AN EXTENDED FUNCTIONALIST APPROACH TO MEMETICS

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ABSTRACT

AN EXTENDED FUNCTIONALIST APPROACH TO MEMETICS

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Memetics is a Darwinian approach to evolution of culture proposed in late 1970s. This thesis proposes an approach to Memetics, which is an effort to overcome some of the problems involved. It is argued in this thesis that units of cultural evolution are functional abstraction of physical reality and are realized within the boundaries of our cognitive processes. The boundaries of human cognitive processes are defined by Clark and Chalmers (1998) in their extended cognition hypothesis according to which, human cognition is understood as a part of the cultural environment. Therefore human cognition and cultural environment can best be understood by studying them together.

As for identifying these units, an extended functionalist approach has been proposed and an empirical cultural transmission study has been conducted and explored in the thesis.

Keywords: Cultural Evolution, Memetics, Imitation, Extended Cognition, Functionalism

ÖZ

MEMETİĞE GENİŞLETİLMİŞ İŞLEVCİ BİR YAKLAŞIM

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Memetik, kültürel evrimin açıklanması için 1970'lerin sonlarında öne sürülen Darvinci bir yaklaşımdır. Bu tez memetiğin içerdiği problemlerin üstesinden gelmek amacıyla bir yaklaşım önermektedir. Bu tezde, kültürel evrimin birimlerinin fiziksel gerçekliğin işlevsel soyutlamaları olduğu ve insan bilişsel süreçlerinin sınırlarında olduğu ileri sürülmektedir. İnsan bilişsel süreçlerinin sınırları, insan bilişsel sisteminin kültürel çevrenin bir parçası olduğuna uygun olarak, Clark ve Chalmers (1998) tarafından, genişletilmiş biliş hipotezi ile tanımlanmıştır. Buna bağlı olarak, insan bilişsel sistemi ve kültürel çevre en iyi bu ikisi üzerinde birlikte çalışılarak anlaşılabilir.

Kültürel birimlerin ne olduklarının teşhis edilebilmesi hususunda da, bu tezde, genişletilmiş işlevselcilik yaklaşımı önerilmektedir. Bunun yanında deneysel bir kültürel aktarım çalışması da yapılmış ve sonuçları incelenmiştir.

Anahtar Kelimeler: Kültürel Evrim, Memetik, Taklit, Genişletilmiş Biliş, İşlevcilik

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CHAPTER 1

INTRODUCTION

Newton showed that there is a law of gravity although everybody was already aware of some facts at a superficial level that apples fall because it is on high or it is heavier than air or the like. There was however more than what appeared to be. The same thing can be true for the cultural evolution. We may say that there are very complex or basic processes in cultural transmission and accumulation, thus evolution at a superficial level, but there can be something more than that. Culture is a material and cognitive reality. It seems to be worthwhile studying deep on this topic in order to see what is under the surface. Darwinian approach can be one fruitful approach on cultural evolution in that sense. But it is very important to ground the claims philosophically and empirically.

In our environment, we can see complex structures[1]. These structures appear and disappear as our visual frame moves in time and space. But some of these structures reappear diachronically in the environment. Examples of these reappearing structures are the bodies of organisms, their behaviors –subset of all living activities– and also artifacts which are the products or extensions of the bodily activities of organisms. How do these structures reappear in the environment? What kind of relationship is there between organisms, their behaviors and artifacts? Are these reappearances of the structures causally connected? Is there a general explanation which can be applied at all the reappearances of these structures, especially at the reappearing structures of human behaviors and artifacts?

In order to explain the reappearances of the structures mentioned above, Darwinian Theory has been proposed as a viable option. Darwinian evolution by natural

1 Or we can name/cognize our chaotic environment as something having structures.

selection and the genetic replication mechanisms are the leading explanations for the replication of organisms. According to this view, information of biological design, which leads to physical structures of organisms, is encoded and copied in molecular structures called DNA. Information in DNA and environmental conditions interacts, and if the physical structures function well (i.e. they make significant contribution to the organisms' fitness) then the organism survives, molecular information gets replicated and the replicating biological structures remain in the spatio-temporal reality. But, if the physical structures don't function well (i.e. the fitness of organisms with these structures is not high enough) the organism and the physical structures are eliminated (see Figure 1).

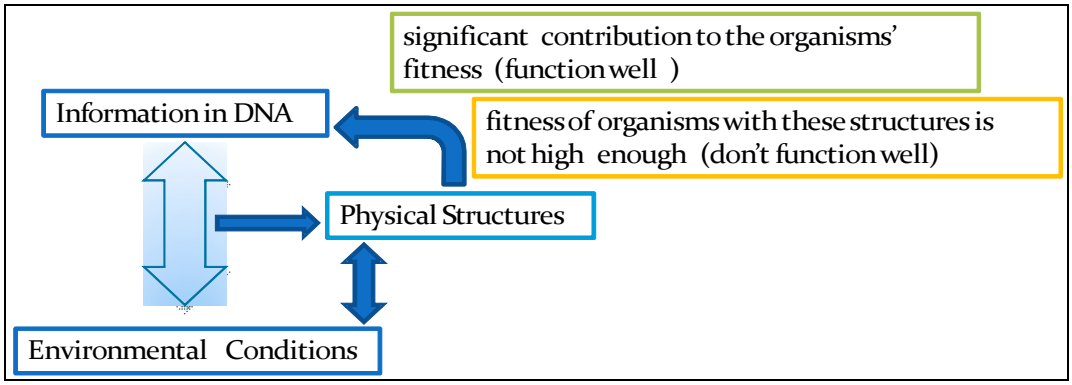

Figure 1: A Diagram illustrating the relations between information in DNA and the environmental conditions and how this interaction is the source of physical structures of the organisms. Physical structures also plays a role in fitness of organism by changing the environment via physical interaction and also play a role in determining what information structures to remain in genetic pool.

From an information- (that is digitally encoded information in DNA) oriented perspective, the Darwinian biological design accumulation can be explained roughly in this way. But what about the other replicating structures, namely behaviors and artifacts? In other words, what about the replicating information structures in the environment other than the digitally encoded biological information structures? As we can see in Figure 1, physical structures of organisms and the environment have a invariable relationship. It is a fact that some structures and processes like cognitive artifacts and behaviors also reappear in the context of these physical structures of organisms and the environment. There are also some

cognitive processes which re-appear in the cognitive world. The question is whether physical structures of the organisms and the environmental conditions must be considered as they are distinct or coupled in activities of organism.

According to embodied and extended/situated cognition views, artifacts and behaviors, accordingly the physical structure underlying these phenomena, are parts of cognitive processes. In this sense, the cultural environment which includes all designs which are not required to be "on-line" parts of cognitive processes *is* a part of the cognitive world, which includes all cognitive individuals and is a part of the cultural environment. Can this view be helpful in identifying the mechanisms of cultural change? Is the Darwinian explanation applicable at the information structures located in he bodies of organisms and the environment, other than the information encoded in DNA? If it is, in what way? How can the units of selection be identified in this relatively complex cultural area? What are the physical correlates of the units and on what conditions do they replicate? What cognitive mechanisms underlie these replication mechanisms?

In this thesis, I propose an extended functionalist approach to Darwinian evolution of culture. This approach is a result of situating culture into the environment and cognition. However it is important to note that cognition and the environment are not two distinct phenomena but they are different perspectives of the same thing, namely culture. Cognition, in this context, will be discussed under the functionalist view of philosophy of mind, but the functionalism will be extended, following the extended cognition hypothesis which takes environment, in certain situations, as part of cognition. I propose the view that cultural evolution can be identified as a Darwinian evolution, if the replicating units are located in the extended human cognition as chains of functional states. The identification of functional units cannot be done without taking the whole cultural context both in spatial and temporal continuity.

In order to support my thesis, I will first give a background placing cultural

knowledge in material cognitive activities. Then, present the conventional memetic views of cultural evolution in the literature and their critics. At the end of the "memetic introduction" I will focus on a physicalist and mentalist views on memetics and show the problems related with these approaches. In the second part, I will introduce the functionalism on cognition, cultural evolution. Later, I will present the extended cognitivist view and its importance in explaining cultural change in contrast with conventional memetic views. In the third part of my thesis, an empirical study is presented. In this study, an evolutionary lineage has been built and this evolutionary change is discussed regarding the extended functionalist approach proposed in this thesis.

CHAPTER 2

BACKGROUND

Phylogeny and Ontogeny

In order to understand information structures which I discuss in the following sections, it is better to examine them together with the concepts of phylogeny and ontogeny.

From an information-oriented perspective, human living activity can be understood from two different developmental schemes that shape human bodies, behaviors and also the environment. First, the phylogenetic development is the long evolutionary process accumulating the design of the organism in the genetic code. And this process shapes underlying biological structures that are shared by all members of a species. Secondly, ontogenetic development of a species accumulates individual experiences over the underlying biological structure by the plasticity "capability" of the biological body. In other words, there are two kinds of accumulated information on the physical structure of a body: one kind of information is accumulated and carried in the every cell of the body through the physical replication of the DNA. Information in DNA determines the phenotype, as we know that there is a design in that information which is shaped by *nature*. But it is important to note that both phylogenetic and ontogenetic developments are constrained by environmental conditions. In other words, both phylogenetic and ontogenetic processes are the results of adaptation of some functional structures. Phylogenetic development will be discussed further (see Dawkins, 2006; Dennett, 1995) in the following sections.

The latter kind of information –ontogenetic information– is accumulated in the

human body and the environment[2] in the process of individual development as a result of the interaction with the environment (or maybe interaction between genetic information and the environment). This second kind of information can be understood as a fine-tuning process of a general adaptation. This second kind of information leads to a design accumulation in terms of behaviors and artifacts. Culture seems to be the latter kind of information which not only interacts with the first kind of information, but also these two types of information mutually affect each other. They are, in a way, two aspects of a total evolutionary process. In this sense, we should be able to understand how this second kind of information, namely culture, has a place in nature. The human cognitive system is the location where we should place culture.

Cultural Cognition

The structures and mechanisms of human cognition can be considered as mainly information carrying structures, meaning that they are highly information oriented in the perspective of cognitive science. In order to understand the mechanisms of cultural evolution, this issue becomes quite important in the case of cultural evolution. Information can be considered as located in memory and transmitted by imitation or through other means of communication, such as speech, and it is fetched from the environment and re-expressed to the environment by the perception-action links. The structures of cognitive mechanisms are phenotypes of the genetic material which is accumulated through the phylogenetic information replication by preservation mechanisms. But the information which is replicated on cognitive mechanisms in the ontogenetic development is, in a sense, worth studying as a distinct phenomenon different from the information accumulated in phylogenetic development. The relationship between phylogenetic and ontogenetic developments and the accumulated information can be discussed further and it can be defended that ontogenetically accumulated information is no more than a result of the gene-environment interaction. But I should emphasize that there is a kind of

2 Maybe more than human body, as we will discuss in the following sections related with the extended cognition and extended functionalism hypotheses.

information that is replicated which is worth studying independently of genetic information.

It is important to emphasize that cognitive mechanisms can be understood better by studying them in the cultural environment, and in cultural transmission and cultural evolution mechanisms –not only by understanding human cognition as an independent phenomenon from the environment. “Culture is not any collection of things, whether tangible or abstract. Rather, it is a process. It is a human cognitive process that takes place both inside and outside the minds of people. It is the process in which our everyday cultural practices are enacted” (Hutchins, 1995, p. 354). Following Hutchins it is reasonable to propose that culture and cognition are two different aspects of the same thing. He proposes “an integrated view of human cognition in which a major component of culture is a cognitive process and cognition is a cultural process” (Hutchins, 1995, p. 354) (see Figure 2).

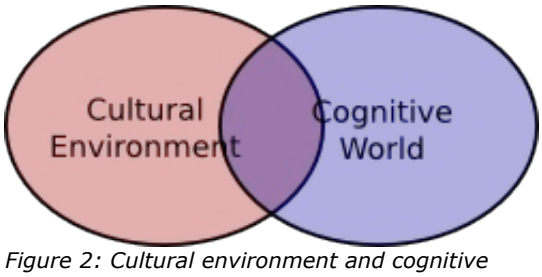

Figure 2: Cultural environment and cognitive world has an intrinsic relationship.

From the perspective presented above, ontogeny is the key playing ground for the cultural niche construction. And similar to phylogenetic development, in ontogenetic development, body, cognition and culture are shaped by the environment. Culture is, in common sense terms, the sum of behaviors, ideas and artifacts which are considered as products of the social learning process[3], however culture is not a collection of some distinct parts. Rather, it is an interactive cognitive activity. First I will present briefly a prominent view on cultural evolution and then, problems and critics of it.

3 See the genetic determinism of evolutionary psychology and sociobiology.

2.1 Darwinizing Culture: Memetics

The human species has quite complex behavioral patterns, artifacts and ideas as a result of cultural development. In this sense, the question is how could this complexity be explained?

Design accumulation by information transmission

The cultural environment changes through time. Design accumulates in this changing process. In other words, culture evolves. Daniel Dennett (1995) says, "We are the only species that has an extra medium of design preservation and design communication, namely culture" (p.338). There are a lot of artifactual and behavioral designs (patterns) in our cognitive activities that have undergone change through time. Can this change be given an evolutionary account similar to evolutionary explanations in biology? Does this cultural evolution operate as the biological evolution? Richard Dawkins (2006) first argued, rather tentatively, that cultural evolution may have a Darwinian pattern and proposed that the unit of this evolution may be *memes*, "second replicators" similar to the first replicators, namely genes. Cultural design is transmitted from individual to individual by these units, though by mechanisms different from genetic copying mechanisms and in *different media*.

In both biological and cultural change, from Dennett's (1995) point of view, the topic discussed is the transmission of *information*, although in memetics it is not clear what kind of information this is. In the case of biology, genetic structures and their causal role in building phenotypes allow us to study biological change very precisely. Furthermore the transmission of the genetic information encoded in a physical medium from one "interactor" to another is also quite obvious. But in memetics, although there is also change, the structures which carry information patterns are not precisely defined. Neither memes nor information transmission processes like imitation are well defined. Could there be any fruitful outcome of conducting research on cognitive mechanisms underlying this evolutionary process,

in order to explain information transmission mechanisms? And if yes, on what philosophical grounds?

Darwinian cultural evolution

Darwinian evolution by natural selection gives a quite accurate account of biological evolution, but his account should not be restricted to biology. Charles Darwin made it clear that whenever the following conditions exist natural selection occurs:

> (1) *variations:* there is a continuing abundance of different elements
>
> (2) *heredity or replication:* the elements have the capacity to create copies or replicas of themselves
>
> (3) *differential "fitness":* the number of copies of an element that are created in a given time varies, depending on interaction between the features of the environment in which it persists
>
> [Dennett, 1995, p. 343]

Any system which satisfies the above conditions undergoes a process of natural selection. If culture consists of this kind of elements or "units", then cultural change can be explained by natural selection. According to main advocates of memetics, memes, which are supposed to be units of cultural evolution, seem to fit into the theory quite well, since, in some cultural transmission processes like imitation or (inter-individual) communication, memes are copied or replicated. In this copying process, "mutations", that is variation, occur. As a result of the copying process, new copies of memes are formed in the cultural environment. Then, as in the case of biological evolution, while some of these "mutations" survive, others go extinct. Dennett (1995, p. 345) says that "[m]eme evolution is not just analogous to biological or genetic evolution, according to Dawkins. It is not just a process that can be metaphorically described in … evolutionary idioms, but a phenomenon that obeys the laws of natural selection". Then, how can we identify *the units* of cultural evolution? This is the primary question about the nature of memes.

Mentalist behaviorist views

In order to present memetic approaches in the literature, we may arrange them into two groups: the mentalist and the behaviorist (Aunger, 2000). According to mentalists, memes reside in the brain and the bodily activities cause memes to be copied. Dawkins (1999) defines a meme as “a unit of cultural inheritance ... naturally selected by virtue of its 'phenotypic' consequences on its own survival and replication” or “a unit of information residing in the brain” (p.109). Aaron Lynch (1998) gives a more precise definition of meme, “a memory item, or portion of an organism's neurally-stored information, identified using the abstraction system of the observer, whose instantiation depended critically on causation by prior instantiation of the same memory item in one or more other organisms' nervous systems”(1998, sec. 10). The classic examples of memes given by Dawkins (2006) are “tunes, ideas, catch-phrases, clothes fashions, ways of making pots or of building arches” (p.206). Dawkins argues that memes “propagate themselves in the meme pool by leaping from brain to brain via process which, in the broad sense, can be called imitation” (p.206). Susan Blackmore (1999) adopts a similar stance about memes and upholds Dawkins' idea.

Robert Aunger (2000) states that from the behaviorist point of view, memes “are a heterogeneous class of entities, primarily including behaviors and artifacts – the observable things that permit empirical work” (p.6). According to behaviorists, memes do not reside in the brain; rather they are behavioral dispositions and artifacts. “Outside the occurrence of the event, the practice of the behavior, or the life time of the artifact, the meme has no existence. The meme does not go anywhere when it is not manifested. It is not stored in some neural data bank, some internal meme repository” (Gatherer, 1998). This approach seems to distinguish between the concept of meme and its physical representation through an abstraction, because, according to a neuroscientific view, it is unlikely to be the case that there are replicating information structures. Dennett (1995) suggests that “what is preserved and transmitted in cultural evolution is *information* –in media-neutral,

language-neutral sense. Thus the meme is primarily a *semantic* classification, not a syntactic classification that might be directly observable in 'brain language' or natural language" (p.353-354). Behaviorists free the memetic study from defining the meme-host relationship, since behaviors and artifacts do not appear to have hosts, but propagate anyway (Aunger, 2000). The behaviorist position is mostly related with the cultural, and not specifically interested in its underlying cognitive structures.

If we consider the gene-meme analogy, the correlates of the terms phenotype and genotype have shown in memetics. Aunger says that "Behaviorists suggest that activities like making pots are the memetic equivalents of genotypes, while the mentalists would call such behaviors the phenotypic manifestations of memes-in-brains" (p.6). Surely, the ideas about the copying mechanisms also change in a similar way as the definition of meme. For example, the copying process of a paper by a copying machine is not a meme replication for the mentalists unless someone has any kind of copy of what is on paper imprinted in his mind. But according to the behaviorist, that paper would be a meme in the form of an artifact; replication, on the other hand, is the process that includes the copying or scanning or reading and behaviorally expressing ideas on a paper onto another paper or onto a computer disk or to other people, respectively. In this behaviorist case, if the information is not expressed, then that information won't be a meme. The different perspective of behaviorists and mentalists on memes is reminiscent of their different conception of language, in terms of E-language (external language) and I-Language (internal language), respectively.

Syntactical or semantical classification

Adopting a mentalist or behaviorist stance also determines what is to be studied in memetics empirically. In this sense, discovering the underlying mechanisms of memetic evolution, mentalists study underlying cognitive structures, but as Dennett states, memes are not syntactically classified information. Rather they are semantically classified information and it seems that there is no way to show the

neural correlates of memes that can be studied. Otherwise, behaviors and artifacts are the memes to be studied by abstracting them from their underlying structures. But this doesn't mean that memes are abstract units, rather “a meme's existence depends on a physical embodiment in some medium; if all such physical embodiments are destroyed, that meme is extinguished. … Memes, like genes, are potentially immortal, but, like genes, they depend on the existence of a continuous chain of physical vehicles, persisting in the face of the Second Law of Thermodynamics.”(Dennett, 1995, p. 348)

Dennett prefers to use the term “memes for something”. This usage indicates a functionalist perspective of memes. If they are for something, they have a function in mental processes for doing that thing. That is to say that they have a certain role in mental causation. The cultural environment lets some functional units get selected because of their function. In this context, 'cultural environment' means that all cognitive activities performed in a community, it has an inter-cognitive perspective rather than a perspective considering individual cognitions communicating. This last point will be discussed in the following sections.

2.2 Critics of Memetics

Current like patterns

Is it really possible to find a unit of cultural transmission? In the chapter "Tidying the Inner Scene: Why Memes?” Mary Midley (2003) criticizes the general tendency of atomizing cultural change. She says that “the trouble is that thought and culture are not the sort of thing that can have distinct units. They don't have a granular structure for the same reason that ocean currents themselves do not have one - namely, because they are not stuffs but patterns.” (p.57) According to her view, she implies the problems of searching ontological categories of cultural transmission. She makes an analogy with the ocean currents and says that “[t]he currents themselves are patterns of movements -ways in the water flows- and they form part of a wider system of such patterns, which surrounds them. To understand the currents one must first investigate these wider patterns." (p.57) Midley indicates

why we tend to atomize culture: “How can we fit the science that is now so important to us into the general pattern of our lives without distorting anything? ... Wilson says culture must be atomisable because atomising is the way in which we naturally think.” (p.63) As we can see, Midley criticizes the view that culture is composed of some kind of *ontological* units. Rather culture must be studied, first, by studying wider patterns that surround *current-like* structures. We can infer from her critics on memetics that memetics should have a broader perspective which takes the context in which cultural units are realized into account in identifying units of cultural evolution –if there are any.

Dan Sperber, in criticizing the memetic approach, says that there is a problem in using abstract objects as the source of the main issue of a scientific project. He claims that such abstract objects

> do not directly enter into causal relations. What caused your indigestion was not the Mornay sauce recipe in the abstract, but your host having read a public representation, having formed a mental representation, and having followed it with greater or lesser success. What caused the child's enjoyable fear was not the story of Little Red Riding Hood in the abstract, but her understanding of her mother's words. More to the present point, what caused the Mornay sauce recipe or the story of Little Red Riding Hood to become cultural representations is not, or rather is not directly, their formal properties, it is the construction of millions of mental representations causally linked by millions of public representations. (Dan Sperber, 1985, pp. 77-78)

Can we have abstract cultural units, as mentioned above, which can directly enter into causal relations, and also have the perspective including the representation issue above, viz., can we have an account of cultural representations/units which can bound the formal properties of abstract units and their construction in more broad environment of public representation (See Section 3.3 Functionalism Extended in Cultural Cognition)?

Another important problem about cultural evolution is its difference from biological evolution in terms of the lineages created by the probable replicating units. As Stephan Jay Gould (1992) points out, “[t]he basic topologies of biological and cultural change are completely different. Biological evolution is a system of a

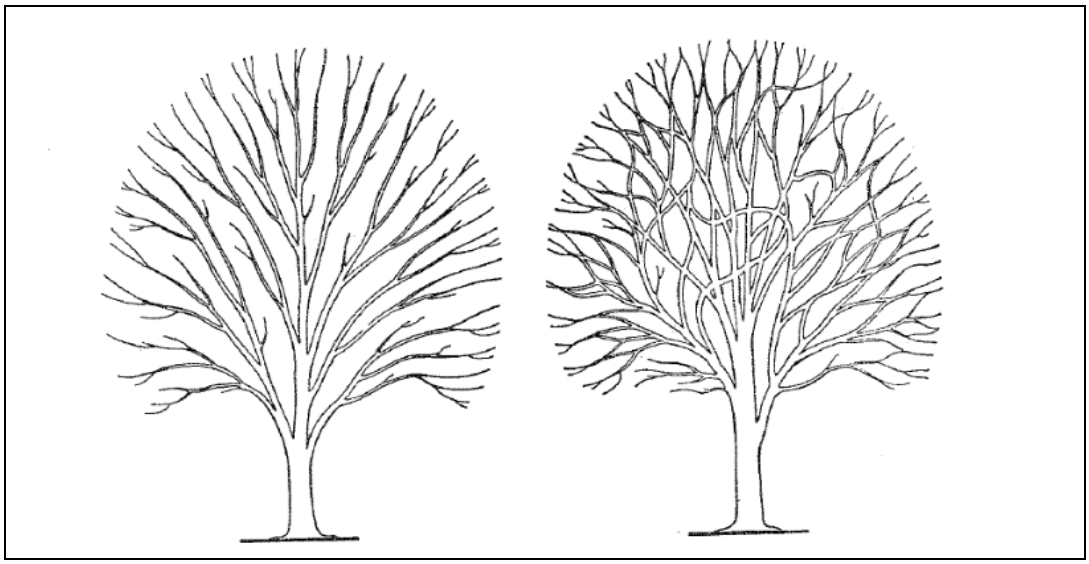

Figure 3: Family tree as depicted by anthropologist Alfred L. Kroeber. On the left is the tree of organic life; on the right is the tree of cultural artifacts. Source: Basalla, G., 1988, p.138.

constant divergence without subsequent joining of branches. Lineages, once distinct, are separate forever. In human history, transmission across lineages is, perhaps the major source of cultural change." (p.65) (see also Figure 3). Mechanisms of cultural information transmission are rather diverse as opposed to biological information transmission and replication. This makes any possible scientific study of cultural transmission rather challenging. From a memetic perspective, if there are species or any other units of selection on which the cultural environment works, we should be quite explicit about it. Here it is very important to focus on how we categorize the units (semantic categorization?), and also how we can study the mechanisms of variation, replication and selection (syntactic and physical correlates).

If we take Lake's (1998) information-structure-based position we may see how memetic information transfer could happen and in what points it could be different from transmission of genetic information. "[R]eplicators are information, that is to say, they are symbolic structures which code for, or refer to, non symbolic structures. If a replicator passes on its structure directly then replication must be a

process in which symbolic structure is transmitted without decoding" (p.82). For the cultural transmission and evolution, "the symbolic structure is often decoded, but it is part of the process of interaction, not replication. In the case of biological evolution, for instance, genes provide information about how to build an organism. The fitness of the organism determines the frequency with which the genes that coded for it are replicated, but these genes are never re-encoded"(p.82). Lake indicates the difference lying on the encoding decoding mechanisms. He assumes that cultural information is a symbolic information which is shaped as a result of interaction process rather than a "true" replication process. Genes are selected according to fitness of the organism, but they are replicated not re-encoded. In the case of cultural transmission, they are decoded and re-encoded, he says. His discussion infers to an ontological clarity of replicating units.

Another objection is made about the points that cultural change is not based on replication of cultural information, rather on its reproduction. In the sense that "they are produced again and again –with, of course, a causal link between all these productions– but are not reproduced in the sense of being copied from one another" (Sperber, 2000, p. 164). As we see, taking memes as discrete units may not be so reasonable. At least memetics "have to give empirical evidence to support the claim that, in the *micro-processes* of cultural transmission, elements of culture inherit all or nearly all their relevant properties from other elements of culture that they replicate" (D. Sperber, 2000, p. 173, emphasize added). In this issue of reproduction rather than replication one quite hot topic comes into discussion: the relationship between the perspective of the structures which carry information coming from genetically design-carrying structures (DNA by phylogeny) and the perspective of structures carrying information coming from interaction with the 'environment' (by ontogeny). How is it possible to differentiate whether a replicating "unit" is a result of a triggering or a copying process? In other words, is the causation relation between probable replicating cultural units a triggering relation of a genetically inherited structure (unit A triggers some structures of human X and X produces A') or a copying relation of cultural units (A replicates itself in the cognitive

environment and the replica A' is replicated).

Thus, following Blackmore (1999, chap. 5), objections can be presented in a number of distinct ways such as: (1) memes have insufficient copying fidelity, (2) nobody really knows what a meme physically is, (3) how large a unit deserves the name meme, (4) memetic evolution doesn't have a well-defined environmental background in which memes are selected.

As we see, these topics show us the basic problems about memetics. It is also very common using a folk psychological language in the memetics literature. This is probably due to confusions about the issue. This kind of jargon makes the memetics look rather shallow. Blackmore (1999) says that memes

> come about through variation and combination of old ones –either inside one person's mind or when memes passed from person to person. ... The human mind is a rich source of variation. In our thinking we mixed up ideas and turn them over to produce new combinations. ... Human creativity is a process of variation and recombination. (p.15)

In this quotation, we should be able to show what we mean by using words such as “variation” and “combination of memes” inside the mind or in the imitation process. If we are trying to show that memes are replicators which sustain the evolutionary algorithm based on variation, selection and retention, then it is almost inevitable to consider memes as atomic units, and their adaptation processes in terms of combinations and variations. But, how could these processes be defined precisely? Can one simple example of memetic change, which illustrates the process of how one meme is copied from one mind to another, be examined on a sound philosophical ground?

In the following section, I will present a perspective on memetics which implicitly adopts a functionalist perspective of philosophy of mind. This view, proposed by Robert Aunger is a challenging view aiming to solve some basic problem which are defined in this section. But I will also show what problems does his view still have in explaining cultural evolution. After presenting Aunger's implicit functionalism, I

will present functionalism explicitly and show the possibility of applying functionalism on a broader area: functionalism on cultural evolution. And then, regarding intrinsic relationship between cognition and culture as a basic argument, I will present the necessity of extended cognition hypotheses in cultural context and show how this extended cognition hypothesis adopts extended functionalism. Following the functionalist view on culture and extended cognition, I will present how it is beneficial to adopt an extended functionalist view to Darwinian cultural evolution. In order to see the validity of these philosophical arguments, I will present an empirical study which I have done in the scope of this thesis. This empirical study is an attempt to build an evolutionary lineage which is basically based on imitations of movements.

2.3 The Electric Meme: Replicators Located in Brain

Replicators

In order to show the problematic aspects of the ideas as we saw above and to show what kind of replicators the cultural evolution occurs with, Robert Aunger (2002, chap. 5) discusses the well-known replicators in the literature and tries to enumerate their common properties. According to him, (1) there must be a causal relation between the replicator and the ancestor and (2) a similarity based on their physical structure, (3) information transmission between source and target must be observed and (4) the number of the replicating entity must be physically increased at the end of the replication process. Here the first three conditions defines the essential functions of the replicator (copying itself), but the last condition forces us to show two distinct entities and the processes leading to the formation of the replicator and its replica. If there is any entity which has its own autonomy in terms of copying itself and satisfying the conditions above, then that entity can form a lineage in time and space in which we will be able to follow its change —independently from the other relatively well-defined causal mechanisms (genetic mechanisms)— which will help us to understand cultural evolution.

The electric meme

According to Aunger's view, replication processes of all well-known replicators can be observed in the physical substance and then, if we are discussing the replicator also in the cultural environment, we must be able to talk about where these replicators are located and how they replicate themselves in the physical substance (see The Sticky Replicator Principle[4], p.151-152). Following his physicalist reasoning, if one wants to explain the copying process by a replicating unit, he claims that it must be located in the *neural system.* He defines the cultural replicators as certain *brain states on the certain nodes of neurons*. The copying process occurs through the neuronal-electrical firings that causes state change in the target neuronal node. By this way, a copy of the source node's (source of firings) state is formed in the target node (the node whose state is changed). Thus copies of brain states are formed in the brain and these copies form a lineage.

From the view summarized above, the host of the cultural replicators are complex neural systems which are suitable (genetically designed by nature) for replication. We can say that these replicators, i.e. relatively stable states of certain numbers of neurons (these states can be conceived in terms of the threshold values of neuron firings), are formed by the processes of *cognition*, namely *perceptual-motor processes*. In other words, the signals coming from out of our body are reduced to neuronal/electrical firings and these firings are transmitted while they are changing the threshold values of synapses. During these transmissions some brain states are annihilated while new ones take place on the same neural nodes. We can say that some of the brain states including new and old ones cause some reproducible behavior patterns. Some of these patterns and artifacts, in a sense, extensions of behavior patterns, have a causal role as being *instigators* in forming new replicators (memes). In other words, in the way of changing and using the physical environment (thus some persistent structure like artifacts are formed) or not by changing and using the environment but by direct interaction with others, these

4 The sticky replicator principle is one prominent aspect of Robert Aunger's definition of meme. It proposes that replicators can be realized only on one kind of substance.

behavioral patterns take an active instigating role in forming a d*uplicate brain state* in another person's cognition. Because the instigators that a cognitive system interacts with perceptually, causes to begin a *similar* cognitive processes which results the *same* brain states occur, thus a new reproducible instigating behavioral patterns, in that interacting cognitive system. We can say that a similar process is applicable for artifacts, the persistent instigators. In this case, we can talk about two copies of the same meme. These copies may cause two different cognitive systems to perform similar behavioral patterns, and we may say that they are two consequent instances of a replicator lineage.

Computer functionalism and the electric meme

By arguing that memes are certain brain states, the memetic approach discussed above takes a somewhat functionalist stance. If we compare two distinct brain states, instances of the same meme, which correspond to two distinct neural nodes, they don't have to be the same in their physical structure. Whereas it is not reasonable to argue for the same physical structures in two different brains, we can still talk about the same meme, probably because of its functional role in the causal relations in human cognitive system ([Multiple Realizability). If we take this functionalist stance into account, can we say that memes may not be restricted to one kind of physical substrate, contrary to Aunger's (see 2002, p. 311) insistence? In other words, can we say that memes like computer viruses are phenomena whose replication mechanisms are only identified on a higher abstraction level?

In conventional Von-Neumann computer architecture, several layers are presumed, each is abstracted from another. In this way, instructions in lower layers which are more similar and/or near to the computer's hardware mechanisms are abstracted from a higher layer in which algorithms designed by our minds are present. Then, the higher level –more similar to how we think– instructions of computer viruses, the replicators in a functionally designed digital environment, are copied from one computer to another. The copying process is functionally independent from a lower level that is near to *physical* hardware mechanisms but the viruses are copied surely

with those physical structures and mechanisms of the computer's 'physical' hardware.

Such a memetic approach mentioned above has a functionalist stance in a way that it proposes that memes correspond to certain brain states. If the physical states which correspond to an –identical– meme are compared, then, as I said before, it is easy to say that they may be totally different, furthermore it is not necessary for them to be identical. For it is not possible to show two identical neural nodes which have the same conditions in two different brains, but it is possible to talk about the "functional" existence of two instances of the same meme. This is a basic example of the "multiple realizability" hypothesis. Following the afore mentioned functionalist stance, can we say that memes may not be located in the neuronal brain nodes as Aunger proposes? In other words, is it, in fact, possible to see memes as a phenomenon which copies itself only on a level of abstraction as in the case of computer viruses, but everything, in a sense, happens at the physical level?

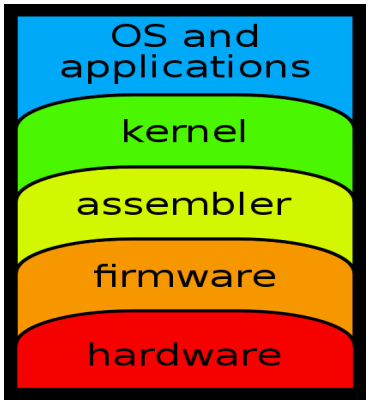

Figure 4: A typical visualization of a computer architecture a series of abstraction layers.

In order to understand the concept of abstraction in computer functionalism we can briefly look at the phenomenon in conventional computer architecture. In the conventional computer architecture there are abstraction layers, each of which is functionally abstracted from the other (see Figure 4). In this way, the instruction in the lower layers which are nearer to hardware are functionally abstracted from higher layers which are mostly easier to understand and more compatible with how

we think. Thus these higher layers are the layers where the instructions of the algorithms are realized. By this way, computer viruses which are bundles of computer instructions are copied from one computer to another on a higher level, but every instruction has some corresponding lower layer instructions. In a functional perspective, computer viruses are copied independently from hardware, but they are exactly physical hardware operations which are *functionally organized*. In the lowest hardware layer we see only the electrical signals of the physical material in a time-synchronized way. Thus computer viruses are not identified by the physical material in which they are realized, but by their algorithms which determine the function which they have in the whole system. Again in this sense, their copying mechanisms are defined in higher layers. If we can identify memes only by their function in the whole cognitive processes and thus in the cultural environment, then can we propose that, as Dennett, Dawkins and Blackmore point out, the same meme can create its instances in various distinct physical media? Answers to these questions will give us important clues about the nature of the cultural replicators.

Is the electrical meme a replicator?

The idea that a meme can create copies of itself in different media forces us to evaluate the crucial features of any replication event –causation, similarity, information transfer, and duplication– which are proposed by Aunger. Because of the possibility that memes can have a similar mechanism to that of computer viruses, unlike the replication mechanisms of DNA or prions[5], especially two of the condition must be discussed. First of the conditions that will be discussed is the necessity of the physical similarity between two copies of the same unit, which we can easily see in the case of DNA and the prion replication processes. But in the case of replication of memes, it becomes very hard to see any physical similarity, if

5 An abnormally folded, protease-resistant protein which forms aggregates in the brain in the spongiform encephalopathies and certain other neurodegenerative disorders, can be transmitted between individuals, and is thought to propagate itself by inducing the abnormal conformation in a normal form of the protein ("prion," 2009). For replication discussion of prions, see (Aunger, 2002, pp. 99-101).

we want to apply the *sticky replicator principle*[6] of Aunger by which he claims that the replicas of the replicator must have only one kind of physical substance. But in the case of memetic replication, if we don't have a single substance-stance, in other words, if the memes can be located in different substances like electrical circuits of neuronal nodes, etc., then it is not possible to claim that there is a physical similarity. Instead it is reasonable to hold the view that the similarity between two instances is in a higher functional-abstraction layer.

The other necessary condition of being a replicator which Aunger mentions is the duplication of the replicators in the sense that they must be increased in number. But from the functionalist perspective mentioned above, increment of physical substance may not be required. Apart from this, the replication is a process which is being realized in a higher abstraction layer which can be considered as a replication of a functional role in the whole system. The thing which is copied is a state or a sequence of states that are realized in any kind of physical substance, thus we cannot see any physical increment in number of instances of the same replicator, as in the case of the replication processes of DNAs or prions.

What if cognition extends?

The neural sticky principle or single substratum approach of Aunger can also be criticized by the basic claims of the extended cognition hypothesis which is first coined by Clark & Chalmers (1998). According to Clark and Chalmers, there is no big difference in actions of two cognitive agents, even if their mechanisms of cognitive processes are slightly different in terms of accessing the information in their memory. If we take into account the information both “encoded” in neuronal nodes and also in an artifact –a notebook– which has a causal role in taking the same action, they both may be in the same lineage of the replicator copying processes. In this case, can we talk about two different instances of the same meme in two different substances or the information which is encoded in the artifact is just an instigator for a new meme replication process?

6 See (Aunger, 2002, pp. 151-152).

If we advocate Aunger's view and say that what we say is a constant relationship between a meme and an instigator of that meme, we can consider a more speculative example. If we knew how the information is encoded in our brain, i.e. in what neuronal nodes it is located and in what conditions and contexts it is, we would also be able to manipulate it as we wish and also extend it in a way that an electronic circuitry memory system would be implanted. In that case, this system could be connected to the neural end and take the neuronal signals in an appropriate way and encode the signals in its encoding mechanism and also decode and give back the signal in the appropriate way by using the information encoded as the source again. Thus, this is a literal extension of the memory which is located in our brain. In this example, the cognitive system is a hybrid system including both biological and electronic substances and the replicators in this system would be certain states or the chains of the states realized in this hybrid system. From this point of view, insisting on the single-substance stance is not reasonable.

As a result of the discussion on the problems above, especially in the case of artifacts' role in cognitive processes, we should scrutinize in what kind of substances memes are realized and copied. Before going any further I want to emphasize that the functionalist view is the one which we cannot escape despite the well-known problems with functionalism. As Searle states (2004, chap. 2), the computer functionalist view is one of the strongest views in cognitive science. Following the criticism made by the extended cognition hypothesis, we can see that this hypothesis has fruitful outcomes in understanding cultural phenomena. Recently, the extended cognition hypothesis is generally thought to be “mandated by the existence of *functionally* specified cognitive systems whose boundaries are located partly outside the skin” (Wheeler, 2010, p. 1). Andy Clark has dubbed this position *extended functionalism* (Clark, 2008a, 2008b).

In the context of extending cognition and functionalism, one important discussion is about the relationship between extended cognition and extended functionalism. The question is about the necessity of extended functionalist essence of extended

cognition. Sprevak (forthcoming) advocates extended functionalism and makes it clear that "[a]n advocate of HEC [hypothesis of extended cognition] has two choices: (1) accept functionalism and radical HEC; (2) give up HEC entirely. " This issue will be discussed in detail later. But, before this discussion, I will briefly present functionalist approach to human cognition, and discuss how beneficial applying functionalism to cognition-in-culture, after the extended cognition discussion.

CHAPTER 3

FUNCTIONLISM

Monist views of the philosophy of mind can be grouped in two accounts: materialism and idealism. Idealism is not a favorable account among the scientists of mind and the behaviorist accounts of materialism also became disreputable among cognitive scientists after 1950s. The physicalist accounts of the mind have become very popular in the field. Physicalist argue that every mental process is identical with some biological or brain process. Two commonly accepted views vary according to their understanding of identity. Some accounts claims that there are some *types* of *mental states* which are identical with some types of brain states. But the identification of the types of state is the problem that is to be resolved. Another group of identity theories hold that a certain mental state is identical with a certain brain state. The former group of identity theory is called type identity and the latter is called token identity theories. Functionalism is the result of the effort for solving the problem of precise identification of states. This identification problem has the view that "there are some mental states which are identified as the same" in different bodies. If two different brains can have the same mental state, according to token identity theory they must have the same physical brain state. But this is impossible. In this sense, the functionalist view has a good account in explaining what the mental states which are identical with physical states are. Functionalism identifies mental states in the way that if we try to decompose brain processes into sub-processes and find causal relations between these sub-processes, then the best way for the decomposition is identifying functional roles of physical processes in the whole system. In that sense, there may be sameness in the functional roles of different brain processes in the whole system. (see Putnam, 1967; Searle, 2004)

Functionalism is basically “the doctrine that what makes something a mental state of a particular type does not depend on its internal constitution, but rather on the way it functions, or the role it plays, in the system of which it is a part” (Levin, 2009, sec. What is Functionalism?) In this thesis I will attempt to show how functionalism, especially the extended functionalism is fruitful in the area of cultural evolution, and how this extended functionalist views support the Darwinian cultural evolution. In order to do so, I will first discuss functionalism within the context of cultural evolution.

3.1 Functionalism in Cultural Evolution

As I mentioned earlier, in memetics we talk about units in cultural evolution. We must have a method in identifying the unit of cultural transmission. According to discussions until now, it is almost impossible to find physically realized units of culture. But we also have some reappearing structures in the cultural-cognitive environment. Then, how can we identify these structures?

Function and selection in cognitive-cultural evolution

If there is a selection on the varieties of replicating units, selection mechanisms and the replication mechanisms are defined by each other. The thing that is selected can be called replicating unit, and the replicating unit is the thing that is selected in the cultural cognitive environment. Hence, identification of selection mechanisms would be one important step in identifying replicators, if we don't already have better method in identifying replicators directly.

In identifying units especially for phenomena at an abstract level , we have trade off in holding token-token identification of units. In this case, Dennett refers to “abstract functional (or semantic) levels to find our common features” (1995, p. 357). But in what functional or semantic level would these units be realized? What is the functional unit, if we consider cognitive structures? Here we can take psycho-functionalist view of cognitive systems. According to psycho-functionalist view “what makes some neural process an instance of memory trace decay is a matter of

how it functions, or *the role it plays*, in a cognitive system; its neural or chemical properties are relevant only insofar as they enable that process to do what trace decay is hypothesized to do" (Levin, 2009, sec. Psycho-Functionalism). The mechanisms of cultural evolution lies on cognitive mechanisms which are functionally identified in a cognitive system. And these processes and mental states are "invoked by cognitive psychological theories". This view is quite compatible with biology as well.

> Cognitive psychology, that is, is intended by its proponents to be a "higher-level" science *like biology*: just as, in biology, physically disparate entities can all be hearts as long as they function to circulate blood in a living organism, and physically disparate entities can all be eyes as long as they enable an organism to see, disparate physical structures or processes can be instances of memory trace decay — or more familiar phenomena such as thoughts, sensations, and desires — as long as they play the roles described by the relevant cognitive theory.(Levin, 2009, sec. Psycho-Functionalism)

In this sense, we can add the replicating units of culture to the list of cognitive phenomena. Thus, they will be part of cognitive cultural environment as long as they play the roles described by the relevant cultural-cognitive theory.

> What is distinctive about psycho-functionalism is its claim that mental states and processes are just those entities, with just those properties, postulated by the best *scientific* explanation of human behavior. This means, first, that the form of the theory can diverge from the "machine table" specifications of machine state functionalism. It also means that the information used in the functional characterization of mental states and processes needn't be restricted to what is considered common knowledge or common sense, but can include information available only by careful laboratory observation and experimentation. (Levin, 2009, sec. Psycho-Functionalism)

As explained by Levin, we can go beyond the computer functionalism. Within the scope of the present study, information used in functional characterization of replicating cognitive states or chains of cognitive states is mostly the result of imitation and working memory studies (see Chapter 4, p.38).

But is the functionalist stance appropriate for selection and fitness explanation in cultural evolution? "As a process, adaptation confers advantage upon organisms which are organized in such a way that their parts have functions which allow them

to better *survive* in their environment" (Menary, 2008, p. 108). As we can see, functions of the parts of organism allow organism to have a greater chance for survival. Similar case can be made for units of cultural selection. If some structures which are acquired by interaction with the environment in ontogenetic development are replicating in cultural environment, then they mostly have functions, even if some of them do not have any identifiable function. But a quite similar case is valid for biological evolution. If some structures are replicated even if they don't have a function, then they don't play any role in survival of the organism. Nevertheless they can acquire a function which may play a role in the survival of organisms.

Function in the context

I also want to draw attention to functional necessities which are defined by the relationship between body of the organism and biological environment. Need for any structure is determined both by the environment and also by the body of the organism. Pumping blood which is the function of the heart is determined by bodily need and the heart is selected. Flying which is the function of the wings is determined both by bodily and environmental needs and the wings are selected. If there is a functional need which is determined by cognitive system some structures will meet the need but the way how it is done is in the interest of memetics in identifying selection mechanisms and replicating units. But the identification of functional needs in cultural environment is rather predefined by biological structures. But it does not mean that they are not important in memetics but their structures are mostly the result of phylogeny rather than ontogeny.

As I said, functions are not determined merely by bodily structures, but are actually the result of body-environment relationship, because the body evolves in the environment and the functional roles of structures are embodied in the environment. Thus, function has a unifying role in collaborating inside and outside from an adaptationist perspective:

> The bird needs its nest to function properly in exactly the same way that it needs, on the other hand, its skin and feathers and, on the other, its seeds. The

> nest, the feathers, and the seeds [food] are all part of the same organismic system. Conversely, the immune systems of the bird are designed to deal precisely with things spatially inside its body but that are not part of the biological system. The distinction between what is spatially "inside" and what is spatially "outside" the bird, as such, has no significance for the study of the avian biological system. The only interesting principled distinction that can be drawn between that portion of the organismic system that is the organism proper and that portion of it that is normal environment is not determined by a spatial boundary. (Milikan 1993, p.159 taken from Menary, 2008, pp. 107-108)

Very similar remarks are also made by Clark: "The pumping adaptation of the sponge cannot be properly described unless we take into account its immediate surroundings, its environmental niche" (Clark, 1989). A similar case can be found in the cultural environment, especially regarding the cultural replicators' adaptation. A diver uses some artifact and behavior underwater. And functional roles of his or her cultural structures cannot be understood unless we take into account its immediate surroundings. That functional role and the way of meeting the functional need have an evolutionary lineage.

If something has a function in a system and that system has the ability to survive and if we can say that the system is a composition of the functional things in the system, then our focus must be the functional things in the system. They are somehow inherited then they are in the focus of evolutionary analysis.

It can be said that most of the processes in the physical cognitive system cannot be attributed a specific function. But the presence of some distinct structures replicating in relatively high fidelity suggests that there must be some definite *functional structures that enable the system to fit in the environment*[7]. This last point indicates *extended cognition hypothesis* which will be discussed in the following section.

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7 The environment can be considered as the interactions with the physical environment including inter-personal interactions.

3.2 How Cognition Extends

In classical [internalist] cognitivist views, cognition is thought within the boundaries of the body or in the neural system or the brain. The environment at the outside of the body is also thought outside of cognition. But as Clark & Chalmers (1998) and many others (Clark, 2008b; Kirsh & Maglio, 1994; Kirsh, 1995) argued, the epistemic action rather than pragmatic ones determines the boundaries of cognitive processes. This view differs from the classical externalism of Putnam (1975) and Burge (1979) in a sense that the "relevant external features are *active*, playing a crucial role in the here and now. Because they are coupled with the human organism, they have a direct impact on the organism and on its behavior" (Clark & Chalmers, 1998, p. 9). From the Putnam and Burge's views, the features "play no role in driving the cognitive process in the here-and-now" (1998, p. 9). According to this view, some parts of the environment around us are the part of our cognitive processes. Clark (2008b) mentions his personal communication with Edwin Hutchins, and says that

> Plastic human brains may nonetheless learn to factor the operation and the information-bearing role of such external props and artifacts [such as nautical slide rule] deep into their own problem-solving routines, creating hybrid cognitive circuits that are themselves the physical mechanisms underlying specific problem-solving performances. ... under certain conditions, such props and structures might count as *proper parts of extended cognitive processes.* (Clark, 2008b, p. 68)

In the ontological development process by the capability of plasticity in human brain and body, some props and structures count as "proper parts of extended cognitive processes". From this perspective, all designs in the environment have a part of a whole *cognitive processes.* And following the extended functionalism, accumulated design in culture is located both in human body and environment as two different perspectives of one functional unit, viz., if some cognitive processes to be identified regarding their roles in cultural evolutionary processes, they are not only located in human body; however, the location of processes must be extended.

To be more explicit, unit of cultural evolution must be extended in spatial

continuum. As I mentioned earlier, this information processing view allows us to make an abstraction of some mental states from the physical underlying mechanisms, which leads to functionalist view of cognition. But in the extended cognition case, the functional states are not functional abstraction of only *brain* states, but also the boundaries of the functional states are extended. Now, the functional states of *extended* cognition are extended to the environment. Clark calls this kind of functionalism as I mentioned before *extended functionalism*. On the basis of this view, how can we identify the units that replicate themselves?

Units of functional analysis

Gregory Batesons' unit of analysis may give us an understanding of how the replicating units can be identified. He gives the following example of a blind man using a stick, going tap, tap. He asks the question: "Where do I start? Is my mental system bounded at the handle of the stick? Is it bounded by my skin? Does it start half way up the stick?" (Bateson, 1972, p. 459) e says that "[t]he stick is a pathway along which transforms of difference are being transmitted. The way to delineate the system is to draw the limiting line in such a way that you do not cut any of these pathways in ways which leave things inexplicable" (p.459). Similarly if we have some cultural units in cultural environment they cannot be limited to the body or brain. Edward Hutchins (1995) says that "[t]he proper unit of analysis ... includes the socio material environment of the person, and the boundaries of the system may shift during the course of activity" (Hutchins, 1995, p. 292). He also emphasizes the importance of temporal boundaries which determines the learning process of activities.

As we can see, boundaries of cognitive activity are not restricted to the body. Thus, if the replicating units are located in the boundaries of cognition then we can also extend the location of the replicator. Then we can predict that the replicating units in the cultural environment are not necessarily in the individual mind or more truly, in the electrical configuration of neuronal nodes in an individual brain as Aunger claims. In the cultural environment, it is more reasonable to investigate the units of

cultural evolution in broader working area. Because culture is transmitted not only via the biological-physical structure of human body which is shaped and informationally loaded (information accumulation) in the phylogenetic and ontogenetic processes, but also transmitted via cognitive artifacts which are *parts* of extended mental states. As I mentioned before, replicating mental states cannot be thought independently of the environment. That is missing in cultural transmission view of Aunger and the other mentalist memeticists. Now, I shall pursue on what I mean by epistemic action and its role in the multiple realizability requirements in cultural transmission process.

Epistemic actions

Kirsh & Maglio define epistemic actions as follows: “Epistemic actions -physical actions that make mental computation easier, faster, or more reliable- are *external* actions that an agent performs to change its own computational state” (1994, p. 3). The environment is used as part of the computation processes of an individual's cognition. Another aspect of the epistemic actions is that “Epistemic actions are actions designed to change the input to an agent's information-processing system. They are ways an agent has of modifying the external environment to provide crucial bits of information just when they are needed most” (Kirsh & Maglio, 1994, p. 38). The epistemic actions indicate the relationship between body and the environment.

The epistemic actions are the actions which are part of external environment, in this sense, they also change the agent's “internal” computational processes. That is to say, the information in the environment is highly coupled with agents’ information processing system. Then the information in the environment becomes a part of the information processing system of the cognitive agent through the epistemic actions. And this indicates the importance of focusing on the processes rather than sole isolated units in time and space. In the following section, I will discuss the importance of context in which functional identification occurs.

3.3 Functionalism Extended in Cultural Cognition

> According to the extended cognition hypothesis (henceforth ExC), there are conditions under which thinking and thoughts (or more precisely, the material vehicles that realize thinking and thoughts) are spatially distributed over brain, body and world, in such a way that the external (beyond-the-skin) factors concerned are rightly accorded fully-paid-up cognitive status.(Wheeler, 2010, p. 1)

Function in cultural environment

Functions cannot be independent of their context. In one cultural environment, one movement may have a certain function/meaning but in another cultural environment/context it may have another function. If we consider shaking up and down one's head that movement has the function of salutation in the American cultural context, but in the Turkish context it means/has the function of giving negative answer if one raises her head. If we consider someone (A) who raises his head with an intention of giving negative answer in New York, the function of the movement in the mental processes of the agent who does that movement is to give negative answer (f_{neg} in A's mental processes), it will have a different function in the cultural environment or in that cultural context (f_{salute} in NY cultural environment). The movement of raising one's head in two different context (A raises her head in NY and Ankara), even if it is a descendant of the same "narrow" functional states (f_{neg} in A's mental processes), it cannot have the same function in the other cultural environment (compare f_{neg} in Ankara and f_{salute} in NY cultural environments) and function of the movement will be changed when we consider the broader functional states of cultural environment[8]. It can be exapted with a different function. Thus, survival of this raising head movement is not only dependent on the function (f_{neg}) in individual's (A') mental processes but it is also dependent on the function ($f_{salutation}$) in broader cultural context or processes (NY cultural environment). If this movement is selected it will satisfy a functional need of salutation rather than negative answer and will be selected because of that function. The same is valid for the biological evolution. Bird wings can have a functional transformation from

8 Remember function is the main property of the cultural unit, which makes the cultural unit be selected in the cognitive processes and thus culture.

thermo-regulatory function to flying function. This example show us why functional extension of mental states is important in understand cultural transmission, selection and adaptation mechanism.

I think this is a comprehensive view which induces a solution to the problems of studying culture scientifically proposed by Sperber (abstract representations), Midley (not atoms but patterns), Gould (transmission across lineages) and Dennett (semantic vs. syntactic distinction) in the Critics of Memetics section above. T The thing which makes abstract representations enter directly into causal relations of physical body and environment is the functional abstraction mechanism argued in the previous sections. From this perspective every thing happens in the *causal closure* of physical reality. However, the abstracted units are actually, not in the substance or property dualist senses but in the functionalist sense in the philosophy of mind, abstraction of physical reality (See Levin, 2009, 1; and for dualism Robinson, 2007, 2.1). But these functional abstractions are not in the boundaries of body as it is claimed in conventional functionalism but in the boundaries of functional roles which allows us to locate a unit into broader context in order to identify the units of selection. From this extended functional perspective, it is easier to identify units regarding history of functional needs and the mechanisms that satisfies that needs. Then, temporal aspect of cultural transmission is another important aspect of cultural transmission together with the spatial aspect. This extended functionalist approach frees us to see how cultural units can be identified in time and space with what kind of mechanisms. According to this view, there is no something like transmission across lineages, but switching between different functional aspects which are determined according to temporally and spatially shaped contexts. If two evolutionary functional lineages are converging than it is highly possible that these linages becomes a part of a new lineage which is in a broader spatio-temporal context.

The example above shows us an important point: the function of a mental state cannot be considered independently of the context of that state in which it occurs.

And then in some cases, the context of a functional state can be taken as part of that functional state. This view also implies an extended functionalist view. According to this view, the functional state which is copied and selected in the cultural environment may not be just the state in one body which causes the head lifting movement but the state which embodies more than one body. From this perspective it is clear that only the mental state which "causes" head lifting is not a cultural unit but more extended physical medium can be considered as a location of the cultural unit. In other words, cultural evolution needs the extended view of cognition, especially in the case of the selection of some functional units. Context and thus, spatial and temporal boundaries of cognitive activities are the major issues in cultural selection. In this sense, functional abstraction is one plausible way to identify units of selection.

Is it possible to argue that, in the case of biological evolution, units of biological selection can be extended: extended phenotype? It is discussed that extended phenotype perspective in biology is a counter part of the extended cognition hypotheses (See Clark, 2008b, pp. 123,218; Menary, 2008). And similar arguments can also be proposed in biological case. As I mentioned also above, extended functionalist approach is has strong notions in evolutionary thinking due to its situating selectional mechanisms into environment in which selection occurs.

Cultural selection

From this extended functionalist perspective, first, *functional identification of units* makes it clear, in the cultural environment, that the structures re-appear in cultural environment while phenomenal aspect of conventional cultural literature including conventional memeticists' ideas are saved. Second, extending embodied-embedded functional mental states into the cultural cognitive environment let us see that the extra categories like artifact, behaviors and ideas are just part of a whole series of processes. Thus, there is no need to use terms like instigators as Aunger does because they are mostly parts of the units, rather than the instigators of replication process of the units.

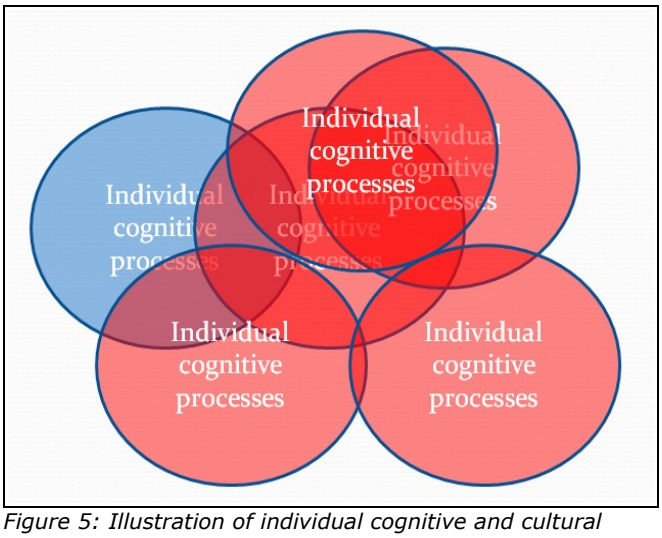

Figure 5: Illustration of individual cognitive and cultural processes. Individual cognitions are the cultural environment themselves and the functional selection is not only located at an individual cognition, but it must be identified in more broad context of whole cognitive-cultural environment.

Following the argument above one may argue that there are some cultural units that don't have any apparent functional role. In that case we can easily argue that there is quite similar case in biological structures. There are genes, units of biological evolution, which don't have any apparent function. Because, in the biological environment in which fitness and selection occur, only traits can be attributed to have functions But in many cases it is not possible to show one to one gene-trait relationship in a biological system of organisms. But this doesn't mean that the gene does not have the potential of a having function or that that the gene already has a role in a trait and thus has a function which couldn't be identified. From a new perspective it may be claimed that DNA has a function alone or with some other genes.

In the cognitive-cultural environment, evolutionary changes occur regarding the "information" and design accumulation. In order to identify replicating distinct cultural units, extended functionalist approach proposes a good Darwinian evolutionary understanding of cultural change. In the following section, I will present an empirical study for discussing the extended functionalist arguments that

are presented above.

CHAPTER 4

EMPIRICAL STUDY

Following the pyscho-functionalism, I will attempt to present some functional units in a chains of imitation task. First, I will present imitations' role in human cognition and cultural transmission and then, present also the working memory concept and its probable role in cultural selection. And present the details and the results of this explorative study. Discussion will be held at the and of this section about the empirical study.

4.1 How Cultural information is copied: Imitation

> What is it about acronyms, or about rhymes or "snappy" slogans, that makes them fare so well in the competitions that rage through a human mind? This sort of question exploits a fundamental strategy both of evolutionary theory and cognitive science, as we have seen many times. Where evolutionary theory considers information transmitted through genetic channels, whatever they are, cognitive science considers information transmitted through the channels of nervous system, whatever they are –plus the adjacent media, such as the translucent air, which transmits sound and light so well. You can finesse your ignorance of gory mechanical details of how the information got from A to B, at least temporarily, and just concentrate on the implications of the fact that some information did get there –and some other information didn't.(Dennett, 1995, p. 359)

As Dennett states, what if we focus on the information which is transmitted from one location to another? From an information oriented perspective, what kind of information is transmitted from cognition A to B? How can we distinguish between the information copied from one cognition to another and the information which is acquired from the environment in social learning processes which are, in many cases, "equivalent, at a descriptive level, to classical conditioning" (Heyes, 1993, p. 1002). How is it possible to identify the information copying mechanisms and are there any criterion in identifying the information copied? Finally, what is the thing

which we call information in the context of cultural transmission?

Imitation is the one mechanism which is commonly used by the memeticists as an example of the meme copying mechanisms. Blackmore states "[w]hen you *imitate* someone else, something is passed on … We might call this thing an idea, an instruction, a behaviour, a piece of information... It is the 'meme'"(Blackmore, 1999, p. 4). Why imitation is commonly used as a meme copying mechanism? Imitation is one important ability that is a shortcut for learning: the imitator does what the model does without any costly try and error or classical conditioning mechanisms. For human cognition, imitation is an important phenomenon which includes both perception and action. In the imitation process, an organism apparently copies certain behavioral patterns of other organisms. These can be both basic and complex[9] patterns in terms of the complexity of what is being perceived. In the literature, studies on imitation mainly focus on basic characteristics of the imitation process. In order to do so, in experiments, target behaviors of models are rather clearly defined basic movements, such as simple language units, voices, gestures, or series of movements. But it is obvious that in general, especially in the cultural environment, imitation is a complex phenomenon which also includes copying of more complicated behavioral patterns. In these cases of complex movements, we inevitably need to mention *what* is being imitated rather than *how* that pattern is imitated. In the literature, goals (Meltzoff & Moore, 1997; Wohlschlager, Gattis, & Bekkering, 2003) and information (A. N. Meltzoff, 2002) are commonly mentioned as the answers to this question[10]. But also there are working memory and attention issues in discussing what is selected from the complexities and according to what principles they are selected.

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9 In this paper, 'complexity' is used in the following sense: if one image in the perceptual field allows more possibility to perceive something, then that image is more complex than the other or if that image causes more variety of reproduction of itself, it is again more complex than an other image. In this sense, in this study experiment, one pattern in the the evolutionary trajectory less complex than its antecedents and more complex than its subsequent one if there is no new details added due to the loss of information and details.

10 In this case copying goals of models and following the extended cognition hypothesis also, extensions of movements which we could call as "cognitive artifacts" comes into play.

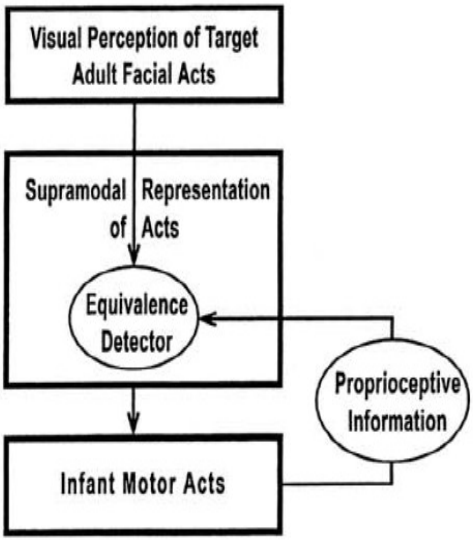

Figure 6: The AIM hypothesis for how infants perform facial imitation. (From Meltzof & Moore, 1997)

There are several approaches to imitation. Meltzoff and Moore (1997) provide a detailed model of the mechanisms underlying facial imitation in infants. In their proposal about the "active intermodal mapping" (AIM) hypothesis, it is argued that imitation involves a goal-directed matching process (see Figure 6). Proprioceptive information and visual perception of goals or behavioral targets are matched in the "supramodal act space" in which the representations from different modalities are located. If proprioceptive information and visual perception are matched, after being compared, then infant recognizes that her perception of the target act is the same as her act. If not, then infants check their motor acts, by using "body babbling" for coordinating movements to organ end-states, perform an action and then make a comparison again. Before performing action babbling is a kind of correction process for creation of the pattern.

> "Infants do not seem able to generate the novel response *de novo*, on first try, by inferring what movements to make from seeing a new OR [proprioceptively monitored organ-relation] *end state* alone. None the less, imitation is powerful and generative in the sense that a match to novel targets can be achieved *without extrinsic reinforcement.*" (A. N. Meltzoff & Moore, 1997, p. 187)

And it is important to note that "infants' imitative responses are not motor units akin

to reflexes that are simply released by the appropriate input. Rather, early imitation is a goal-directed response whose aim is `matching the target' " (1997, p. 182).Thus, we can roughly say that Meltzoff and Moore unify the goal-directedness and information copying perspective of imitation. In the first chapter of *The Imitative Mind,* Meltzoff says that:

> "The idea of supramodal coding of human acts that emerged from developmental psychology is highly compatible with Prinz' theory of common coding, which derived from cognitive experiments with adults (W. Prinz, 1990, 1992, this volume). It also dovetails well with the neuroscience discoveries about the brain bases for coupling observed and executed acts(...). (2002, p. 25)

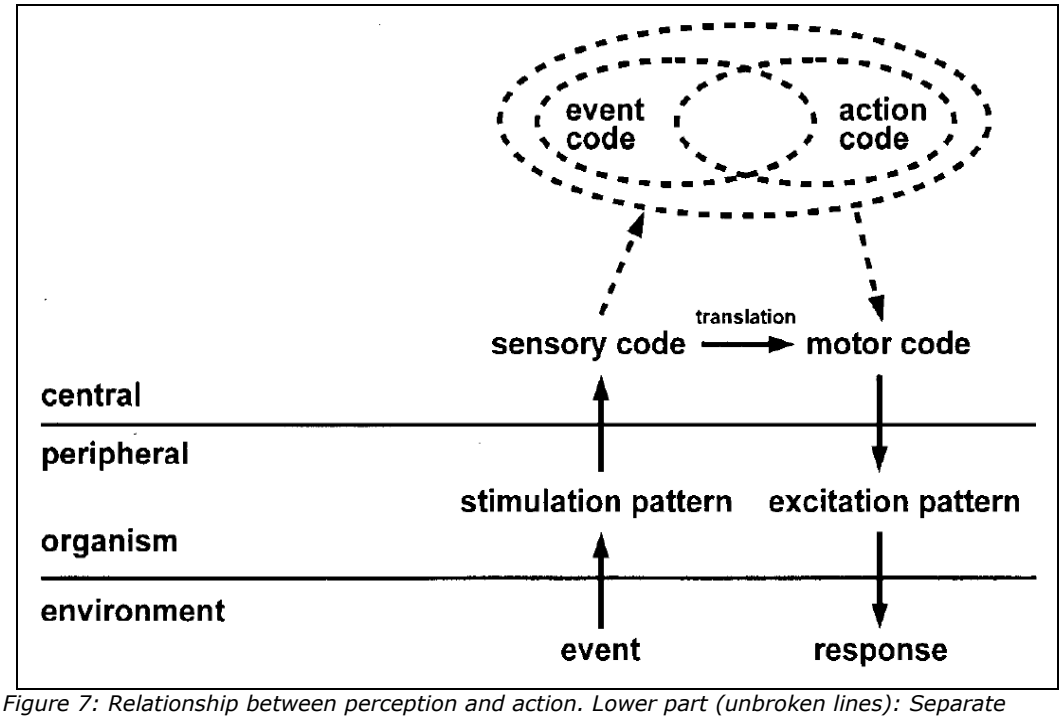

Figure 7: Relationship between perception and action. Lower part (unbroken lines): Separate coding (sensory codes, motor codes and translation between them). Top part (broken lines): Common coding (event codes, action codes and induction between them). (taken from Prinz, 1997)

In Prinz' theory of common coding (1997), he talks about *representations* of perceived events and planned actions and in this framework event codes and action codes have a common representational domain which is called "common coding" (see Figure 7). As Meltzoff states, their ideas are quite parallel; one may say that Meltzoff's supramodal act space is kind of an application of common coding idea to

imitation. In this sense, how can we relate the AIM theory with the information copying process?

As it is proposed, some representations of visual and auditory observations are matched with the particular representations of action (proprioception). If we state this in the terminology of common coding framework, some sensory codes of *stimulation pattern*s are not only "translated" into particular motor codes which stand for *excitation patterns*, but also "another level of representation is added to the previous basic scheme. 'Event codes' and 'action codes' should be considered the *functional* basis of percepts and action plans, respectively. It is held that they share the same representational domain and are therefore commensurate" (W. Prinz, 1997, p. 133). In this sense, we can say that these event and action codes are the information *units* which also implicitly represent the action goals in their *structure*. As Prinz clearly states these codes are functional categories of percepts and action plans. But the important question is what kind of information is coded in these event and action codes and where are these codes located? How broad content do they have? It is reasonable to propose that these event and action codes are functionally identified cognitive states. This functional identification is also advocated by the extended functionalist stance which is a philosophical result of the extended cognition hypothesis as we will see in the following sections. In order to present the notion of situatedness of cognition in the environment, Hommel, Müsseler, Aschersleben & Prinz (2002) presents the *adaption views* of perception and action which is present in the literature on spatial and temporal orientation and adaptation. Hommel et al. say that this perspective refers to

> the notion that perception and action control make use of shared reference frames with respect to space and time. In particular it posits shared frame for environmental objects and events and for the actor's body and his or her movements. These reference frames serve to specify the spatial and temporal relationships between environmental events and bodily actions and, thus, to coordinate one with the other. … [T]his assumption appears to be a prerequisite for the successful functioning of sensorimotor systems. (2002, p. 853)

What if we assume that the environmental events play an active role in functional

codings of event and action? And can we argue for the view that the event codes and action codes are extended functional abstractions of information transmitted between cognitions? These questions are quite important for understanding cognition in culture. Because the mechanisms of perception and action in human cognition must also be in the center of the mechanisms of cultural transmission and evolution.

Thus, supramodal representational space of AIM and "common coding" (i.e. event codes, action codes and induction between them), but not the framework of "separate coding" (i.e. sensory codes, motor codes and the translation between them), can be interpreted as the general framework of *information transfer* which I use in this section as a framework. But it is quite important to situate the information into the cultural cognition.

If we could say that there are some *restricted* perceptive patterns which are obtained from the continuum of the complex environment of events (assume that there are restricted patters because of working memory capacity limitations), and if there are also some *restricted* patterns of action in the continuum of wide action space (assume so); then with a *reproduction* process*, variation* and *selection* (which implies the *elimination* of the non-selected features*)* of *information units* are unavoidable. So, from this perspective, we could -in a way- talk about how information evolves.

From another perspective, a behavioral pattern instigates one cognition to create one mental state, namely common codes of event codes and action codes. In the scope of AIM, the mental state instigated by an instigator (in this imitation case, a behavioral pattern and/or goal of behavioral pattern) is matched with proprioceptive information.

To sum up, almost always some of the behavioral patterns are copied and there is reduction of complexity in the original movement. These patterns are *perceived* and copies of those patterns are *reproduced* by human cognition. As we mentioned,

these patterns can be interpreted as information units. One basic example is Stadler and Kruse's study (1990). In that study, they conducted an experiment of serial reproduction of dot patterns. In the experiment, the first subject is given a matrix of randomly generated dot patterns and asked to reproduce that pattern after presenting the pattern for a small interval of time. The same procedure is done to the next subject with the generated pattern and so on... When the final copied pattern is compared with the initial one, it is observed that the randomness of the pattern decreased dramatically. The reason behind this reduction is that, for every copying process, each individual subject gradually reduced the amount of "information" presented to him/her. From this phenomenon, it is induced that, there are some *constraints*. These constraints may rather be related to perception, reproduction of what is perceived or both. It is important to note that, these constraints are valid for more wide area of imitation, too.

4.2 Working Memory

"We can use the existence of a particular sort of cultural representation endemic to oral traditions to shed light on how human memory works, by asking what it is about *this* sort of representation that makes it more memorable than others" (Dennett, 1995, p. 359).

Human memory is the one of the major topics in human cognition, which includes the discussions of information storing, replication and selection mechanisms. And imitation is the an innate mechanism of the information copying and selection. We know that these two mechanisms work together. In the imitation process, there are some constraints in copying the model movements in detail due to the working memory limitations. As I discussed in the "perception action: meme patterns" section, we cannot copy everything in all details but fetch a pattern from perceptual complexity. What is fetched and by what mechanisms that perceptual pattern is fetched are quite important questions in terms of cultural replication. This discussion is also the discussion about cultural unit identification and selection mechanisms of the units in the cultural environment. A common definition of

working memory is the following: “The theoretical concept of working memory assumes that a limited capacity system, which temporarily maintains and stores information, supports human thought processes by providing an interface between perception, long-term memory and action” (Alan Baddeley, 2003, p. 829).

As we see, there is a limited system in human cognition, that is explained in terms of the information maintaining and storing processes. This limitation takes place between the bodily stored long-term information and the environment. As Aunger states “[o]ur model of memes must be consistent with what we presently know about the *distributed* and *contextual* nature of memory and learning in the brain”(2002, p. 194) and according to his view, as we mentioned before, the replicator of culture are neuronal states of the brain. These neuronal states are “infectious” if they are in short-term memory. He states that “[i]nfectious states can be fixed in place by protein synthesis. This obviously has important implications for the longevity of individual memes and hence for the ability of memes to create lineages” (2002, p. 205). Here the fixation of infectious states refers to storing the short-term information in long-term storages. It seems quite obvious that the working memory plays a crucial role in memetic evolution.

Having a role between perception and action and long-term memory processes indicates that working memory play a role in replication of information from one cognition to another. “The possession of a working memory system … allows the organism to reflect and to choose its actions, rather than simply react automatically to the information available” (A. Baddeley, 1998, p. 167). This indicates a selection mechanism in action planning. And the attentional system of working memory indicates selection in perception, and hence information is selected in the working memory system. The limited capacity of working memory indicates also the variation of information in a very short time period. Very basically, working memory induces replication, variation and differential fitness. But, it is important to note that these are not ultimate mechanisms of cultural replication. Replication, variation and selection mechanisms are broader than this scope of working memory.

Mechanisms which are comprised under the name of working memory have key role, regarding selectional mechanisms.

As I considered before, the units are not only located in the human brain and body but also in the environment, the location of cognitive processes and also of culture. In this sense, If working memory mechanisms play a central role, then these mechanisms must include distributed information processing mechanism of human cognition. Then, with the extended cognition hypotheses, we also extend the memory location which carries cultural design. That design is the design that accumulates in cultural environment.

4.3 An Attempt to Build a Lineage

Boyer (1999) answers the question of how we can study this evolutionary process from a cognitivist perspective by indicating that

> [h]uman cognition comprises a series of specialized capacities. Transmission patterns probably vary as a function of which domain-specific conceptual predispositions are activated. So there may be no overall process of cultural transmission, but a series of domain-specific *cognitive tracks* of transmission. Models of cultural evolution are tautological if they state only that whatever got transmitted must have been better than what did not ... This is where cognitive models are indispensable. Experimental study of cognitive predispositions provides independent evidence for the underlying mechanisms of cultural evolution. (Boyer, 1999, p. 211)

In order to observe how cultural transmission occurs I have designed an empirical study in the scope of this thesis. I investigate the role of imitation and working memory in cultural transmission. In the literature there is no much experimental studies on human cultural transmission and evolution regarding memetic theories due to the problems of memetics presented in the section 2.2 . Recently, Caldwell and Millen (2008) shows that "it is possible to demonstrate [cumulative cultural evolution] under laboratory conditions by simulating generational succession through the repeated removal and replacement of human participants within experimental groups" (p.165). They creates "microsocieties" in which participants are instructed to complete some simple tasks like building a spaghetti tower or

paper aeroplane. They measures their success in completing tasks. They shows that an information accumulates in the microsocieties. But it is not possible to see what the information units of cultural accumulation process are, and how they replicated in what environmental pressures in the microsocieties' culture.

In order to focus on functional units in cultural evolution, a chain of imitation is designed and results are discussed under the light of the extended functionalist approach .

4.3.1 Stimuli and Sample

In this study there are different sequences of 4 distinct movements. Movement are as follows: (1) turning around 360º first to the right and than to the left. While turning right, right hand is in front of the body at the level of chest, and left hand is in the back of the body in the level of waist. And in turning left all the details are symmetric to the detail of the turning-right movement. (2) Lifting right hands and the legs up and turning right 90º, and symmetric movement to the left. (3) Touching to left elbow with right hand and its symmetric movement. (4) Bending front and shaking shoulders (see the images in Figure 8).

The movements which are taken from an African dance were designed to have no apparent meaning in order to let the subject have an unbiased perception of these movements. So that *variation* of the representation of the movements would be possible.

Movements are distinct rather than continuous and merged for the reason that we should be able to identify the units as they occur and see easily how mergings and splittings of the movements might occur. And this would also let us see if the subject would really represent and perform some distinct movements which are candidate to be units of transmission.

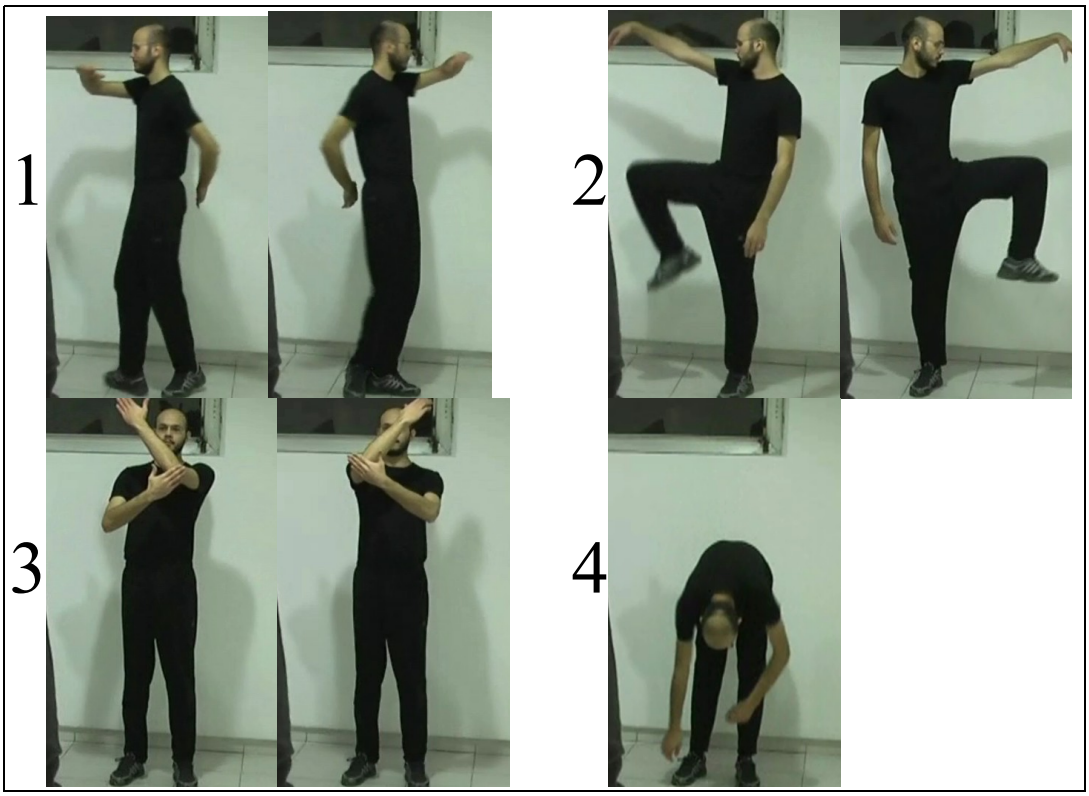

Figure 8: Movement sequence of the first chain.

Sample was university students between the age of 17 to 23 and they are the members of the theater group. So they share a common background, viz., they share relatively more behavioral inclinations than other students. The common background that the subjects share was expected to show us the *selectional pressures* of the cultural environment and how evolution of the movements occurs in relation to the broad cultural context. Furthermore it was expected to show us whether the evolutionary pressures in cultural evolution can be better understood by focusing on inter-individual cultural environment.

4.3.2 Procedure

In order to build a lineage of the movements, I designed chains of imitations of a sequence of movements. At the beginning, a model shows a certain sequence of movements and a subject standing in front of the model is requested to watch movements carefully so that she can perform these movements afterwards. After the

model completes his performance and leaves the room, the subject herself who observed the model becomes the model for another subject who observes her. The same procedure is followed until 8th person (the last person in the chain) have performed the sequence of movements.

In addition, for each subject who observes and performs the movements, there was a questionnaire to be filled after their performance was completed. In the questionnaire, they are asked (1) to name the movement sequence, (2) to enumerate the movements which they performed, (3) whether they think movements have any meaning, (4) any problems in performing the movements, and (5) whether there were any movements that they forgot performing. This answers of this questionnaire is mainly used for the goal identification of the subjects, whether they meet any difficulty in performing actions. They are also used to investigate the relation between *meanings* and *goals* and *details* of the movements and *fidelity* of the imitations.

There were two different chains of the same movements in this empirical study. Sequences of the movements is rotated in two different chains, which means that in the first chain, sequence was like in the picture above (1-2-3-4) and in the second chain sequence (2-3-4-1). The reason for this is to see whether there was any effect of certain movements on any particular transmission.

4.3.3 Analysis

During the imitation processes, all the movements are recorded in order to make a detailed analysis. Changes are investigated for each movement distinctly in a sequence (See pictures below). The main criteria of changes were *goals*, *details* and *direction* of movements which are main aspects of the movements.

Figure 9: An illustration of a lineage of a movement (Movement 3 taken from second chain).

Goals of the movement is determined regarding the end state of the movements or full dynamical action units. For example, for the second (lifting arms and legs) and third (touching elbow) movements in Figure 8 (p.48) I have considered the end states of the movements, but for the first (turning around) and the fourth (bending) movements it is better to take full dynamical action as a goal of the movement, because there is no apparent end state of movements. In determination of the goals answers of the questionnaire was helpful. Subjects enumeration of the movements and naming the movements and the meanings of movement which are given by the subjects are also considered as a source in identification of the goals of the movements. This goal identifications will be discussed in the discussion part.

In analysis of the imitation sequence, other aspects of the movements are details and directions of the movements. In the performance of the movements little changes in details of the movements are inescapable and this can be main source of mutations and variations in the movements. There may be a relation between detail changes in movements and the goal changes. For example, in the Figure 9 above, there are little changes in imitations of the movement, but second and third subjects grasp the elbow and pull it. That little changes causes the goal changes of the movements.

After the fourth subject little more change also occur and it begins to be some what different movement.

Relationship between directions and the other aspects of the movements is one another point which is investigated in this study. For each of the movements, there is a direction of the movement and there was no problem in identification of the errors in directions of the movements.

4.3.4 Results

First I should say that this study is an attempt to realize the concepts which I have discussed in the previous sections. And see how a cultural transmission process occurs and how a cultural replicator unit replicates itself. Thus, due to the design of experiment, results which I want to emphasize are mostly explorative rather than descriptive.

We take each movement as a unit of transmission. In the replication process of the units, as mentioned in the analysis part, there was three aspects of the movements: goal, detail and directions of the movements. In order to analyze how each perspective effects the transmission replication process, a table created and changes of goals details and directions and probable conceptual changes are also presented in that table (see Appendix). You can see the number of changes in each movement:

Table 1: Changes in goals, details and directions of the movements.

Movement	Gaol	Detail	Direction
1 in 1st chain	1	4	4
1 in 2nd chain	2	4	3
2 in 1st chain	0	4	1
2 in 2nd chain	1	4	0
3 in 1st chain	3	5	2
3 in 2nd chain	1	3	4
4 in 1st chain	0	4	0
4 in 2nd chain	2	2	2

Each subject is compared with model and movements are analyzed whether there is any chance and if there were a change in three aspects of the movements (goal, detail, direction), then changes are marked in table with reasons why. For example, consider the movement 3 of the second chain. Details are changed in second, third and fourth subjects and a goal change identified in subject 4. And it was also a conceptual change in the movement mark with "*". Because, in the questionnaire she named movement "a training movement with arm" she did not grasp her elbow and thus she changed the end state of the movement. And gave a different meaning to the movement.

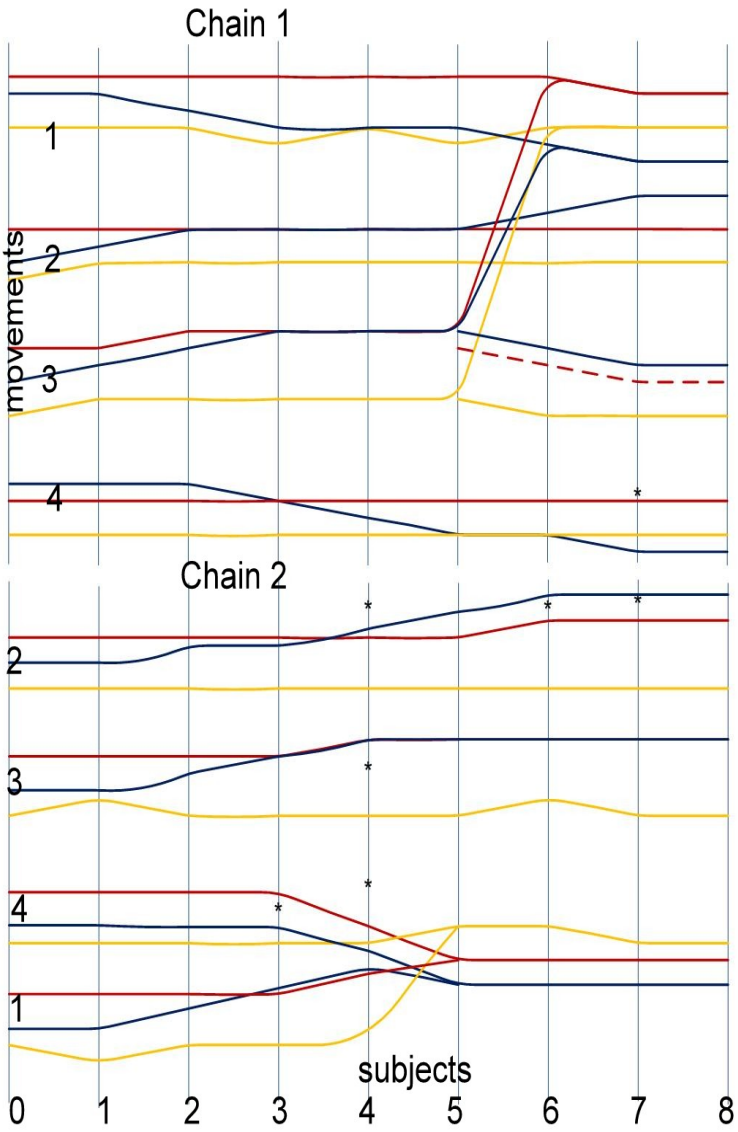

Figure 10: Evolutionary change of the movements in the sequences. First chain is at the top and the second is at the bottom. Lines show the lineages of the movements in three aspects: goal (red), detail (blue) and direction (yellow). Number of movements are present in vertical axis and the subjects are presented in the horizontal axis of the graph. Each subject refers to the new copy of the replicating unit.

Following the Kroeber's illustration in Figure 3 (p.14) we can draw a evolutionary graph as in the Figure 10. This graph illustrates the concepts used in evolutionary terminology. In this graph each group of the three lines (red: goal, blue: detail and yellow: direction) represents a unit of replication in this imitation chain lineage.

4.3.5 Discussions

Although the changes in details and directions of movements are observable the changes in goals are ambiguous in many cases, because the goal is a controversial phenomenon if there is no predefined goal oriented movements as in the studies of (Wohlschlager et al., 2003). They clearly defines the goals and the details of the movements in order to show the distinction between goal and the literal movements which are used to achieve the goals of the movements or the imitations. In the present study, the goal changes are identified according to the results obtained from answers to the questionnaire, especially from the subjects' enumerating the movements in the sequence. For in general, their naming the movements was mostly related with the end states of the movements. This indicates that when the observers observe movements what they have in their mental processes is the end states of the movements which, in most cases, refer to the goals of the movements. According to Prinz' common codding mechanism, common codes of event and action codes are created. This creation is determined by perceptive limitations of observers. These restrictions are due to the limitations in the capacity of the working memory and attentional system as mentioned before.

One restriction perspective is related with perceptive perspective of human cognitive mechanisms. Another is related with action perspective. In the case of taking action related with the common coding representations, literal movements differ due to the physical body restrictions in the sense that every subject in the experiment has habitual restrictions in representing a new goal, especially in the scope of this study subject does not have any chance to correct their movements for matching proprioceptive and the visual perceptions of movements, regarding the AIM theory of Meltzoff and Moore (1997).

Furthermore in the light of the discussions about functionalism in the previous sections, the common codes in the cognitive processes have a certain functional role in individuals' cognition but if they are selected in the cognitive environment they also must have certain functional roles in broader context of cultural environment.

This broadness includes both spatial and temporal extension of the boundaries of cognitive activities, which I discussed in the previous sections (see also Figure 11). For example, the lineages formed by the replicators in the empirical study that I conducted, replicators are mostly evolved into meaningful movements (touching the elbow – the second movement of the second chain, evolved to an exercise movement in the theater group; lifting arms and legs – the first movement of the second chain, evolved to an "Egyptian" movement; bending movement to dancing movement of the third movement of the second chain etc.). This indicates an evolutionary pressure on the replicators – the functional chains of states in the individual cognition from a narrow perspective. The first forms of the movements couldn't survive, however their variations are survived because of their functional role in the cognitions in which they are located. But if this empirical study would done in a community, we would be able to see how the cultural environment would effect the selection of the replicators. In Figure 11 we can see an illustration of what is replicated in the cultural environment from two perspectives. From individual's perspective, images, goals of the movements or, as mentioned before, whole dynamical movement in some cases, are copied. But also we mentioned functional roles in an individual cognition as it they are replicators. And their identification is depended on the context. From other perspective of cultural processes, context changes and what is selected as an intrinsic relationship with the concept of meaningfulness (remember the head movement example in Section 3.3 - Functionalism Extended in Cultural Cognition).

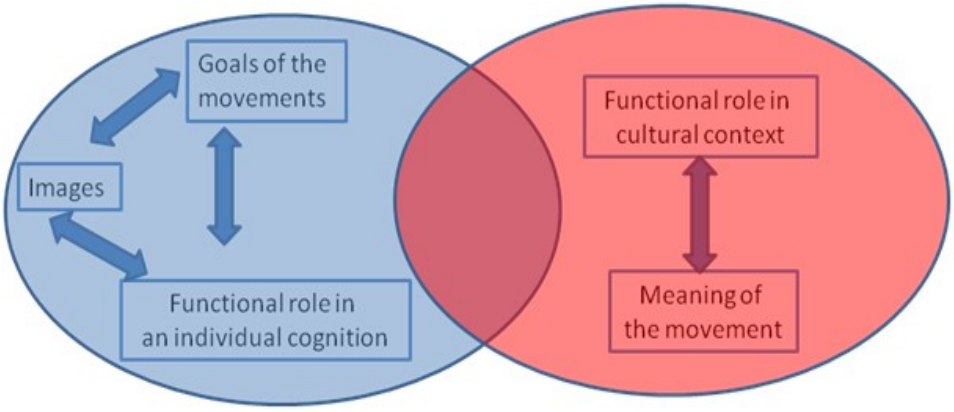

Figure 11: Relationship between goals, images, meanings and functional roles both in an individual cognition and cultural context. Blue area represents individual cognition and the red area which represents the intersections of all individual cognitions also represents the cultural environment.

We can identify goals/targets of the movements with the functional roles of the movements in each individual's cognitive processes if the thing which is copied in the imitation is basically goals/targets of the movements. As we can see, even if goals are copied in a high fidelity, it is not always possible to achieve that goal precisely, which means that there are bodily differences. When we consider all of these perceptual and motor restrictions of our cognitive system how is it still possible to have some re-appearing units in the environment?

This question brings us to the extended functional stance of the cultural cognition. Even though human bodies have a high plasticity capability there still are some innate structures. And the environmental conditions also have structures which have an intrinsic relationship with human bodies and just this intrinsic relationship determines some functional needs of human cognition. I should emphasize the role of the physical environment which is shared by all human cognitions in the same cultural environment. This intrinsic relationship mention here is the main source of functional commonalities in human cognition. Variation occurs, in this sense, in the scope of functional needs. If the varying functional units, such as behaviors in this empirical study, have function in human cognition, then it is selected. But if it does not have any function, there is no reason for its selection. But this does not automatically mean that it will be eliminated in the cultural environment.

CHAPTER 5

CONCLUSION

Following Mary Midley's criticism about atomizing culture, cultural units may not be taken as ontological categories; rather they may be taken as methodological categorization of physical reality. Relatively simple discrete “units”, i.e. patterns, are projections from “continuously complex” systems. In order to make it clear, let's consider the following case: we show a picture to someone or have her listen to a tune, and then ask her to sing, write, draw or play and –if possible– “imitate” what she has seen or heard. In that case, what she perceives from the picture or tune can be called the pattern acquired; then following (but of course, in many cases, there is no well-defined boundaries between perception and action) behavioral expressions of the tune can be called patterns generated. According to the context in which these perceptions and generated activities are made, patterns perceived as well as the productions would obviously vary. But can something be said about the commonalities of patterns perceived (or perceptions of the patterns) from the same visual or auditory senses? It is quite hard to find commonalities (the attributes which make patterns similar or same in mental imagery) in perception of rather more abstract concepts or thoughts like “understandings” (patterns acquired) from reading a book whose discourse “indicates” functionalist ideas or from looking at a painting in which surrealist ideas are “expressed”. But for more basic concrete behaviors or artifacts of ideas, it is easier to talk about commonalities. But it seems worth mentioning that if we remember or do something we also have an image of it and that image is quite distinct, which makes it memorable. Furthermore it can be claimed that the image has a function/meaning in our conscious activities. For many cognitive activities (remember the direct link between perception and action and their intrinsic relation with the phenomena which we call cognitive), even if we

don't have an explicit meaning or function about that activity, we can inescapably attribute a function or meaning to that activity. This attribution of function comes with the causal links of the images in our mental activity. What are the things that we call images in this context, then?

I suggest to call these images mental states of our mental activities and these mental images can be replicated. But it is important to note that they are defined with their context in which they are realized and identified. Furthermore images are not determined only in our neuronal-nodes or only embodied in our whole body limited to our skin, but they are also *extended outside our bodies*. This last point of extending images to shared external media makes it inescapable for us to have similar, but also, to some extent, the same chains of mental images in distinct individual cognitions. In this sense, there is also one more intrinsic relationship between images and the context in which images are defined.

In the cultural environment, expressions of patterns are very important for their replication but being highly bounded with the shared environment makes some images to be easily replicated because this replication process in cognition is somewhat extended to our environment, namely the material world. But, if these patterns are able to be re-expressed –replicated– in other individual cognitions, then they are interesting to the memeticist. Since, only if they are replicated, then they can form an evolutionary lineage, and then cultural change can be identified as a Darwinian evolutionary change.

In the replication issue, one important question is as to how we perceive two different patterns as the same meme. For example, two different forms of a tune, namely a tune played by the piano and flute, are perceived as the same meme. The probable answer to this question is, as Dennett (1995, p. 354) pointed out, that memes are not syntactically but semantically classified, in the sense that they are media-neutral and language-neutral. In this sense, saying that memes are media-neutral does not mean that they cannot be studied cognitively, but the problem is in

their classification. This thesis proposes that they can be classified according to their functional role in that specific context and this may be called a kind of semantic classification. But everything happens on the physical level. In this sense, showing the relationship between functional classification and physical correlates of the classification is one thing which functionalism stays away.

In the example (two forms of the same tune) above, the meme is created in the composer's cognition and copied to another person's cognition. But how could that tune appear in the composer's cognition in the first place? It seems reasonable to say that there was no such thing as appearing in the first place or the first time, rather it must be thought as part of a causal chain of images, whether it is consciously done or not. But probably there were images in the composer's cognition which lead the composer to make him compose it in that way. The thing which gets copied is related with the context in which it is copied. It is copied, because in that particular context that functional cognitive state has a function in that cognition and a similar or the same function is also realized in the other cognition in which the replica is located.

Concepts which are used in this thesis can be summarized as in Figure 12 below. Each individual has identifiable cognitive processes which are basics of culture. In the illustration, processes in the intersections can be named cultural processes which are collectively shaped by each individual. Processes outside of individual cognition are cultural environment of the individual cognition and that individual cognition in some cases interacts with those environments, or in some cases that environment can be a part of the individual cognition. The boundaries and physical medium of individual cognition is defined by extended cognition and functionalism hypotheses. As for the cultural selection, cultural selection does not occur only in the boundaries of an individual cognition or only in cultural processes, but within the boundaries of both. Units of selection are determined according to functional roles of the processes both in the individual and cultural processes. And this functional determination needs a historical perspective in order to follow the lineages of

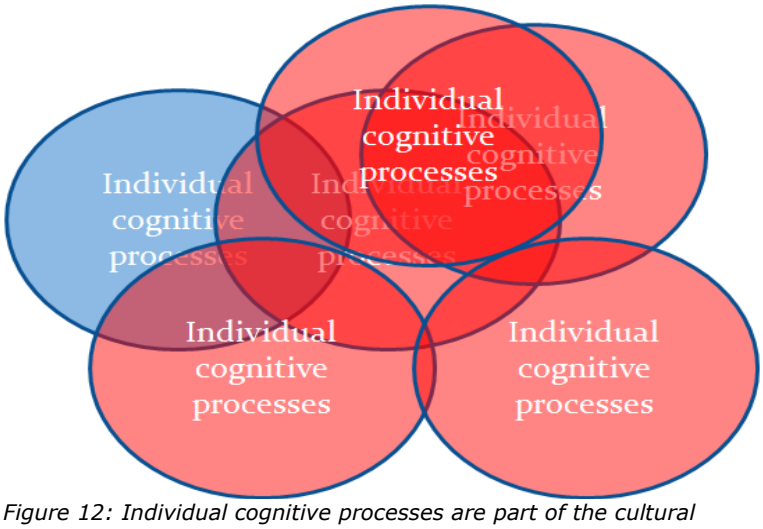

Figure 12: Individual cognitive processes are part of the cultural environment. And at the same time, the spatio-temporal continuum in which individual cognitive processes intersects is called cultural processes. Blue area represents individual cognition and the red area which represents the intersections of all individual cognitions also represents the cultural environment.

cultural replication. Spatially broadness and flexibility perspective of functional units is another necessary perspective in determination of the lineages in cultural evolution.

In this thesis, I proposed an extended functionalist approach to Darwinian cultural evolution which is a cognitive phenomenon. I first discussed where the culture must be placed in both ontogenetic and phylogenetic developmental processes. In these developmental processes, information and design accumulate. I argued that apart from the biological information accumulation in phylogenetic development, information also accumulates in ontogenetic development of all individuals. This second information accumulation is a key for understanding the difference between cultural and biological evolutions.

Next, I discussed how the cultural phenomenon should be placed into the causal relations of the material world and study it scientifically. I followed and discussed the views that cultural processes are also cognitive processes and they can be better understood by studying cognitions in the cultural context and this also implies that cognitive phenomena are also cultural phenomena and they can best be understood

by studying them in culture.

In the second part of my thesis, I presented Memetics –the Darwinian approach to cultural evolution (section 2.1) and then presented its main critics (section 2.2). Then I discussed a physicalist account of memetics and took as a kind of basis for my arguments (section 2.3). That physicalist view has functionalist notions, but it was not utterly expressed because of the mistakenly having a single substance account. But, I argued, cultural phenomena and thus replication cannot be "stuck" into single substance, as proposed, like neurons but it must be located physical world but their identification must be done by an abstraction from the physical reality.

In the next part functionalism is presented and discussed (chapter 3). First I discussed why functionalism is a good view on evolution but specifically on cultural evolution (section 3.1).Importance of context-dependence of functionalism and allowing it to situate the cognitive processes into the environment is stressed in this section. Then I presented how cognition extends, and argued that extended cognitivist perspective is necessary for a comprehensive cultural evolutionary account (section 3.2). Finally, I attempted to show how extended functionalism can be applied to cultural evolution and what might be the units of cultural evolution.

Functionalism part is followed by a part in which an empirical study is presented (chapter 4). In that study the arguments which I proposed in this thesis are explored whether or not they are applicable. And the empirical study itself is a proposal as to how cultural evolution might be studied experimentally.

Finally, this thesis concludes that units of cultural evolution are functional abstraction of physical reality and are realized within the boundaries of our cognitive processes which are defined by the extended functionalist approach.

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APPENDICIES

APPENDIX A: Data Analysis

Table 2: Table indicates the changes in each movement. "*"refers to conceptual change, "subs" indicates substitution of the movement and "om&add" indicates that an ommision and addiditon of the movements.

	First chain					Second Chain				
	1st	2nd	3rd	4th		1st	1 st 2nd	2nd 3rd	3rd	4th
					end					
	1	1	1	1	state	1		1	1	1
Subj. 1	1	1	1	1	detail	1		0	0	1
	1	0	1	0	direction	1		0	0	1
	1	1	1	1		1		1	0	1
Subj. 2	0	0	1	0		0		0	0	1
	1	0	1	0		1		1	1	1
	1	1	1*	1		1		1	1	1
Subj. 3	1	0	1	0		0		1	0	0
	1	1	1	1		0		1	1	1
		subs+								
	1*	0*	0*	0						
	0	0	0	0		1		1	1	1
Subj. 4	1	1	1	0		1		1	1	0
			subs	om&ad		0		1	1	1
	1	1	0*			1		1	1	1
	0	1	0			1		1	1	0
Subj. 5	1	1	0			0		1	1	1
	subs+									
	0*	1	1			0	1	1		1
	0	1	0			0	0	0		1
Subj. 6	1	0	1			0	0	1		1
	subs+									
	1*	1	1			1	1	1		1*
	1	1	1			0	0	1		0
Subj. 7	0	0	0			1	1	1		1
	subs									
	1	1	1			1	1	1		1
	1	1	1			1	1	0		1
Subj. 8	1	1	1			1	1	1		1

APPENDIX B: Video Records

Video records are attached in the CD.