A THEORY OF ARCHITECTURE

CHAPTER 10

DARWINIAN PROCESSES AND MEMES IN ARCHITECTURE: A MEMETIC THEORY OF MODERNISM.

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The process of design in architecture parallels generative processes in biology and the natural sciences. This Chapter examines how the ideas of Darwinian selection might apply to architecture. Design selects from among randomly-generated options in the mind of the architect. Multiple stages of selection generate a design that reflects the set of selection criteria used. The goal of traditional architecture is to adapt a design to human physical and psychological needs. At the same time, however, any particular style of architecture (adaptive or not) constitutes a group of visual memes that are copied for as long as that style remains in favor. Darwinian selection also explains why non-adaptive minimalist forms have been so successful at proliferating. The reason is because they act like simple biological entities such as viruses, which replicate much faster than do more complex life forms. Simple visual memes thus parasitize the ordered complexity of the built environment.

1. Introduction

The world of the architect is created in an architect's mind according to physical systems that govern the biology of the brain. According to one theory of the thinking process, an idea arises out of the competition and selection among similar and dissimilar ideas occurring simultaneously in adjacent neural circuits of the brain (Calvin, 1987; 1990). The same principles of competition and selection might be said to apply to the general public in their willingness to accept architectural forms and styles. Things in the built environment originate and endure — not just in the tectonic sense, but in their survival value in a society's common language — because they "make sense" in some way. Competing ideas in a society eventually suppress or reinforce each other to produce one or more dominant themes. In other words, creativity and survival work in ways that are compatible with the cognitive machinery that makes up the mind.

Nevertheless, sometimes the mind works against the body by acting in a harmful manner. An architect's mind has the power to either create designs that adapt to human needs and emotions, or to impose arbitrary forms on the environment. A Darwinian selection process in architecture takes place among competing ideas in the mind of the architect (see Figure 10.1). A second

selection process, also Darwinian, occurs in the society of consumers. This second process acts among styles, where certain styles dominate over others. In both of these selection processes (i.e., in the architect's mind, and in society), the criteria are a mixture of human needs and irrelevant forms. We will set up a model to explain why these two disparate sets of selection criteria can coexist, and how one set can displace the other.

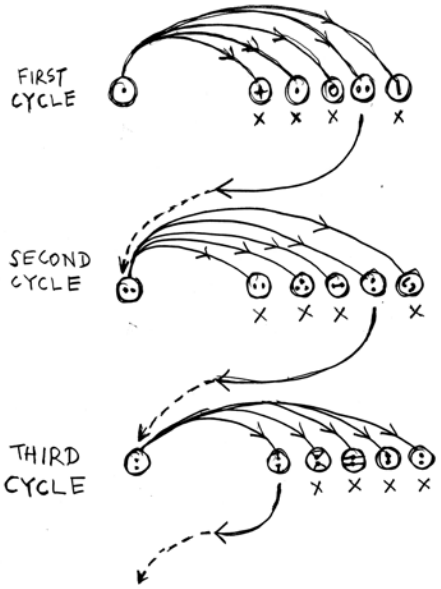

Figure (10.1) Darwinian cycle generates variants, then selects from them.

The word "meme" denotes any idea, image, tune, or advertising jingle that endures and propagates (Brodie, 1996; Dawkins, 1989; 1993; Dennett, 1995). Memes — ideas, tunes, or images — are the equivalent of agents that "infect" memory. An image will stick in memory if it is encapsulated in a meaning structure. Memes are conceptual entities that propagate among human minds. An image will be more likely to be transmitted to others if it is easy to remember. What distinguishes a meme from a more complex entity is the meme's low information content. For example, the typical advertising jingle is not a complete song or musical composition; it usually lasts only a few seconds. In the same way, an image meme is not a detailed picture but usually a simplified advertising logo. An idea meme has no intellectual depth, but is usually a simple catchy slogan. In all these cases, the brevity of the meme is what helps it to propagate.

This Chapter applies the theory of memes to the field of architecture. Two main points are argued. First, Darwinian processes (combining variation and selection) are important to architecture. Second, the specific case of minimalist architecture corresponds to a meme, which has spread in spite of its being non-adaptive for the people that make use of such buildings (because of its mode of transmission, it may be termed "parasitic"). These two theses are logically independent, though both are necessary to present a picture of how architectural styles

propagate. A reader may feel sympathetic towards the first thesis, yet it has unexplored implications for the design process in general. The second thesis is more controversial, and is discussed in greater depth. Our eventual goal is to explain the unlikely success of modernism by other than subjective criteria.

Contrary to architects' regard of design as a purely creative process, adaptive design is a problem-solving activity. Human intelligence allows both the generation of possible alternative solutions and selection among them to take place mentally. This summarizes our intellectual advantage over other animals: our imagination is a profoundly useful virtual reality simulator. A more intelligent system will have a more efficient mental representation and selection process. The architect's mind is impacted by the problem space — the space of all possible solutions — and various memes from a variety of sources. These could come from one's own memory; from visual templates from the environment; from the influence of other architects; etc. Competing forces such as engineering constraints, a desire for creativity, and the unique need to express oneself drive the design to its final state.

A Darwinian process in the mind of the designer depends on a set of selection criteria. Traditional societies such as pre-industrialized people, and the industrialized nations up to and including the nineteenth century used a wide range of selection criteria that, among other practical constraints, enhanced emotional well-being for the user. Specific architectural styles, however, can replace the selection criteria of traditional adaptive design by a process of matching to visual templates, or memes (see Figure 10.2). Once adaptive design is abandoned, the spread of architectural styles depends strictly on factors governing meme propagation in a society. A minimalist style then possesses an unbeatable advantage over more complex styles, because of its low information content. This is one of the main points of this Chapter.

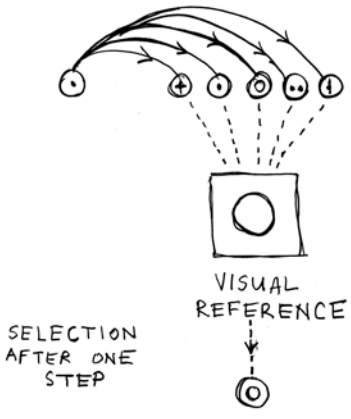

Figure (10.2) Selection based on images is not Darwinian.

It is possible to explain in this way an important event in the evolution of humankind: the

drastic change in the visual character of the built environment during the twentieth century. After a design style is introduced and is accepted for whatever reasons by a group of people, then it is subject to Darwinian selection from among the pool of competing styles. This is where consumers, the construction industry, and the architectural establishment come into play by exerting selection forces. A second selection occurs entirely outside the architect's mind, within the arena of human society (de Jong, 1999). Some architectural styles die out, whereas others survive and become popular. Perhaps surprisingly, their success has little to do with their fitness for human habitation. The criteria for success in Darwinian selection of architectural styles have changed to an abstract set that is not based directly on human needs, even though it is human beings that do the selecting.

An architectural meme is a visual component of a particular architectural style. It is a representation of form, geometry, surface, etc. Studying how architectural memes spread in a society, and how competing memes are selected requires a knowledge of the factors affecting meme propagation. The philosopher, physicist, and Computer Scientist Francis Heylighen has identified a list of these. We will discuss seven of his factors: SIMPLICITY, NOVELTY, UTILITY, FORMALITY, AUTHORITY, PUBLICITY, and CONFORMITY in the context of architecture (Heylighen, 1993; 1997). With the exception of UTILITY, none of these factors serves actual human needs. We will argue, therefore, that the spread of a design style occurs in a society more because of the proliferation of images through mass media than for practical reasons. Even UTILITY will be shown to obey memetic transmission, but in a roundabout way. Often, the mere promise of UTILITY is responsible for the success of an architectural style that creates buildings impractical in actual use.

We will propose here an eighth factor that aids meme propagation: ENCAPSULATION describes how memes link with other memes. This process confers an advantage to the encapsulated meme because it increases the meme's virulence by making it appear more attractive, and it protects the meme from external challenges by insulating it inside a complex of other, beneficial memes. For example, in advertising, the image of a product can be encapsulated in a musical meme such as a jingle. From that time on, people recognize the product by way of the jingle. An encapsulated architectural meme also manipulates our emotions in order to propagate. ENCAPSULATION embeds a meme or collection of memes into a meaning structure (i.e., a set of related concepts that we attach meaning to; see Chapter 7 in this book). Through this mechanism, visual memes can 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 ideology.

It is also possible to discredit an architectural style by deliberately encapsulating it within a shell (an encapsulating meme) 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. 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. We will argue that by encapsulating them using pathological memes as a shell, those styles have effectively been placed in a sort of quarantine.

Success in the spread of social memes is measured by how deeply they establish themselves as basic beliefs in a society. A group of memes achieves its greatest success when it becomes part of the establishment; i.e., it is institutionalized. We are first going to deal with those factors that increase the spread of memes, and thereby help in their chances for eventual institutionalization. In the final section of this Chapter, we explain how once memes have been institutionalized they acquire a rigidity that makes them extremely difficult to replace. The institutional perspective offers some strong explanations for the remarkable persistence of some twentieth-century typologies of architecture and urbanism in spite of their inhuman qualities.

2. Architectural style and military architecture

The "International Style" of architecture has been the overriding building design since the 1920s. The style is instantly recognizable by its geometry of cubes and rectangular slabs; flat plain surfaces; the lack of wide frames and thick connective boundaries; the use of steel, glass planes, and concrete panels; and in many cases the elimination of color and visual structure on the human range of scales 1 mm to 1 m (see Chapter 1). 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.

Designers claimed their buildings to be "functional", based on a "machine aesthetic". Simply looking like a sleek machine from the 1920s doesn't guarantee functionality in a building, however. Those machines providing the visual inspiration for that style of architecture were either housed in smooth metal shells, or followed cubist aesthetic principles. Surface qualities and appearances substituted for genuine structure, reducing complex forms to simple images. In either case, their "look" had nothing to do with their function: it merely conformed to a passing artistic fad. A culture that substitutes images for the real thing risks losing its accumulated knowledge. Many authors claim that this has already happened, since our generation has lost innumerable adaptive architectural traditions stretching back several millennia.

More recently, "high-tech" has become the fashionable international style of corporate architecture, simply because its superficial appearance of metal pipes, glass, mirrors, and plexiglass links it to modern technology; this goes on despite high-tech's extremely high cost and low user comfort. Representative high-tech buildings and architects include the *Centre Pompidou* (1977) by Richard Rogers and Renzo Piano, and the Hong Kong and Shanghai Bank (1986) by Norman Foster.

Two contradictory movements in twentieth-century architecture work against Darwinian selection that adapts towards the human needs of users. The first is an attitude taught in recent decades by our schools: that an architect has artistic license to look beyond certain practical

constraints — indeed, that it is necessary to do so — in the pursuit of a "great work of art". The second is a standardized approach to buildings, behind which is a conviction that shaping design to particular individual needs (i.e., those of the client or user) is simply being self-indulgent and therefore socially irresponsible. Early modernists set up standards for minimal dwellings that had little relation with the living needs of human beings, and incredibly, most of them are still applied today. A central idea in German social housing of the 1920s, the *Existenzminimum* (Broadbent, 1990) codified the minimum space in which a German blue-collar worker and his family could be housed. We inherited those absurd restrictions on living space as part and parcel of twentieth-century architectural typologies. That is where oppressively low ceilings and cramped, tiny kitchens in today's apartments originate.

There are obvious stylistic similarities with military architecture, since many modernist buildings look forbidding, ominous, stark, alien, faceless, and present a generally hostile appearance. The reason for this impression is that they utilize some of the same typology from military and prison architecture. Here we face a paradox: how could society select an architectural style for human use that has a similar typology as a style developed specifically to make people feel uncomfortable? Our explanation is that modernist architecture is a meme group that has memetic advantages (discussed in detail later), which helped it to take over. It is for this reason that modernism won out over competing architectural styles, even though it contains typologies that are non-adaptive to human use and sensibilities.

Although most traditional architecture for human use adapts to human needs and sensibilities, military architecture is the exception. A well-defined typology has been used throughout the ages to construct deliberately uncomfortable environments. These include defense installations and castles (experienced from the outside), and dungeons, prisons, crematoria, etc. (experienced from the inside). 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 us: they communicate danger, anxiety, 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. One would never have expected this architectural typology to spread to residences, schools, hospitals, and commercial buildings, but that's precisely what happened.

3. Design as a Darwinian process

Design ought to begin by understanding a building's particular uses. A designer is aided by recalling built examples that work under similar circumstances; this is the idea behind Alexandrine Patterns, which distill working solutions from widely different cases (Alexander *et al.*, 1977). Alexander's *A Pattern Language* provides a collection of design constraints extracted from traditional architecture the world over that are meant to anchor and guide an emerging design (Salingaros, 2000). These aim to make the designed structure adaptive to human needs (by guaranteeing that all the pieces relate to each other, and come together in a way to enhance human utility), while leaving the overall form and visual aspect unspecified. It really doesn't

matter what triggers one's creativity — the manner of creation — as long as many alternative designs that cover a broad enough range are generated, and the selection process is adaptive. The possibilities of a Darwinian process of design are tied to the system of alternative options within which it operates, and the richer the system is, the broader the field of design possibilities, and the better the architecture.

Each design scheme 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. More detailed designs generate further alternatives, which are culled by selection in the subsequent round of the selection process (Figure 10.1). 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 (Calvin, 1987; 1990; 1997).

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. Nevertheless, this initial inspiration must be used for momentum, and not held onto uncompromisingly. An adaptive design must be allowed to evolve, which means that architects should learn to let go of fixed ideas.

When architects turn for inspiration to fixed images from a set vocabulary defining a style, images displace the adaptive component of design by changing the selection criteria. You change the selection from satisfying human uses to how a design looks. Design then becomes a process of comparison with certain visual stereotypes, which radically affects the end product. Matching to currently popular images takes priority over all other design constraints (Figure 10.2). You copy from buildings already in existence. The selection does not aim at adapting a design to human needs. Also, the process itself ceases to be recursive (i.e., doesn't go through several cycles) because selection occurs only on the first level. An immediate visual matching is derivative of memory and stored images rather than adaptivity. If structural, functional, and practical constraints are abandoned in the interest of maintaining images, however, such a design method acquires advantages of economy over more complex approaches that are adaptive (and which allow it to propagate more easily).

By accepting input from natural objects (e.g., Le Corbusier from a crab shell he found on the beach and later used to model the Pilgrimage Chapel *Notre-Dame-du-Haut* at Ronchamp); man-made artifacts; buildings originally intended for another use (e.g., the fascination of Walter Gropius and Le Corbusier with American grain silos); architects chose not to follow an adaptive process for turning their inspiration into a practical design. Copying an image is very easy to do, and gives a superficial sense of understanding while ignoring the complexities of both the copied structure, and the needs of what is being designed. Grain silos were the end-result of adaptive design for agricultural storage, not for habitations. Copying the "look" of a structure developed for something else, and applying it to a use for which it was never intended, is not adaptive. A crab shell is beautifully adapted to house a crab, but not for its magnified shape to house human beings wishing to worship in a church.

We don't wish to diminish the value of having a "concept" or "vision" of a building that can guide the design process through its multitude of iterations. Frequently, it is precisely such an inspiration that leads to an innovative design. We insist, however, upon a stepwise selection according to human needs, through which the initial vision must necessarily change in adapting, sometimes into an unexpected final state.

4. Memes and architecture

Memes have a theoretical lifetime; they can "die" when they cease to be of interest to the population for whatever reason. If memes die, then in a given collection of them, one can speak of the survival of some, and the death of others. Survival in an environment, coupled to forces that promote mutation and change, leads to Darwinian selection. The concept of memes thus has explanatory value. It also has heuristic value because it forces us to examine how ideas in general persist and propagate.

While our topic is architecture, it is instructive to discuss for a moment a parallel situation in biology where the concepts of memes and Darwinian selection are routinely useful. In considering how microbes attack tissue, as for example those in the oral cavity that cause tooth decay, the scientist studies the tendency of a microbe to adhere to the tooth surface. Microbes that have the greatest stickiness are also likely to have the greatest virulence; i.e., cause the most serious disease. The logic is straightforward: the stickier the microbe, the greater the number that will adhere to the tooth at any one time. Research shows that the surface of tooth enamel has a certain chemical structure, and the virulent microbes have a corresponding chemical structure that binds to it; rather like the two mating surfaces of Velcro.

Similarly, an image has a set of attributes that makes it more or less likely to stick in memory and to be transmitted to others. In the universe of Art and Design this mechanism is readily apparent. The volatility of design themes drives the world of fashion, where the business and sales force creates a strong pressure for selection that is Darwinian at its core. New meme mutations arise with regularity, and these are tested against the environmental forces in which they appear. The life and death cycle can be swift for unsuccessful fashion styles. The same is true in architecture, where there is an undeniable and changing "fashion". Fashion is adaptive, but to artificially-created criteria, which moreover, are constantly changed by the industry. A fashion arrests the adaptive design process as it relates to genuine human needs, in which selection evolves specific solutions to individual problems that are exquisitely suited for their job and surroundings (Salingaros, 2000).

Architectural memes, through their materiality, are more nearly analogous to physical replicating entities such as viruses, than to more general memes representing only ideas that exist only in the space of information. The reason is that the former are encoded as actual structures (other than neuronal circuits). It is only their replication that occurs through memetic transmission; the artifact in this instance has a physical existence outside the human mind. An architectural style thus exists in two very different forms: first, as an ideology codified in books and taught in architecture schools, which perpetuates a group of memes in people's brains; and second, as images represented in the built environment. Each aspect reinforces the other. The

built environment serves as a source of continuous re-infection by visual architectural memes. The image/building/image cycle feeds on itself, and can lead to an exponential rate of infection (see Figure 10.3).

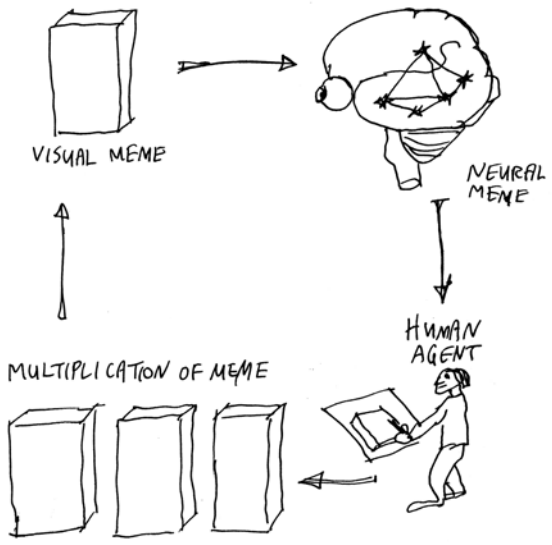

Figure (10.3) Architectural meme proliferates using a parasitic cycle.

While architecture is often classed along with music, poetry, and the fine arts as a vehicle for individual artistic expression, it is actually far more than that. Humanity needs to house itself, and architecture represents a world-wide building industry that is forever looking for prototypes to copy. The vast majority of buildings, be they commercial (a non-contextual typology) or vernacular (a contextual, local typology), require a typology of reproducible patterns. Clearly, the process by which architectural styles spread through copying is one that lends itself to a memetic explanation. This is seen in practice, where throughout history, a single example was often sufficient to establish a new style of architecture. Even though the early buildings defining a new style could number only a handful, their true impact lies in their easy repeatability. Conversely, a style that is difficult to reproduce because of its complexity (i.e., Art Nouveau) will die out. A style succeeds not because its original examples are either attractive or useful, but because of its simplicity, which allows it to easily infect the vernacular building tradition.

5. Explaining the unlikely success of modernism

In 1922, Le Corbusier exhibited a series of drawings labeled "A Contemporary City" at the *Salon d'Automne* in Paris; he built the *Pavillon de l'Esprit Nouveau* for the International Exposition of Modern Decorative and Industrial Arts, held in Paris in 1925; Walter Gropius built the Bauhaus

building in Dessau in 1926 as a visual example; Ludwig Mies van der Rohe organized and contributed to the mass housing projects for the Stuttgart *Weissenhoffsiedlung* in 1927, which consisted of very similar white, rectilinear, flat-roofed temporary and permanent buildings. All of those buildings and drawings provided images for young architects to copy. The reason anyone would even consider such excessively plain prototypes was the promise of inexpensive housing for all made possible by modular design, bolstered by proclamations of links to a "new" society.

The rate of transmission of a visual style among human minds depends on several factors. Considered simply as information, the success of an architectural style is governed by the speed at which the associated memes can propagate. The situation is akin to percolation or diffusion: copies of an object (a piece of information encoding the style) have to pass from one human mind to another. This resembles the mechanism by which infectious agents spread in a population. Individuals in the population have little control over the process. Propagating agents are obviously not selected by the host, since they parasitize their more complex hosts. The process is infection rather than fair competition among similarly endowed entities. An epidemic occurs when a virus has evolved an unbeatable advantage over its hosts.

Francis Heylighen has identified factors contributing to meme propagation (Heylighen, 1993; 1997). The meme could be an image, or a set of rules defining an architectural style. We will start by examining the four factors SIMPLICITY, NOVELTY, UTILITY and FORMALITY, which are relevant for explaining the initial spread of modernism. Three more of Heylighen's factors helped in the institutionalization of modernism, and they are discussed later in this Chapter. One of Heylighen's criteria is 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 (Heylighen, 1997). Therefore, an architectural style that is simpler to encode will propagate more successfully than one that is difficult to encode (see Figure 10.4). In an analogy with life forms, viruses reproduce much faster than more complex organisms because of a reduced structural investment. Biological and computer viruses take advantage of their host's structural complexity, using it to propagate themselves, and without which they could never replicate at all.

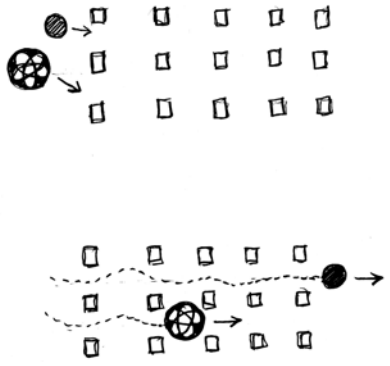

Figure (10.4) Styles with lower information content diffuse faster.

Early modernist buildings provided images of geometrical emptiness with enormous replicative power. An abstract sense of purity leads to SIMPLICITY. 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 (see Chapter 1). We see some or all of these features used in a majority of buildings throughout the second half of the twentieth century. Design richness and complexity in the prevailing architectural style were eliminated in the drive to create forms with minimal information content. Other architects of the 1920s working in a traditional style originally dismissed this effort as perverse and not worthy of notice; they didn't realize that it satisfied the SIMPLICITY criterion for memetic propagation.

Another criterion is NOVELTY, where standing out and thereby attracting one's attention facilitates a meme's assimilation. New, unusual, or unexpected ideas arouse one's curiosity (Heylighen, 1997). Twentieth-century architecture used novelty of a deliberately shocking kind. The early prototypes looked strange to people used to Nineteenth-century architecture. Indeed, the modernist style is arrived at by reversing design criteria of previous traditional styles (see Chapter 1). The spread of those novel images occurred primarily through the media before any significant number of examples were actually built. Le Corbusier was remarkably successful at propagating these architectural memes through the journal *L'Esprit Nouveau*, which he controlled (Colomina, 1994). That was the age when picture magazines became a popular medium for visual information, helped by technical advances in photography, printing, and distribution. People were eager to read about new ideas, especially if they were accompanied by never-before-seen and futuristic-looking illustrations.

UTILITY plays a double role here. 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 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. Still, the mere promise of UTILITY is often enough for propagating spurious ideas (Heylighen, 1997).

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 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 (Benedikt, 1999). 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. Philip Johnson (the American architect who promoted modernism) frankly admitted that: "The "International Style" did sweep the world because it came along at the same time developers wanted to make cheap buildings, and this was cheaper than other architectures" (Kunstler, 1993).

Yet another factor is FORMALITY: the more formally an idea is expressed, the more likely it survives in transmission (Heylighen, 1993; 1997). Adaptation requires selection on the basis of 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. The intention of modernist design is to be context-independent. Materials of choice are pre-formed panels, glass, steel, and reinforced concrete; these are industrial materials that are detached from any region. Modernism imposed an abstract visual language to come up with "one single building for all nations and climates" (Blake, 1974).

Non-adaptivity to human needs helps in memetic propagation. The philosophical origins of modernism in Germany of the 1920s reveal a parallel with totalitarianism (Watkin, 2001). The German art historian Wilhelm Pinder (a supporter of Hitler) and his student Nikolaus Pevsner (an architectural historian who was one of the strongest promoters of modernism as a guide for social and political ideals) argued that great architecture is the product of the *Volk*, during periods when ideology triumphs. Adolf Hitler, Josef Goebbels, Walter Gropius, and Ludwig Mies van der Rohe all shared the conviction that architecture was an expression of the central spirit of an epoch, and thus justified idealism, absolutism, and arrogance (Watkin, 2001). In this view of the world, the individual is insignificant, and the needs of the human user are thus of little consequence (Watkin, 2001). Philip Johnson complained of the futility of trying to discuss the aesthetics of modernism with Walter Gropius: "Talking to Gropius was a dead end because he would still mouth the Giedionesque platitudes of social discipline and revolution" (Colomina, 1994).

6. Competition among early twentieth-century architectural styles

We are now ready to use this model to explain historical events. The successful spread of modernist design is interpreted in terms of the replication of memes in a Darwinian process.

The unbiased human mind applies selection criteria that seek the most positive emotional feedback from a built structure. This is something we have evolved to do: we instinctively avoid pain and discomfort, and seek out physical environments that are emotionally nourishing. If a design (and, by extension, the building when finished) is emotionally satisfying to the architect, then one can expect the user to share that experience. The same does not follow, however, when

purely intellectual selection criteria replace those based on a local vernacular context, which coincidentally elicits the most positive emotions. What one person believes in ideologically is not necessarily shared by others. Modernism was very successful at convincing people to forgo sensual pleasure from built forms, as minimal surfaces and spaces offer less visual stimulation than human neurophysiology is built to handle (see Chapters 4 and 7). Memes help us to understand why architectural styles that give emotional satisfaction were replaced by those that don't.

Once built, structures survive or not according to Darwinian selection. Here we are no longer talking about Darwinian processes in the mind of the architect, but survival in the outside world. Occasionally buildings get destroyed by natural or human acts; most often conscious decisions are made on whether to repair the inevitable wear in an existing building, or to build a new building altogether in its place. In biology, the survival rule for a species is to procreate before death. Culling of organisms is determined by survival in the environment. In architecture, survival of a particular style depends on whether the buildings representing that style are preserved, or are replaced by those of another style. Architectural survival therefore depends upon decisions that are heavily influenced by stylistic concerns, independently of the buildings' adaptivity to human physical and psychological needs.

Different styles competed with each other at the beginning of the twentieth century. Any architectural style that contained traditional elements was doomed to extinction because people now demanded (or were manipulated to demand) NOVELTY. Neoclassical, Beaux-Arts, Victorian, and Edwardian styles were thus abandoned. Styles that had comparable NOVELTY were further selected on the basis of SIMPLICITY, UTILITY, and FORMALITY.

Art Nouveau is very high in informational content. The convolutions, curves, and complex colors upon which the style depends do not propagate rapidly, and that's exactly what happened. Also, its NOVELTY was short-lived. Even though Art Nouveau buildings were certainly novel at the time, they are reminiscent of organic plant forms. Very soon, the fickle critics led the public to crave styles with even more visual NOVELTY, which could only be satisfied by the opposite of organic forms. Despite an initial flourish, Art Nouveau didn't last for more than about a decade. Its markedly plainer successor, Expressionism, was equally short-lived because of its curvature, which encodes mathematical complexity. Art Deco abandoned the curves of Art Nouveau and Expressionism, adopting a more rectangular geometry, and was somewhat longer-lived. One could surmise that, by lowering its information content, Art Deco acquired greater staying power. Finally, minimalist modernism got rid of the visual richness of Art Deco, reducing its information to an absolute minimum; it won out over its competitors by spreading around the world and surviving until today. These events in architectural history support a memetic theory of architectural styles, with selection on the basis of SIMPLICITY.

Looking at both UTILITY and FORMALITY leads to the same conclusion. Unless there is a strong societal demand for information-rich buildings and environments, the construction industry will select those that are visually plain (since they are often cheaper to build, though not to maintain). This is selection on the basis of UTILITY for the construction industry, but not for the user. Modernism is a highly formal design method, thus possessing the FORMALITY criterion for propagation. A set of context-independent rules was never established for either Art

Nouveau or Art Deco, thus both those styles lack FORMALITY. We have no formal set of symbols that can generate an Art Nouveau building. The style depended upon the individual creative genius of say, Louis Sullivan or Victor Horta, who drew their inspiration freshly from each new specific architectural context.

It is worthwhile noting that a highly successful style in architectural history, the Classical Style, also depends on rather precise formal rules that can be applied in any situation regardless of context. Nevertheless, its much higher complexity compared to modernism allows for design that is adaptive to human needs and emotions, as witnessed by the countless locally-adapted Neoclassical buildings built around the world in the last two centuries. Those buildings today are rightly judged to be far more useful and sustainable than the "International Style" buildings that replaced them as the preferred institutional style.

A large number of Art Nouveau and Art Deco buildings were built in the early decades of the twentieth century, before the modernist selection criteria took hold. Many of those buildings did not survive, precisely because the selection criteria used in the 1960s for preserving older buildings were the same as those for designing new buildings. The stereotyped visual template of a glass or concrete box determined which buildings to save from demolition, and those buildings that did not match these images were destroyed. In effect, structures were categorized according to specific images, thus providing a mandate to eliminate those judged to be "misfits". Such decisions were supposedly founded on rational laws as opposed to base emotions, which is true up to a point. Nevertheless, the incredible persistence of modernist architectural memes in the twentieth century is fundamentally emotion-based. This emotional dimension of memetic transmission will be discussed next.

7. Encapsulation of images in the mind

Entities with a finite lifetime will survive in the sense of propagating their information only if they are favored by selection forces. An encapsulating shell that surrounds a meme by an attractive verbal explanation endows it with a meaning structure that helps in transmission. Once inside a mind, a meme will lose its boundaries as it is sacrificed to a larger meaning structure that is expressed as a physical grouping of neurons. The mind shows itself to be a multiply-connected network, where ideas, opinions, factual knowledge, and prejudices are all interlinked into what may be called one's "consciousness" (see Chapter 7; Edelman & Tononi, 2000). In this way, memes influence an individual's thoughts and actions. This is the idea behind advertising: embedding a commercial product into a person's consciousness will guarantee the use or purchase of that particular product as the result of a subconscious decision (Brodie, 1996).

Architecture and advertising act in much the same way. After they are taught in Architecture school, the memes of an approved style become a permanent part of one's thinking patterns. They are encapsulated into meaning structures such as metaphors. The group of neuronal circuits recording images, their encapsulation, and their interconnections defines some domain of one's consciousness. Those regions of the brain provide bases for meaning structures, which are used to interpret the world throughout one's life (see Chapter 7; Edelman & Tononi, 2000). We are thus programmed to automatically replicate memes whether or not they are good or useful; that's

because they are part of a person's inner belief system (Brodie, 1996). This also explains why visual icons can rarely be dislodged by scientific arguments. A simple but irrational belief can displace an accurate but more difficult description of the world.

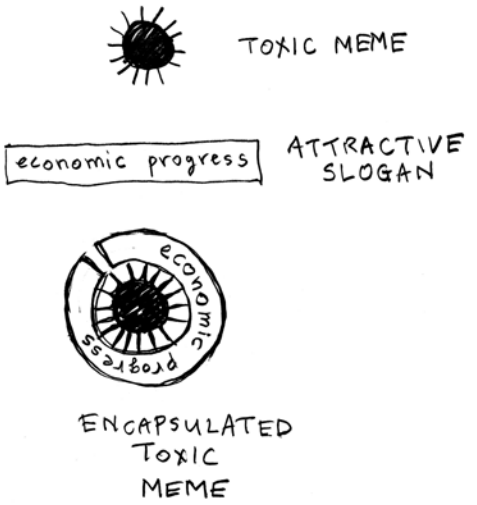

Figure (10.5) A toxic meme appears attractive from its shell.

We propose here another factor affecting meme propagation: ENCAPSULATION. A meme boosts its virulence by linking itself to other attractive memes, which then shield the original meme (see Figure 10.5). (This is related to but distinct from Heylighen's criterion of COHERENCE, wherein the assimilation of new ideas depends on their being consistent with existing knowledge (Heylighen, 1993; 1997)). The advertising industry is founded upon techniques of encapsulation: either physical packaging, or the packaging of products within ideas. A commercial product sells just as much because of an attractive package as for any other factor. An effective marketing strategy encapsulates a product with emotional appeals to self-esteem, sex, status, power, individuality, etc. It is not a coincidence that modern advertising techniques developed alongside modernist design, and early modernist architects showed a keen interest in psychological manipulation as it was then being incorporated into the advertising industry (Colomina, 1994). Le Corbusier actually made a living from mass media and commercial promotion independently of his work as an architect (Colomina, 1994).

This concept applied to architecture reveals an unexpected yet major reason for why architectural design evolves the way it does. A change in encapsulation comes from societal discontinuities, which affect architecture just as much as practical matters such as the introduction of new materials and novel methods of construction. For example, immensely powerful social forces unleashed between the two world wars led people to adopt modernist design memes as a reaction to class oppression. They identified decorated buildings as visual

symbols of what was wrong with the past. With all the old values discredited by the horrors of the First World War, people eagerly embraced new ideas and hopes, thus linking desirable social aims to encapsulated memes. They willingly sacrificed immediate and direct pleasure from their surroundings for the promise of a better future. Human beings will adopt almost anything that promises them a better life. The *1918 Manifesto* of the Dutch group of modernist architects (that included Gerrit Rietveld and Christian Küpper alias Theo van Doesburg) known as "De Stijl" states:

"The war is destroying the old world with its content ... The new art has brought to light that which is contained in the new consciousness of the age ... Tradition, dogmas and the predominance of the individual stand in the way of this realization. Therefore the founders of the new culture call upon all who believe in reform of art and culture to destroy those obstacles to development ... The artists of today, all over the world, impelled by one and the same consciousness, have taken part on the spiritual plane in the world war against the domination of individualism, of arbitrariness." (Conrads, 1964).

Bruno Taut, a key member of the German group of modernist architects, had this to say in his *Frühlicht* of 1920:

"Oh, our concepts: space, home, style! Ugh, how these concepts stink! Destroy them, put an end to them! Let nothing remain! Chase away their schools, let the professorial wigs fly, we'll play catch with them. Blast, blast! Let the dusty, matted, gummed-up world of concepts, ideologies and systems feel our cold north wind! Death to the concept-lice! Death to everything stuffy! Death to everything called title, dignity, authority! Down with everything serious!" (Conrads, 1964).

These extracts give an indication of the rage against traditional styles in art and architecture prevalent at that time. They reveal the profound societal discontinuity that was to provide a breeding-ground for any ideology, mixing political as well as artistic memes, which promised radically new solutions to the problems facing humankind.

A biological virus remains infectious against the continuous development of antibodies by host organisms. The way it does this is to change its encapsulation so that it is no longer recognized by the host. This is said to be one of the mechanisms for the resistance of the HIV virus to therapy (Levine, 1992). In exactly this manner, modernism successfully changes the shell in which its memes are packaged (Figure 10.5). Modernist ideologues accomplish this switch with great dexterity: almost a sleight-of-hand. As soon as one of the encapsulations is identified, and it is realized that it does not lead to the promised benefit, the shell is changed to a new one. The central core — containing images that lower information and organized complexity in the built environment — remains the same. We list eight encapsulations for modernist memes, where each encapsulation is itself a meme:

Table 10.1. Encapsulations for Modernist Memes.

(i) "progress and economic prosperity from technology";

(ii) "freedom from class oppression through new design";

(iii) “social equality and housing opportunities for all”;

(iv) “moral superiority from using honest materials”;

(v) “improved health and hygiene through smooth surfaces”;

(vi) “the mathematical principles of pure form”;

(vii) “cost benefits resulting from modular production”;

(viii) “design that expresses the spirit of the age”.

Today, the modernist style predominates in architectural practice, and is taught in our schools to the exclusion of most other styles. The above encapsulations are therefore presented and discussed at length as part of the standard architectural literature: not as misleading packaging, but as “truth”. It is not useful to repeat that propagandistic material here. What is of immediate interest is that the eight slogans listed above are very successful at encapsulating modernist memes, thus helping their propagation. These are very powerful promises. Our point is that, in the absence of either a scientific or sensory basis, modernist architecture justifies itself solely by its memetic encapsulations. For detailed criticisms of the claims of modernism and the weakness of the usual arguments trying to justify those encapsulations, see (Alexander *et al.*, 1977; Blake, 1974; Salingaros, 2000).

It is worthwhile remembering that meme (v) in the above list was created soon after the devastating 1918 influenza pandemic, and thus touched upon questions of life and death. While microbes can stay on any type of building surface, a smooth, non-porous surface appears easier to clean. Shiny polished metal, ceramic, and glass surfaces looked more hygienic, and this “look” caught on. We adopted the hospital aesthetic for our kitchens and homes.

An architectural meme that has become part of our meaning structure (and is thus fixed in our world-view) is protected by its ENCAPSULATION. Attempting to revise the meme pulls at the entire meme complex, which is attached to the rest of the mind’s associational network of concepts. Writings by modernism’s proponents link the visual images representing the style to other, beneficial memes, so that questioning modernist design appears to question the technological, scientific, economic, and social progress of the twentieth century. This often triggers a strong emotional reaction that is reminiscent of religious intensity (Watkin, 2001). We suspect that certain memes such as these become fixed into our belief systems in places traditionally occupied by a religious credo.

When confronted by criticism based on scientific reasoning, many architects base their arguments on what the modernist “masters” said (i.e., “less is more”), as if that were some sort of revealed truth. This is indicative of religious fundamentalism. An automatic reliance on any dogma as part of one’s basic belief system is consistent with a memetic infection; i.e., the justification for a belief is the infecting meme itself. It is pointless to argue against ideas and values that people accept unquestioningly, or have adopted in the struggle to better their lives (Brodie, 1996). The reason is that people are physically, viscerally, and emotionally attached to their beliefs, regardless of how they acquired them, and irrespective of their absolute validity. No-one

wants to have to reach back and re-wire their brain into new habits of thinking, because such a process can be traumatic. It is far easier to hold onto one's ideas and values, and when challenged, the natural reaction is to defend them emotionally without thinking about their origin (Brodie, 1996).

8. The two faces of encapsulation

ENCAPSULATION has also been used to discredit traditional architectural styles and throw them out of favor. The meme here is a negative association, which spreads independently of whether the accusation is true or not. This happened to the Beaux-Arts style, which was tainted by association with pre-World-War-I society in supposedly "decadent" western Europe. The same is true of the Victorian and Edwardian styles in England (Watkin, 2001). The Classical style, after surviving for more than two millennia, was discredited because Neoclassical buildings were erected during the Second World War in Germany, Italy, and in Stalinist Russia (Watkin, 2001). The absurdity of this argument does not however undo the remarkably effective use of ENCAPSULATION to further an agenda. As a result, there exists a violent resentment today against traditional architectural styles; although no-one who feels that way can explain logically why that should be so (see Figure 10.6).

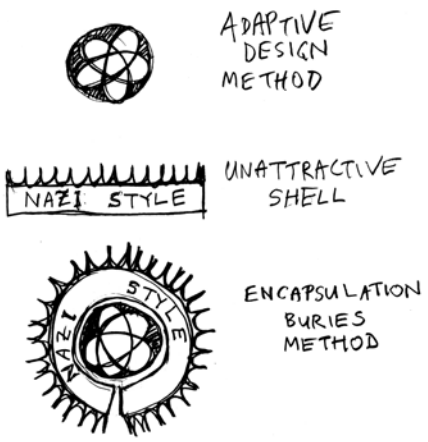

Figure (10.6) An adaptive method of design is made to appear toxic.

It is very ironic that the superficially Classical style adopted by Hitler and Stalin for their grandiose public buildings is itself an ENCAPSULATION of something sinister. The underlying architectural style is certainly not Classical, but is instead a pure expression of megalomania and the power of a totalitarian state. In order to disguise this obvious but disquieting message, buildings that represented each regime's public face were given a superficial veneer of Classical elements. This was done so that people would naturally associate that regime with the positive

qualities of “stability”, “wisdom”, and “balance” that are the traditional message of Classical architecture. Unfortunately, even eminent architectural historians confuse this misappropriation of Classical architecture.

Destructive ENCAPSULATION is well known in the political arena, where it is used for character assassination. In the world of art, the Iconoclastic movement declared figural representation to be unholy, despite the complete absence of any such restriction within Christianity. This happened around the 9th century, and led to the wanton destruction of religious paintings and mosaics before it was reversed. Early Christian icons dating to before the 11th century are as a consequence extremely hard to find. A brief resurgence of Iconoclasm occurred in Italy in the 15th century, instigated by the deranged monk Savonarola, which prompted the burning of several of Botticelli’s paintings. History is unfortunately replete with examples in which individuals, groups of people, races, ideas, or artifacts are eliminated, after being branded by association within a destructive ENCAPSULATION.

One of the twentieth century’s most successful memes is: “Ornament is a crime”, coined by the Austrian architect Adolf Loos in 1908 (Conrads, 1964). This phrase is impossible to forget; it goes straight to one’s memory whether one agrees with its message or not, thus ranking it with the most successful advertising jingles ever (see Figure 10.7). Because of the NOVELTY criterion, the more outrageous social memes are often the most virulent (Brodie, 1996). This particular ENCAPSULATION identifies anyone who dares to enjoy architectural ornament with persons who by creating ornament supposedly become criminals, and “inflict serious injury on people’s health, on the national budget and hence on cultural evolution” (Conrads, 1964). Infection by this meme continues to this day because Loos is presented as a pioneer of the modernist movement, instead of as an eccentric who used frosted window panes in his buildings so that people could not look out (all the photos featured in histories of European architecture have been altered to hide this) (Colomina, 1994: pages 234 & 272).

Figure (10.7) Architects believe propaganda like they do advertising labels.

Something occurring outside established architecture may eventually prove far more damaging in the long term. For millennia, people have built modest structures such as pieces of wall, a raised flower bed, a veranda, or an addition to someone's house, etc. This vast "architecture without architects" is simple, functional, often ornamented, and made out of available materials. Some of humankind's most endearing artifacts are produced within this tradition. They possess an emotional appeal and mathematical coherence that is lost when such structures are replaced by rigid industrial objects trying to emulate the purity of a crystalline geometry. People infected with modernist memes are eager to erase their heritage, since it reminds them of the past. Because of inner fear and feelings of inadequacy, people are terrified to risk losing what they believe to be progress. In many societies, it has actually become illegal to build anything that doesn't fit within modernist terms. Something wonderful and complex — a tradition of building modest things to please one's emotions — is becoming extinct as a result of this memetic infection.

9. A complexity threshold

The rapid spread of modernism is reminiscent of the spread of biological and computer viruses. What links them is their reduced complexity overhead (i.e., the minimum structural complexity they have to maintain during transfer from site to site). By sacrificing the structural complexity needed for metabolism, viruses gain an unbeatable advantage over more complex, metabolizing life-forms that they infect (Levine, 1992). There is a parallel here with minimalist design as it competed with more complex architectural styles such as Art Nouveau and the

Classical style. Any style that attempts to adapt itself to human physical and emotional satisfaction, as well as to local materials and climate, will necessarily exceed a certain complexity threshold. In neglecting those needs — indeed, in making it its explicit aim to ignore them — minimalist architecture crossed the complexity threshold going towards total abstraction. This brought it an unprecedented memetic advantage, but removed an essential quality that we associate with "life".

Although "life" has not been rigorously defined as a concept, biological life consists of two components: metabolism, and replication (Dyson, 1999; Maynard-Smith & Szathmáry, 1999). The apparatus for metabolism represents much of what we observe as biological structure in every organism. The machinery for replication, on the other hand, occupies only a limited portion of an organism's structure. A virus replicates its encoded genetic information without being able to metabolize. It is the simplest possible life form, and by this definition, it is not "alive" in the sense that a more complex metabolizing organism is. In an analogous manner, minimalist structures, though immensely successful at replicating in the built environment, do not possess the same degree of "life" (measured in terms of organized complexity) as do more traditional architectural styles that adapt to human use and emotional needs.

There is a debate going on in evolutionary biology as to whether viruses developed before, concurrently, or after metabolizing life forms (Levine, 1992; Maynard-Smith & Szathmáry, 1999). The third option argues that parasitic replicators have to have a population of more complex organisms to parasitize before evolving. A probable scenario for this third option is that some incomplete pieces from the replicating apparatus of an organism found it possible to lead an independent existence outside the metabolizing structure. Whatever the actual case, this third option is intriguing for its parallel to architecture. With the above analogy, minimalism could not have taken root before society became complex enough to support it. The intuitive perception of minimalist buildings as "alien" forms invading our cities (and minds) makes more sense in a society that is so morally and ideologically confused as to be in no position to stop the invasion.

Evolution relies strongly on the organization of complexity. The metabolizing structure of all life forms exceeds a certain complexity threshold. Natural selection pushes organisms to become more complex. It is true that some species reach a plateau when their structural complexity provides a reasonably good chance for survival and reproduction. Those that do this have no need to change as long as their environment or ecological niche remain stable. Nevertheless, the direction of evolution as defined by the progress from elementary life forms to humans is one of increasing complexity. A sudden decrease in organized complexity thus appears as a catastrophic reversal akin to species extinction. Just as when viruses kill off a population of mammals, or when computer viruses erase a host of hard disks full of organized data, so the organized complexity of the built environment is erased when Nineteenth-century buildings are replaced by ones in a minimalist style.

The low information content of minimalist design distinguishes it from other, more traditional styles of architecture, as well as from more recent stylistic trends. We want to clarify a misunderstanding in discussions of complexity in architecture. Biological forms are characterized by their extraordinarily high degree of organized complexity. A high degree of organized complexity (visual as well as structural) is also found in the great buildings of the past such as

mediaeval cathedrals and mosques, and in vernacular architectures. This property is the opposite of the high degree of disorganized complexity that is seen in detailed, busy, but disorganized buildings such as postmodernist and deconstructivist structures. Disorganized complexity is also encoded in the visual cacophony of signs and materials in the suburban commercial strip, and the jumble of neon signs of the Las Vegas casinos. Our age appears incapable of organizing spontaneously-generated complexity.

10. How architecture perpetuates modernist memes

By a remarkable confluence of historical events and circumstances, selection on the basis of empty images has succeeded in displacing a variety of architectural traditions based on adaptation to human needs. Those who promote minimalist structures agree that the style's lower organizational complexity is meant to deliberately contrast with the higher complexity of traditional architecture. Is it possible now to re-establish traditional adaptive design methods in practice? Additional insight comes from seeing how three more criteria proposed by Heylighen: AUTHORITY, PUBLICITY, and CONFORMITY, contribute to the propagation and eventual institutionalization of memes (Heylighen, 1993; 1997).

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 (Heylighen, 1997). 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. In our times, the administrative buildings of the European Community in Brussels embody modernist memes. People conveniently forgot that modernism was the official architecture of Fascist Italy (see Figure 10.8).

Figure (10.8) Fascist architecture is modernist and not Classical.

The acceptance of architectural memes by governments and organizations elevated their

architects to a position of AUTHORITY. The 1932 exhibition on Modernist Architecture at the Museum of Modern Art in New York was a highly influential event, using the museum's AUTHORITY to promote the so-called "International Style". After New York, the exhibition traveled for seven years around the United States (Colomina, 1994). Two former directors of the German Bauhaus school were subsequently made heads of Architecture schools in the United States when they emigrated from Europe. Those architects then used their positions to promote memes through their teaching, and the media. Their positions of AUTHORITY also guaranteed them more commissions to erect buildings, thus setting up a self-sustaining cycle. The public rarely feels confident enough to challenge the AUTHORITY of individuals presented as the world's experts on the topic, even if what they say runs contrary to people's basic feelings and intuitions.

Professors at prestigious universities such as Sigfried Giedion and Nikolaus Pevsner — the first enormously influential as the Secretary of *CIAM* (*Congrès Internationaux d'Architecture Moderne*) — wrote scholarly "histories" of architecture that twisted facts to promote an ideology (Watkin, 2001). Modernism was falsely presented as the inevitable end result of the continuous evolution of historical architectures, instead of the radical negation of traditional styles that it represents. By claiming that modernism is not a style, and thus not subject to stylistic competition, they extended its AUTHORITY above and beyond architecture. Styles that modernism competed with and displaced (e.g., Neoclassical; Edwardian; Art Deco) were either dismissed as irrelevant, morally reprehensible, and were ignored altogether, or they were misleadingly appropriated as ancestors of modernism (e.g., Art Nouveau; Expressionism). An invented architectural history thus endowed modernism with false historical and moral AUTHORITY. Those treatises, along with others bearing the same misleading message, became the standard textbooks for more than one generation of architecture students.

An essential feature of evolution is that complex organic systems build upon existing complexity: each new development adds something to what already works. New layers of functionality develop on top of older structures, without altering them radically. This summarizes both the advantages and disadvantages of cumulative design by selection (Dennett, 1995). We can trace evolutionary ancestry by looking for features in common with less developed organisms on the evolutionary scale; some of which survive in an inactive or useless form (like our appendix). For an architectural example, the Classical style retains features of its ancestral wooden construction, although they make no structural sense when building with stone. Nineteenth-century styles retained much of what had developed up until then. As modernist architecture was intent on replacing all past and existing styles, however, it cannot be termed an evolution of those styles.

PUBLICITY is the effort to spread an idea; often an ideology includes explicit injunctions that believers should spread the word (Heylighen, 1997). 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 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). 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 design 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 guarantees that newcomers into a group will be infected by an accepted meme, even though it might reject sound knowledge and contradict established beliefs. CONFORMITY pressure establishes and maintains an invariant belief over a group of people (Heylighen, 1993; 1997). The constant exposure to a particular architectural style creates a familiarity, which in turn promotes CONFORMITY to what many others have already accepted. 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 currently trendy design style. In their efforts to meet their audience's expectations, architectural magazines tend to publish only articles featuring buildings that maintain the party line. Architecture students are naturally under pressure to conform to what is celebrated by these magazines.

The teaching of architecture changed in response to concepts established by the Bauhaus, such as the architectural design studio, creating an environment where design is almost entirely image-driven. It is very difficult even to discuss adaptive design components such as Alexandrine patterns (Alexander *et al.*, 1977), because those concepts are not images. In avoiding patterns, academic architects still invoke the tired "modern versus traditional" argument based entirely on superficial visual appearance, which ultimately thwarts adaptive endeavors.

11. Modernism has become an institution

Thus far, this Chapter described how modernist memes spread in society, to the point where they displaced most other architectural styles. We now wish to discuss how to remove those memes from our society. A group of memes achieves its ultimate success by becoming institutionalized. The rigidity of institutionalized memes then makes it extremely tough to get rid of them. This Section explains the great difficulty in displacing ingrained memes from today's architectural establishment. We don't believe that significant changes can come from within mainstream architecture, because it is itself a product of (and is totally dependent upon) modernist memes. It is more likely that users rather than architects will begin to consider alternatives once they understand the effects of memetic infection.

An institutional system will take actions to protect its political base, which results in a conceptual bias. Decisions are made as to which information is relevant to it (i.e., relevant to architecture strictly as defined by those in power), whereas other conceptual models will be ignored. The political agenda favors specific issues, deciding as well how dialogue with competing issues is to be addressed, if at all (de Jong, 1999). The same rules apply to any other meme group that has become institutionalized, and are not specific to either architecture, or design (de Jong, 1999). The institution defines both the importance and the interpretation of

concepts, so that it controls whether a particular idea will be discussed, and whether any action will be taken. Not surprisingly, arguments and actions that do not fit into the conceptual framework of those in power are not pursued.

This analysis is confirmed by how architecture has progressed since the Second World War. The institutionalization of modernism in our society acts as a filter for innovation within architectural design. Despite well-publicized reactions against empty forms, most of the original visual memes have been retained in post-modernist design. The overall forms may vary, yet the basic "look" is still familiar. Architecture today remains at its core non-adaptive to human needs; that basic aspect certainly has not changed. Neither has the proscription against detailed ornamentation and complex color harmonies that the early modernists imposed. Materials tend, on the whole, to be those preferred by the early modernists because of their universality, and even when traditional materials are used, they are used strictly in ways so as to mimic the "pure" surfaces of industrial materials.

Because every institution acts as a memetic filter, innovative concepts may be able to evolve only outside it. In the case of architecture, the evolution of design that is adaptive to human needs is taking place mostly outside the establishment: either spurred by architects who have been evicted from the establishment, or by other professionals who have discovered that the official system is too rigid to deal with societal problems. The establishment is reacting in a predictable manner by ignoring innovations that could threaten its power base. Instead, it underlines its absolute control by allowing limited debate within certain boundaries. The debate is very tightly controlled, however, and is never allowed to endanger the institutional basis. Topics from the present book appear in mainstream architectural publications, but in a primitive guise, and always accompanied by twisted arguments whose aim is to support the establishment fashions rather than to understand architecture. Thus, the declaration of the postmodernists that "modernism is dead" should be interpreted for what it really is: a diversion meant to protect the architectural establishment from any serious attack.

Proponents of modernist design sought to eliminate competing styles by employing two tactics: aggressive attack, and ridicule. The switch from one to the other marks the point when modernism became an institution. In the years up to the 1950s while modernism was peripheral and was trying to gain the upper hand, destructive encapsulation was used with great effect (see Section 8, above). By the time this tactic succeeded, the establishment (now modernist) found it more appropriate to express its strength by ridiculing its competition. The word "pastiche" was henceforth used to make fun of any architects who tried to incorporate traditional elements into their designs. "Pastiche" is the artistic equivalent of "plagiarism" in the sciences, and implies that such an architect is not being original. In fact, those who follow the establishment typology are doing exactly that, since the majority of buildings still copy the same industrial typologies from the 1920s.

Developments in architectural design touch upon the commercial benefits of a particular style in comparison to other factors. Modernist designs, because of their simplicity and context independence, are designs that can be produced industrially for a reasonable price. The institutionalization of modernist architecture has taken place in the entire construction industry, driven by the rise of industrial construction. This institution is separate, and more powerful than

architectural education, institutes, and magazines. Some authors have identified this as the dominant factor for modernism's success (Benedikt, 1999). In accepting a Faustian bargain, architects provided ever plainer designs that could be built even more cheaply, until by now the level of design complexity is so low that it is extremely difficult to raise. Any change that threatens to increase construction costs while lowering productivity in the construction industry is going to be fought by a massive establishment.

12. Conclusion

The idea of design as a Darwinian process that relies on selection has interesting ramifications for architecture as a whole. This explanation of how design emerges in the human mind reveals a split between design methods based on stereotyped images, and those based on adaptation to human needs. Both architectural and popular literatures come back to the theme that a majority of twentieth-century buildings provide neither the physical nor the emotional comfort for their users that older buildings — which are built in a freer, more adaptive style — almost invariably do. Nevertheless, despite such strong criticisms, certain visual styles continue to dominate construction and design practice today. An answer to why this is so comes from visual memes: self-sustaining conceptual entities that become fixed in human memory. Originally introduced in discussions of evolutionary biology, 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 as well as other innovative architectural styles.