'Open in New Window' choice is picked with the left mouse button. One alternative to do that is using the shift key with the left mouse button. If the new link is clicked while holding down the shift key, the web page will directly be opened in a new window. It is like a short cut.

2. Another widely known example would be the delete command in the Windows Operating System. While using a computer there is not just one way to do things, there are at least more than one alternative. For example, a file, a folder etc. can be deleted by using the delete key on the keyboard or using the right mouse button and clicking on the delete choice. But both of these would not delete the file permanently, they will just send it to the Recycle Bin. But after selecting the file, if the shift key is hold down and delete key is pressed then it will be deleted permanently. This is an example of a combination of the shift key with other keys.

3. Also all the number keys have combinations with the shift key in order to form special characters like: ! - @ - # - $ - % - ^ - & - (-).

Control key (Ctrl) is also similar to the shift key in function. It is located just under the shift key on almost all keyboards. Control key is pressed along with other keys to perform system tasks or special tasks within an application program. It is widely used with the program Microsoft Word which is a kind of an extension of the electronic word processors. One can create and edit text and graphics in letters, reports, web pages, or e-mail messages by using Microsoft Word. There are some keyboard shortcuts within Microsoft Word like cutting or copying (a word, sentence or a figure) in a document and pasting it into another. They are, in order, Ctrl + X (pressing the X key while holding

down the Ctrl key) Ctrl + C and Ctrl + V. These shortcuts are also valid within other programs too, for instance Adobe Photoshop; a program that most of the designers are familiar with. Most of the computer users are aware of these shortcuts and can easily guess that they will work within other suitable programs too, also within the operating system itself in any context e.g. editable text regions, desktop etc. In fact, users do not just guess them; but they expect them to work, because they are memetic patterns. Those widely known shortcuts working within software for years are now transferred to the hardware also; some keyboards are produced with those shortcuts written on the keys like reminders (see following figures).

Figure 80. Vestel PC Keyboard

Figure 81. The keys of Vestel PC keyboard

Such uses have become the basics of the computer systems and programs. Generally, all computer users and computer program designers are aware of those, since it is simply memetic and it fits to the evolutionary system. Being aware of the opportunities of the Shift, Ctrl and Alt keys in the system, computer users also try to use those keys in every computer program possible. While using a computer program, when a feature or a command is newly learned, generally if it is suitable, the user would also try that command with holding down one or two of those keys too, guessing that something extra would happen regarding the command. This is because the special

features of the shift key had been memeticly transferred for years. There is an expectation of a settled behaviour. As a design those key combinations survive and *those survivors pass on their characteristics to the next generation, then the characteristics that helped them survive will be more common in the next generation.*

As examples, the programs that designers use in general can be referred to, like Adobe Photoshop. Shift, ctrl and alt keys are important keys in such programs. A simple example to the use of the shift key would be its acting as a snap command which means it helps to draw totally horizontal and vertical lines (Figure 80).

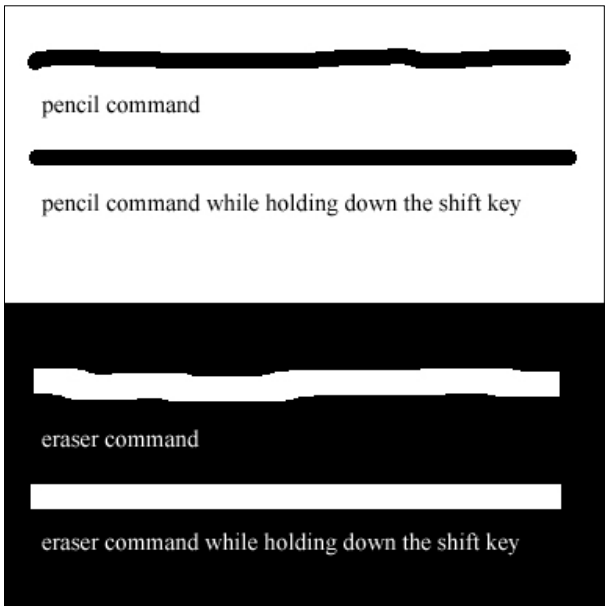

Figure 82. An example to the facilities that shift key offers within the graphic design program Adobe Photoshop

Drawing such lines is also possible by turning on the 'snap to all' command but it is still not as easy as holding down the shift key. When a new user realises the easiness that shift key offers he/she would try it during other commands too. Another ease is the use of the ctrl and alt keys together. Holding down both keys in Adobe Photoshop creates a copy of a desired layer. Of course, all those commands need the use of a mouse at the same time. As industrial designers know, such combinations are also important in 3d modeling programs too, e.g. Rhinoceros, 3d Studio Max, Catia V5. They offer important features and ease. The most interesting combination of those three keys is within the software called Alias Studio; a special program for industrial

designers. In order to use this program in an efficient way, the user is directly dependent on the shift, ctrl and alt keys with the mouse.

The shift key started its *life* offering a simple combination; capitalizing letters. It worked out, and it has been transferred to the next generations. However, since the environment was changing and the circumstances were altering, in order to live on, the shift key has become responsible for some other combinations too with some added keys like Ctrl and Alt while kept on capitalizing letters. Once the user experiences that those keys enable some extra features, he/she will try them as much as possible during the use of any program suitable. In addition, computer program designers and product designers are aware of this behaviour too, and actually, it is this fact that lets the shift key used for years with an increasing popularity. The altering behaviour of the shift key has been transferred since 1878 (see Figure 36; Remington No. 2) and different combinations have been added to it until today.

CHAPTER 4

CONCLUSION

Industrial Product Design, not only during the design process but also in research context deals with a wide variety of disciplines such as engineering, social sciences, humanities etc. In this thesis, beside those sciences, Biology is tried to be presented as a useful science for Industrial Product Designers and design researchers to take advantage of. The starting point is evolution in biological design and genes that drive that evolution as true replicators. The DNA coded 'selfish' gene is not the only replicator on this planet according to Richard Dawkins, the other replicator is the *meme*. Dawkins - a Darwinian zoologist - invented and introduced the term meme in his book *The Selfish Gene* in 1976 as the other selfish replicator.

Just as genes propagate themselves in the gene pool by leaping from body to body via sperms or eggs, so memes propagate themselves in the meme pool by leaping from brain to brain via a process which, in the broad sense, can be called imitation. Genes are instructions for making proteins, stored in the cells of the body and passed on in reproduction. Memes are patterns producing behaviours, stored in the cells of the brain and passed on by imitation. Memes behave in similar ways to genes, and in this way, their behavior and development can be described in terms of evolution.

There are three main features lead to evolution in nature; variation, selection and retention. If there is variation among the offspring then not all the creatures would be identical, second not all the offspring can survive, there must be an environment in which some varieties do better than others which is called selection and finally the survival offspring having some special characteristics is passed on to the next generation which is called retention (heredity). According to these features, any characteristics that are positively useful for the survival in an environment must tend to increase, then evolution simply must occur. Those features, leading to evolution are to count something as a replicator. If memes are also replicators and can sustain an evolutionary process, those principles must be valid for them, too. Throughout the study, it is claimed that memes have *variation*, there is a memetic *selection*, and there is *retention* of some of the ideas in the memes that are passed; something of the original

meme must be retained. In addition to those features, in order to be a successful replicator a meme has to be copied accurately, many copies must be made and the copies must last a long time.

Also there are some important premises which biological evolution is based on:

1. In ideal circumstances (limitless resources), populations will grow exponentially.
2. Resources are limited.
3. Individuals within a population have unique characteristics.
4. An individual's characteristics are passed on to its offspring (inheritance).
5. Change can occur, and this sometimes results in offspring having slightly different characteristics to their parents.
6. Given the fact that individuals have varied characteristics, it is reasonable to suppose that some individuals will have characteristics that give them a better success at acquiring resources and reproducing.
7. Characteristics that enhance an individual's survival and reproductive success will be passed on to subsequent generations – 'survival of the fittest' – natural selection.
8. Populations that possess above characteristics will evolve from simple to complex and from homogeneous to heterogeneous characteristics.

To apply the system to any population a biological entity is not necessary, it just should:

i) compete for resources,
ii) have unique characteristics,
iii) can reproduce,
iv) produce offspring that inherit their characteristics,
v) and whose offspring might be different. That is to say, the offspring may find themselves with characteristics that their parents did not have.

During this study, Industrial Product Design world is tried to be presented as a population which the premises above are valid thus it is regarded as a population which evolve like biological entities. Therefore, the important pattern in this population is design memes. Throughout the study, some design memes - that is design ideas - are

tried to be revealed and how memes drive the evolution of an industrial design product is tried to be presented.

Within all this analogy, genes are one example of a replicator and memes another. The general theory of evolution must apply to both of them, but the specific details of how each replicator works may be quite different.

Langrish's ideas and point of view about memes, memetics and evolutionary design is followed during the study in general. Thus, the thesis is carried out with a biological view (B) instead of a physics view (P), and it is tried to be showed that B is more useful for designers while examining the industrial design world and/or accomplishing a design study. B is based on Darwinian evolution which welcomes diversity and different types of things. P is based on Newtonian mechanics which gives importance on the essence of things rather than their differences which means P expects one theory of everything. It is better to adopt the B for anyone who is interested in evolution, so for designers.

In a way, memes are replicators that are being transmitted between generations through the history of Industrial Product Design. Accumulation of the survival memes formed the surroundings around humanity. Based on this, the idea of designing onto the previous is expressed which means designers, in practice, build on what other designers have done generally. They start off where other designers (or they themselves) have left off. So, design, mostly, can be thought as something about improving earlier products, like modification than innovation, and that designers are thereby linked to earlier objects, or actually to their own or their colleagues' earlier solutions - and thus to yesterday like generations in biological evolution. Basalla has been one of the important references for this topic with his ideas on evolutionary history of design and technology. The general idea explained goes like this; most of the 'new' designs in the made world based on some designs already exist which forms a point of view that collects the creative part of a sole designer and the collaboration of the past and the future. However, this process should not be confused with simply copying. Regarding design - mostly- as a gradual, step-by-step process of adaptation of already existing solutions is suggested. Considering the term re-design instead of design is offered since most of the successful designs result from an evolutionary process, with successive slight modifications.

Consequently,

1. Memes are replicators analogous to genes in Biology which work in non-biological systems, e.g. Industrial Product Design. Thus, they work according to similar principles of natural selection and survival of the fittest rule in Biology.
2. History of design is the history of ideas which their evolution is a Darwinian process. Those ideas are the memes of design.
3. In this context, design ideas are memes that can replicate, compete, mutate, co-evolve and may die.
4. Biology as a science offers enough contribution and assistance to Industrial Product Designers to benefit from during their design processes and design researches beside Physics, Mathematics, Psychology, Sociology, Ergonomics, Anthropometry, Engineering Sciences etc.
5. *Typing* is one of the memetic behavioral patterns which co-evolve with its design ideas/memes like typewriters, keyboards and their layouts, special keys etc.

Suggestions for further studies:

1. The types of memes, which Langrish puts forward as Recipemes, Selectemes and Explanemes, can be examined more deeply within a specific product or a behaviour that forms that product.
2. Revealing and discussion of the successful and unsuccessful memes of a specific product that have been transferred or failed to be transferred between generations, with the consideration of its concurrent environment and conditions that effect its memetic transfer and thus its evolution. Afterwards, if necessary a future design of that product may be suggested taking into account of the consequences of the study.

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APPENDIX A

DEFINITIONS OF TYPE BARS

Throughout the typewriters history, five different type bar machines can be seen:

1. **upstrike**: Blind writers like Remington and many others.

Figure 83. Remington No. 2 (1878) ; example to upstrike typewriters
(Source: http://www.officemuseum.com/1878_Remington_No._2_front_OM.JPG)

2. downstrike: Type bars standing erect and swinging down from the front (Franklin), side (Oliver), or rear (Fitch); rear/downstrike also called backstroke.

Figure 84. Franklin Typewriter (1891); type bars standing erect, swinging down from the front (downstrike)
(Source: http://ednixon.com/pix/2003/typewriters/Pa136406.jpg)

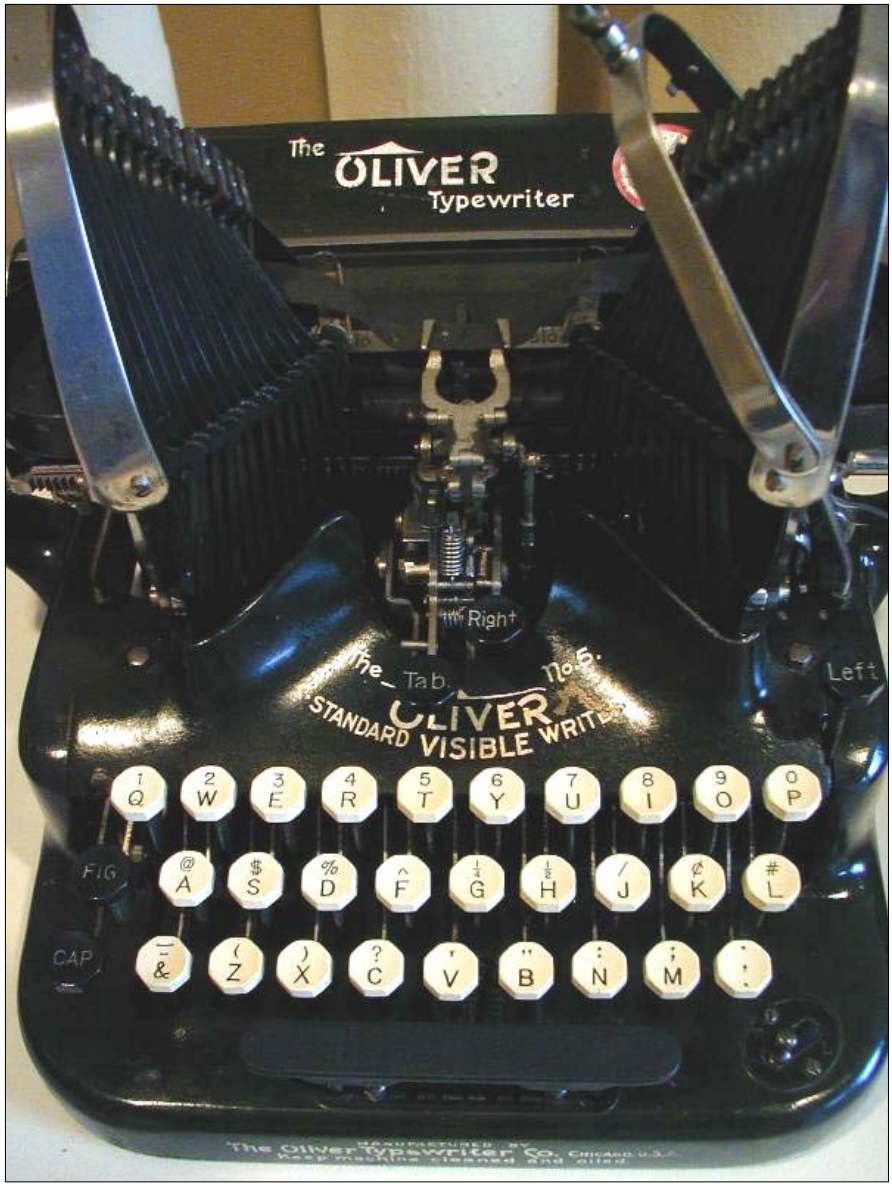

Figure 85. The Oliver Typewriter (1906); type bars standing erect and swinging down from the side (downstrike)
(Source: http://ednixon.com/pix/2003/typewriters/Pa136416.jpg)

Figure 86. The Fitch Typewriter (1888); type bars standing erect and swinging down from the rear (downstrike)
(Source: http://www.maquinasdeescreverantigas.com.br/fotosg/fitch-front-jpg.jpg)

3. **frontstrike**: modern conventional machines.
4. **thrust action**: bars sliding forward to platen (Wellington, Adler, Empire)

Figure 87. Wellington No.2 (1890s) and Empire No. 2 (1908) - from left to right; bars sliding forward to platen (thrust action)
(Source: http://ednixon.com/pix/2003/typewriters/Pa136413.jpg and http://typewriter.rydia.net/empire2.JPG)

5. **grasshopper**: odd action with type bars ‘hopping’ forward to hit platen (Williams)

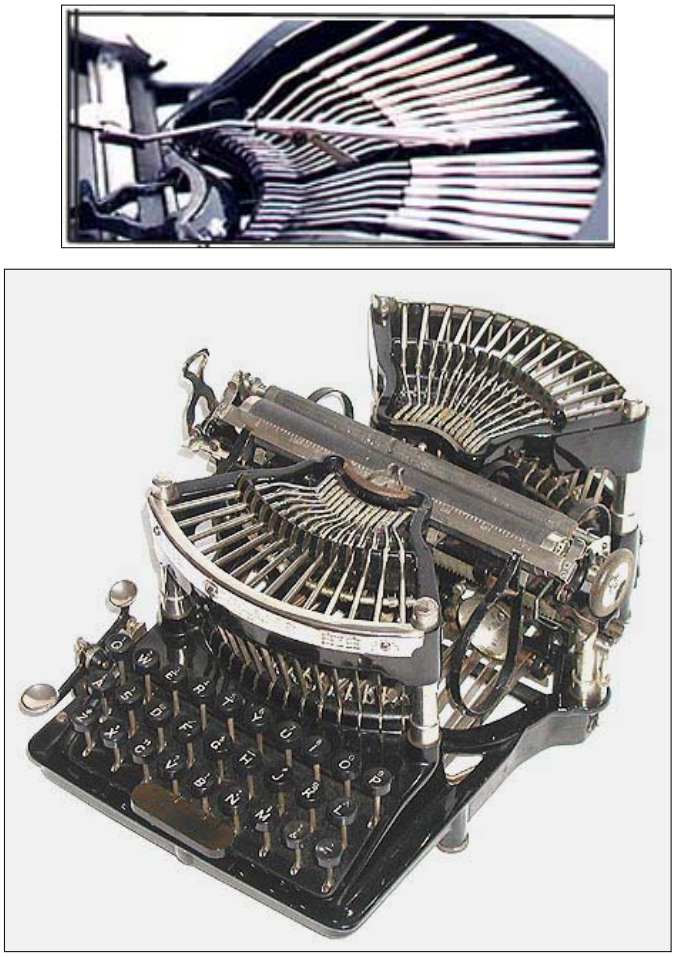

Figure 88. Williams Typewriter (1900s); type bars ‘hopping’ forward to hit platen (grasshopper) (Source: http://typewriter.rydia.net/williams1.jpg)