MEMETICS: ON A CONCEPTUAL FRAMEWORK FOR CULTURAL EVOLUTION

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INTRODUCTION

The aim of this paper is to present a conceptual framework for the selective memetic evolution of strategies belonging to large organizations. The framework was designed as a basis for further research on policy formation processes. This research hopes to enhance our understanding of such processes, ultimately in order to design more efficient policy processes. This framework draws on analogies between memetic and genetic evolutionary processes, put forward by Dawkins (1974; 1989) and developed by David Hull (1980; 1988a, b).

The first and major part of this essay is devoted to the introduction and analysis of the analogy between memes and genes, with an emphasis on the selective context in which the evolution takes place. The second part is a preliminary view on how memetic concepts can be used to analyze the selective evolution of strategies.

OUTLINE

In 1976 Richard Dawkins launched the concept 'meme' in 'The Selfish Gene'. This concept features in a view on social evolution, directly analogous to genetic evolution. In biological evolution, genes are replicators floating around in a genepool. In the same way memes can be seen as replicators in 'memetic' human evolution, floating around in a memepool (chapter 11). Dawkins gives examples of memes such as 'catch-phrases, tunes, ideas, clothes, fashions, and ways of makings pots or of building arches'. In 'viruses of the mind' (1993a) he stated another example:

Less portentously, and again especially prominent in children, the 'craze' is a striking example of behavior that owes more to epidemiology than to rational choice. Yo-yos, hula hoops and pogo sticks, with their associated behavioral fixed actions, sweep through schools, and more sporadically leap from school to school, in patterns that differ from a measles epidemic in no serious particular. Ten years ago, you could have traveled thousands of miles through the United States and never seen a baseball cap turned back to front. Today, the reverse baseball cap is ubiquitous. I do not know what the pattern of geographical spread of the reverse baseball cap precisely was, but epidemiology is certainly among the professions primarily qualified to study it.

The appealing thing about this view of memes, the study of which I shall call memetics, is that it can describe the spread of such cultural units such as ideas, fashions, etc., in a society, group of people etc. The society then somehow refers to a memepool, and the ideas, fashions etc. to memes. Since the spread of fashions, songs, ideas and opinions is so recognizable in many aspects of everyday life, I find it relevant to achieve a systematic scientific view that can address these phenomena. Furthermore, because there are several other scientific approaches that address the spread of ideas, opinions and fashions in science, policy processes and the media this endeavour has theoretical potential. To begin with I shall sketch the basics of the analogy between memetics and genetics. However, because of the difference of context of the particular processes and

mechanisms of genetic and memetic evolution, there are also many disanalogies. Some of these I shall go into.

THE MEME-GENE ANALOGY AND THE SELECTIVE CONTEXT

Dawkins' meme-gene analogy (1976; 1989, 1993a) uses replicators, replication, and a replicator pool as cornerstones. Gene- and memepool being examples of replicator pools, and genes and memes being replicators. What is to be explained in the analogy is why and/or how (by what mechanisms or processes) certain replicators spread better through a pool than others, and thus change the (content of a) pool. Replicators and pools are almost always situated in a biological selective context. When questions as posed above are phrased in biology, like why does a specific gene spread through a population, most questions are explained with the use of the evolutionary concepts of variation, selection and reproduction (or replication, which is replication of genes connected to the event where an organism produces new organisms). The selective context assumes that central entities in evolutionary biology, genes, organisms and species, are, each at their own level, in a constant competition for survival. A short observation that is characteristic of how the spread of genes through a genepool is generally explained can show this. In biology the genepool 'belongs to' a species (or lineage; genealogical line of reproducing organisms). In the common view, genes that result in unfit organisms die along with the organisms they are in, resulting in the spread of fitter genes through the genepool (by reproduction). Note that this logic will only work if there are unfit organisms, else all variation will stay in existence. This means that there must be a selection pressure in view of which organisms are fit or unfit. It also means that there must be variation in genes to select upon, and therefore a process that produces this variation. The explanation thus uses the concepts of natural selection: variation, reproduction and selection (or in more general terms, replication, interaction and lineage, see endnote 1). Because an analogy is assumed between memetic selective evolution and genetic selective evolution, the for genetic evolution necessary assumption of survival context is also applicable tomemetic selective evolution.

REPLICATORS AND REPLICATION IN A SELECTIVE CONTEXT.

A central concept to the meme-gene analogy is replication. A replicator is firstly defined as a unit that has largely the same structure before and after a copying or replication process. Some errors may be made in the process, but too many errors are not allowed for a copying process to count as a replication process. The second essential characteristic is that it is part of a lineage. Genes are called replicators because they are copied over and over. Over and over means that a replicator is first copied from a mould, then in a next replication event it is used as a mould itself, from which a new copy is produced, that again will function as a mould in the next event, and so on. This happens in replication processes like cell division (mitosis and meiosis) or in other processes like virus replication. The mould-copy-mould/copy connection is an historical physical connection. The historical sequence mould-copy/mould-copy is called a (genealogical) lineage.

Analogous to gene replication, cultural traits are for instance copied over and over again from human to human (Boyd and Richerson, 1989). In the social context memes (as replicators) form lineages, for example particular central theories (like the Darwinian theory of evolution by natural selection, or Newton's laws [Dennet, 1991, p 201]) are

passed on from human to human, and from generation to generation. As mentioned, replication in biology is attached to the central selective concept of variation (since variation[2] results from the many replications of genes). David Hull (1980; 1982; 1988a, b) has described evolution by natural selection by means of concepts that are designed to describe evolution by selection in general, and which coincide with Dawkins' concept replicator. Therefore, I find it useful to use his concepts to examine the meme-gene analogy. Hull's critical concepts are replicators, interactors, and lineages. This leaves me to elaborate on the concept interactor.

Hull's actual definitions of the concepts are appended in an endnote[I]. A gene or replicator lineage, which changes or variates because of replication errors, might be a single lineage, or a spliced one. It would be a single lineage if every mould is only copied to one copy. For instance if an organism only reproduces itself ones (asexually), transmitting only one copy of its genes to a new organism, and this organism does the same, we have a single lineage. We can picture this situation as mould-copy/mould-copy or m-c/m-c. However, one mould can also serve for the production of several copies. For instance in the case where organisms (asexually) produce a large progeny. If these several copies differ, the different moulds will be the beginning of a 'spliced' lineage, which has several replicator 'lines'. This spliced lineage now contains variation, within one generation, since the different lines have become different by copying errors. We can picture this situation as

m-c1/m-c/m-c -c2/m-c/m-c -c3/m-c/m-c -c4/m-c/m-c

where there is only one generation that has a large progeny. In a selective context, the organisms represented by the lines (one to four) can compete or interact in some competitive way, resulting in what Hull would call (natural) selection. To describe (natural) selection we not only need replicators and lineages, but in addition, but also interactors. Interactors are wholes, like spermcells, organisms, species, or genes, that interact in a selective context (Brandon, 1988; Hull, 1988a). Note that the most obvious replicators in biology, physical genes[3], are not directly subject to selective forces. Selection takes place on characteristics (the phenotype) of interactors. There can be many steps or processes between a replicator and the characteristics of interactors (organisms, species, spermcells, etc.). Genes are messages, symbols or commands that contain information that prescribes the building of interactors including their behaviour, and other characteristics upon which selection can take place. In the biological literature on replication, organisms as the most obvious examples of interactors, are sometimes also called the vehicles of genes. Authors that do not emphasize the many steps between the genotype and the phenotype incline to see organisms as vehicles steered by genes, where those that do are find the concept interactor more apt (Hull, 1988b).

A similar selective context is often presupposed in memetic evolution. Like genes, memes form lineages, and these memetic replicators can interact in a selective context. For example, in science, a theory can be seen as a meme (Hull, 1988a). Theories can compete for the description of phenomena. In policy making, particular instruments, such as license systems, that were previously used in one policy field are copied to other policy fields. If a choice has to be made between instruments, or between amounts of

money used for different instruments, we have a selective situation. Thus in both science and policy there is a selective context.

We can minimally distinguish between two approaches to such selective situations that differ in what is selected for. Dawkins (1989) and Dennet (1991) emphasize 'braintime', or 'entry in as many minds as possible' as the major selective factor, where Hull emphasizes selection for cases where memes compete for being 'true', or 'useful'. There is considerable difference between the two approaches, because memes that are untrue, might still be very successful in entering many minds. Take for instance the idea of Lamarckian evolution, that is often replicated in scientific publications for the sole purpose to show that it is wrong (Dawkins, 1982; Dennet, 1991; Hull, 1982). Above I have characterized A) the concept replicator, B) that replicators (by definition) form lineages C) that replicators can interact in selective events, in which case they, or their vehicles, can be called interactors.

MEMEPOOL VERSUS GENEPOOL.

In analogy with genes, memes are presented as floating in a memepool (Dawkins, 1989 page 192-194). However, it is often unclear what a memepool is exactly, if it has boundaries, and in what respect memes disseminating through a memepool are and are not analogous to genes disseminating through a genepool. To achieve insight into what a memepool is I shall firstly investigate what a genepool is, and then elaborate on a possible analogy. While doing so I will also elaborate on some analogies and disanalogies.

Genepool versus population, or replicator pool versus unit-pool

First of all, in my view the genepool[4] is a statistical description in terms of relative gene-frequencies, and must be distinguished from a sexually reproducing population of organisms. Instead it is a mental construct to describe genetic changes in a population. It is a bookkeeping device in which all the genes from all the organisms considered to be in the population are accounted for. It is the boundary over which no genetic communication takes place of the actual population that forms the shores of the pool. If genes can be said to travel through anything, it is through the population, and not through the genepool. If the relative frequency from a specific gene increases, this gene can be said to spread through the population. Notice that 'spreading' means a change in relative numbers of organisms, often accounted over more generations.

In terms of general replicator concepts, a replicator pool is a content description for a unit (population of organisms in the case of genes as replicators) in which communication or transmission by replication takes place. The word replicator pool (genepool) denotes to the replicator contents of this unit (the genes in the population). From now on, I will refer to this unit as unit-pool (population). The boundary of the unit-pool determines the 'boundary' of the replicator pool (what replicators are counted in the replicator pool), this can be described as a border which replicators do not cross. The consequence is that particular replicator lineages run only within a unit-pool.

In a population of sexual reproducing organisms, replicators are part of lineages that meet each other in vehicles (organisms) in which they are replicated at the same time, by the same replicator mechanism(s). The borders of the population are determined by

the fact that replicators, which might exist within other populations are not replicated by the same replication mechanisms. Stated in terms of replication mechanisms, we can say that every replicator mechanism, and the entity it is in (the organism or vehicle), that replicates a replicator of a specific lineage, belongs to the same unit-pool (population) as every other mechanism that replicates a replicator of the same lineage. Within a population different replicator lineages can be distinguished because of splitting processes like meiosis (recombination). In successive generations, lineages that were parted before can meet again in a vehicle in which they are replicated together again. For instance in sexual reproduction, a replicator like the y-chromosome can be distinguished that is replicated as a whole to the progeny, and thus is a lineage (unbiased by recombination mechanisms). If the y-chromosome is in the same organism as an x-chromosome, it won't be with it or its descendants again in the next generation (if there are only two sex-chromosomes in one organism, and every parent donates one). In the next generation however, the y-chromosome can end up in the same organism again with one of the descendants of the x-chromosome.

In biology, it makes little difference to say at any point in time that the genepool consists of all genes, or to think about it as a group of physical bodies (the organisms) genes travel through because genes and organisms go together. Genes mostly 'travel through' the unit-pool along with the organisms they build, via sperms or eggs Dawkins (1989, page 192). In this way 'memes travelling through a memepool' becomes analogical: Dawkins sees memes disseminating through (a part of) society. His example of schools featuring the 'craze' shows this. In such examples a meme spreads through units that make up a society (schools, or better the individuals in such schools). For example the 'craze' can first appear at one school, then at another one, when individuals from different schools communicate it, and so on.

This dissemination of memes through society looks superficially analogous to genes spreading through a genepool. However, as stated above, a replicator pool is no physical entity, the unit-pool is. Dawkins (1989) doesn't make a difference between the unit-pool, and the mental construct to describe this pool (the replicator pool). He describes the genepool as something physical through which genes travel, for instance in the sentence 'Just as genes propagate themselves in the genepool by leaping from body to body via sperms or eggs, so memes propagate themselves in the memepool by leaping from brain to brain via a process... (p 192), or 'those genes that behave in such a way as to increase their numbers in future gene pool' (p196), and 'the old gene-selected evolution, by making brains, provided the soup in which the first memes arose' (p194). Assuming that Dawkins knows the difference between a unit-pool and a replicator pool, his choice of language is unfortunate, because it gives food to the thought that a genepool is something physical through which things can travel.

Virus versus organism-genes and memes

Even if we grant that Dawkins' way of using the concept genepool is just a figure of speech, there are still problems with his view. Genes in the genepool are replicators that are involved in building the vehicles (organisms) they reside in. Memes do not, they only reside in vehicles that are built by genes (humans) as well as in other vehicles (like books, etc.). As shown above, in a unit-pool, the vehicles built by the genes are the physical entities with which genes 'travel'. So genes do not travel from organism to

organism, but they are recombined from previous generations and build new organisms that make up the next generation.

Above I have carefully avoided the cases where genes do jump from organism to organism to avoid a too complicated picture. But such genes do exist, in viruses, plasmids, and other examples. In fact, if we look at the definition I have given of the boundaries of a unit-pool, viruses belong to that pool, since their replicators (constituting distinguishable lineages) meet replicators that belong to the hosts' lineages in the same cells where they are replicated by the same mechanism (however, not always simultaneously). In the analogy Dawkins sketches for memes he explicitly uses the examples of horizontal spreading genes through the population, in the form of viruses (versus the vertical traveling that characterizes genes that are involved in building the organisms). Boulding (1978) and Boyd and Richerson (1985) call this 'jumping' from entity to entity in social evolution multi-parental transmission, while Campbell (1965) refers to this as cross-lineage borrowing in social evolution. With this virus-meme analogy Dawkins also introduces the concept of a parasitical relation into the gene-meme analogy. In endnote two I shall deal further with this concept, and the way Dawkins uses it[II].

The virus analogy is probably better than the analogy with genes that build and travel with organisms through their whole life cycle. Like viruses, memes do not build organisms, or are alive in the sense that they have metabolisms, but they can evolve by natural (or intentional) selection (Hull, 1988a). This analogy of viruses disseminating in a hostpopulation and memes disseminating through society is appropriate, but the use of the word genepool for the unit-pool of the hosts is unfortunate, as also the claim that memes must be parasitical towards their hosts. In the case of the virus, according to the definition above, it can be said that they indeed belong to the host genepool, but this definition is not a common one. Probably most biologists will not view viruses spreading through a host population as genes that spread through a genepool. The mixing of two metaphors, virus/host and genes/genepool, will only be confusing, also for biologists. Memes spreading in a unit-pool are thus analogous to viruses in A) that they do not 'build' the organisms they 'travel through' and B) their horizontal spread. They are analogous to organism-genes in that they can be beneficial for the 'host' (see endnote 2). Memes differ from both virus-genes and organism-genes because A) they are replicated in brains, and not by DNA replication mechanisms, and B) they do not have to be instructional toward (a part of) the behaviour of the host. Memes are analogous to both virus-genes and organism-genes in that they are replicators that can evolve.

A definition for the memepool and its unit-pool

After the analysis of some analogies and differences between memes, genes and viruses we can return to the definition of a replicator pool, and unit-pool in memetics. According to the replicator pool characterization previously, the memepool is a content description (in terms of memes) of a unit-pool which boundaries are determined by communication or replication mechanisms in it that replicate replicators from identical lineages. A memetic unit-pool thus exists of replicator mechanisms (brains, or minds), that are connected by replicator-lineages. According to this definition, two minds that share a meme-lineage belong to the same unit-pool. Boundaries between memetic unit-pools occur: where humans do not communicate, where memes are transmitted, but not

replicated, because they are not understood, or ignored for other reasons. Such almost physical boundaries occur between people that speak different languages, or that use different paradigms in a scientific community.

However, if we take the criterium that all humans (being the replication mechanisms) that have ones shared, or share only one lineage must be counted as vehicles in the same unit-pool, virtually all humans belong to one big unit-pool in contemporary society. This is the case of course because of the horizontal multiple parent spreading, which characterizes a great part of memetic dissemination, as well as because there is an enormous amount of memetic information in every human. For example, if a theory is used in a scientific discipline the replication sphere for this lineage would be the minds (or parts of the brain that replicate) of scientists involved. These scientists are thus part of the unit-pool for this theory lineage.

If we imagine that the scientists work on environmental problems, like acid rain, they will probably replicate theories that belong to the same lineage, as government workers that are involved in policy planning to solve that problem. According to the characterization of a unit-pool, both scientists and government workers should thus be included in the unit-pool. Both share identical meme lineages.

According to the definition of the unit-pool different lineages that are replicated simultaneously belong to the same replicator unit, and pool. This means that all other lineages that are replicated by the scientists must also be counted as a part of the memepool (If we relax the criterium that they must be replicated at the same time). But if the scientists also share some meme lineages with philosophers, regarding methodology for instance, and with many other professional groups, not to mention with people they deal with in the personal sphere, the unit-pool will in reality virtually be unlimited, since the philosophers, etc. will in their turn share identical meme lineages with other people again, etc. While genetic unit-pools are highly constrained because interspecies breeding is impossible, and populations of the same species can be divided geographically, memetic evolution might not have such boundaries.

The memetic unit-pool as a useful concept

A less strict definition of unit-pool in memetics may be practical with regard to the criterium that replication mechanisms belong to the same unit-pool if they only share one identical meme lineage. Something similar occurs in biology where populations are distinguished that only occasionally exchange genes. In the same way, some memes might be transmitted from one unit-pool to the other as long as this is the exception rather than the rule.

Further relaxation of the definition can be made with regard to different (classes of) memes. Two groups of people might communicate frequently about the weather for instance, but never replicate each others religiousness memes. In fact, further relaxation results in the appearance of all kinds of interesting questions: In groups of people different memes present can be unequally dispersed; the unit-pool for one meme (meme A) can overlap with the unit-pool for another (meme B). A newly introduced meme (C) could be accepted in unit-pool A, but not in unit-pool B. Meme C can for example be in conflict with meme B, but not with meme A. It is possible that meme B and C describe

rival explanations, or maybe meme A must be mastered before meme C can be taken up, etc.

In this approach we can describe situations where already 'installed' memes select new memes, or create a 'niche' for new memes, yielding memetic dispersal structures in unitpools. Dennet (1991, chapter seven) for instance, has developed a view where already installed memes are necessary for the uptake of other memes. Notice that such logic can apply to memes as ideas, but also to memes as norms, or instructions how to handle particular situations. The research on dispersal structures, as well as on memetic structures within minds (what ways of thinking must be mastered to understand differential mathematics, or evolutionary theorizing for instance) is a potentially rich source for empirical research that I would call memetic. Above I have proposed definitions for memepool, and unit-pool. They are necessary concepts for a systematic comparison of the meme-gene analogy. I believe the characterization of the unit-pool, and its content of memes is analogically a good one. To address the phenomena of memetics, such as why memes spread, we need to go further. I have mentioned the selective environment as a key-ingredient for the explanation of genespread in a population, and also that memes can select memes. Below I will elaborate on what memetic selection can denote to.

SELECTIVE EVENTS AND MEMES

A third cornerstone of the meme-gene analogy next to replicators and replicator pools is (natural) selection. Dawkins tries to use this to explain the spread of memes, although he does not elaborate much on this, he confines himself to competition for 'braintime'. Hull (1988a) presents a more elaborate view on memetic selection in the scientific community. I believe that selective evolution is relevant for explaining the spread and evolution of meme lineages, memeplexes, and the like. To do this systematically we need to bear in mind the differences between genes and memes as information carriers, and the way they are processed in genetic and social contexts, distinguishing between different kinds of selection, selection pressures, and outcomes of selective events. Below I shall elaborate on three distinctions: selective and non-selective situations, intentional and natural selection, and selection that does or does not involve evolutionary learning.

Selective and non-selective environments

The first distinction is between selective and non-selective evolutionary environments. The example of religions as memetic entities by Dawkins (1989, 1993a) can show this. Religions can be seen as entities that can spread through society. A religion can be said to be a set of 'co-adapted' memes: memes that will be more successful in spreading through the soup, when copied together, than if copied alone. Two subsets of memes that are co-adapted and appear in many religions are rules that make believers A) active in ensuring that others believe too, but B) inactive in questioning those rules. In general such a combined group of memes is called a memeplex. That such memeplexes exist could be explained by saying that they copy better together, than if they would spread alone. This presupposes a situation where this memeplex (A and B) has competed with the lonely versions of the memes (A or B), and has won. Thus, a selection process is involved. The selective context here is the fact that people do not have two religions at a time, and only select one (if at all).

However, a religion could also spread and form memeplexes without competing with other religions. If we take a human's choice (intentional or not) for a particular religion to be an example of a selective event, many people have not made such a choice, because they were simply raised with one (or non) religion, and have never been seriously exposed to another one. If a religion simply spreads through society, without competing with other religions, we have a non-selective situation what the religion choice is concerned (of course in view of mind-space, the religion will have competed with other memes that are no part of a religion)[5]. In the no-choice case the religion simply spreads from human to human. A nice example for two religions that do interact in a selective way is a situation where a child has two parents of different beliefs, and can choose which religion he or she will adopt. Non-selective situations also occur in biology. A similar non-selective example is the introduction of an exotic (not native) species, like the introduction of the rabbit in Australia, which had virtually no selective pressures to deal with (occupied an empty niche), and thus could spread very fast. Most of the examples that Dawkins uses for the dissemination of memes can be called nonselective. The spread of the craze through schools has virtually nothing to do with selection of any kind. A craze just spreads, and dies out. Until a particular spread competes with another one, or does not spread to particular schools, there is no selection.

The distinction between selective and non-selective is also important in deciding whether humans are just vehicles (see Hull, 1988a) interacting under the control of memes, or if they are the agents by and in which different memes are selected. If humans execute instructions of memes, or believe the contents of a meme is true, this can be observed by the fact that they don't question the meme itself. Thus the meme is not selected by the human involved, but accepted. If such humans meet others that believe other memes to be true, and both memes can't be true simultaneously, the humans can interact 'in the name of' the memes. When the humans stick to their memes, they are the interactors, since they interact as wholes in the selective event.

If humans on the other hand reject memes, they are like an environment in which memes are selected. In this case competing memes are 'judged' within a brain by some mind process. This can happen unintentionally, when there are no rational criteria, or in a process we denote as 'rational choice', where some known criteria must be present upon which the judgment is based. In both cases the memes are the interactors, even if it is not clear whether they can be said to 'do' anything[6]. In summary memes can be said to be interactors if they are subject to a selective event inside a person. This can happen rationally, or not. If memes are not rejected by a person, they either have survived a selective event, or are under no selection pressure practiced by the human, in which case the human can become the interactor.

Intentional and natural selection

The second distinction is between intentional, artificial or conscious selection and unintentional or natural selection (Hull, 1988a). Genetic selection, without humans involved is always natural. When humans are involved selection can, but does not have to, become intentional. The distinction between intentional and unintentional not only denotes to the selection process, but also to the process in which variation is produced. Note that this distinction is about characteristics of the mechanisms involved in selective processes, thus only of relevance if there is a selective situation.

For instance in The Origin of Species, Darwin (1985) gives the example of humans trying to breed animals by selecting the best ones to breed with. Although the introduction of variation in this case is unintentional, the selection is intentionally executed by the breeder. If this breeder would introduce genetically engineered genes in the genome of the animals, the introduction of variation would also be intentional. The example of breeding is on genetic evolution. In memetic evolution the same distinctions can be made. Replicators are, in the conceptual evolution of science, descriptive (and I add also prescriptive) statements, and theories. Interaction is the testing of these replicators (Hull, 1988a). This testing, analogous to selection, is ideally an intentional affair. By critically bringing a part of the theory into contact with selective criteria a theory can be falsified. In the case of theory a criterium is that it describes or explains relevant phenomena in a scientifically appropriate manner. Other criteria are that the tests should be reproducible, that the explanations are internally not contradictory, and of course that the theory corresponds with empirical reality. However, theories can also be selected in an unintentional way. For example when simply not tested but just ignored without reason, or when not used because it is too difficult to master or understand.

Selection with or without evolutionary learning

The third distinction that I would like to emphasize is between selective events including A) trial and error learning, adaptation or in general involving a selective retention system with evolutionary feedback-loops (Vromen, 1994), and B) selective events when no such processes are involved. In genetic evolution the species is the paradigm example of a selective retention system. When Hull mentions evolution by selection such systems are usually presupposed. This kind of selective evolution, can occur if a system can retain what it found out by trial and error to work[7]. Since natural selection is commonly used for species, and learning for individuals (humans or other animals), I will use evolutionary learning as the word for processes in which trial and error learning in a broad sense takes place. In a selective retention system evolutionary learning takes place. This general class of systems has been described by Campbell (1965; 1974, see also Weick, 1969).

In a selective retention system we find the essentials of biological evolution by natural selection: the occurrence of variations, consistent selection criteria and a mechanism for the preservation of positively selected variants. In such a system: 'evolution in the direction of better fit to the selective system becomes inevitable' (Campbell 1965). In this statement the words 'better fit' are equivalent to 'adaptation'. Campbell links the concept retentionsystem to both natural selection and trial-and error learning 'that have formal parallels'. A selection system in this context is the 'problem' a system has to solve (Campbell, 1974 page 435), and is equivalent to what Brandon (1988) refers to as 'selective environment'. The concept of evolutionary learning is a more general description for the way species, or asexually reproducing lineages of organisms or viruses evolve with adaptations occurring over the generations. With the introduction of lineage in this essay, where one mould yielded four slightly different copies, I mentioned that those copies could now compete with regard to some selection pressure (problem). Such a lineage, producing variation, is the most simple example of a selective retention system capable of evolutionary learning in genetic evolution. The individual organism represented by one copy can be said to contain variation (compared to his parent, and his brothers or sisters) in solutions to problems faced in surviving and reproducing. Selective events take care of the destruction of problem-solutions that do not fit as well as others. In a species, feedback about the fit of solutions to the problems is thus given through survival and reproduction of individuals (see Hull 1980, page 287 for an illustration of the feedback loop of a species). This feedbackloop is what Vromen (1994) calls an evolutionary mechanism. In his words a mechanism is evolutionary if it works through actual, that is realized past consequences. When a selective event occurs, evolutionary learning can, but does not have to play a role. In the example of the religion involving instructions A and B, evolutionary learning could have been involved in the production of the memeplex. There could have been one religion with only instruction A. At one time instruction B could have been added, creating a replicated, but altered new 'generation'. In competition for dissemination and survival, the new generation could have won, having an adaption compared to the religion with only instruction A. In contrast to learning by individuals, or adaptations in species, it is not directly obvious what are the elements of the selective retention system in this example.

The situation involving evolutionary learning must be distinguished from a situation where two genealogically unrelated religions compete. While still one religion might win, there is not necessarily anything that adapts by selective evolution: competition does not always yield evolutionary learning. Memetic evolution involving selective events does not have to involve evolutionary learning. Therefore, the question if evolutionary learning takes place deserves explicit attention in memetic evolution. Hull, as well as Dawkins tend to focus on evolutionary learning events without explicitly mentioning it. Hull for instance (1988a, b) refers to learning processes in science, while Dawkins (1993) sketches the possibility of computer viruses becoming selective retention systems with evolutionary learning. However, memetic spread through a unit-pool does not necessarily involve evolutionary learning. Therefore, the learning part in memetic evolution deserves explicit attention.

Summarizing the role of selection in memetic evolution, I have shown that where most theories in genetic evolution presuppose species or lineages of organisms that are selective retention systems, evolutionary learning in memetic evolution is less obvious. Furthermore, memetic evolution can be studied without focusing on selection, like in the case of the craze disseminating through schools. Where selection is involved, it can be intentional or not, involving humans or memes as primary interactors.

THE MEME-GENE ANALOGY

Before applying several issues to the evolution of a strategy, a short summary. Above I have firstly introduced the meme-gene analogy from Dawkins and Hull. I have shown that memes are replicators forming lineages that can disseminate through unit-pools involving brains as the physical structures that replicate them. In doing so I have tried to show that the implicitly mixed use of metaphors from biology does not help to make memetic issues more clear. Secondly I have focused on selective processes involved in the meme-gene analogy, since this part of the analogy can be approached in different ways. Although there are probably more issues I have not examined, than the ones I have, I believe I have described some key-issues in the meme-gene analogy. With those issues clearly in mind, it will be easier to picture processes where memes disseminate, are involved in the selection of other memes, etc. Issues touched only lightly, deserving more elaboration are numerous. I would like to mention the genotype-phenotype distinction applied to memes. Memes can be instructions like genes, but do not have to

be. I do not see how songs, and replicated desires are instructions for instance. Another issue that could be elaborated upon is the selection of memes by memes, for instance when some memes must be mastered, before other memes can be used. or where 'ways of thought' and cultural habits play a role in the selection of memes. The last issue that needs some elaboration is a classification of types of memes, since meme types like songs, beliefs, ways of thought, norms and values and concepts seem to be very different things. The next step in this essay will be the description of a particular class of social or memetic evolution, being the selective evolution of a strategy held by an organization to achieve goals. In this second part I will build on the concepts examined above, adding one or two along the ride.

AN ORGANIZATIONAL STRATEGY EVOLVING.

The aim of this final part is to show that the concepts introduced can be used to describe the selective evolution of a strategy. A strategy can be seen as a memetic entity evolving by selective processes including evolutionary learning. The aim is not so much to explain the evolution, but to show how such evolution can be described by an approach that is based upon the concepts and logic introduced above. I cannot do this exhaustively, but will show that many parallels exist between evolutionary approaches involving memes, and the evolution of strategies. I am not aware of selective evolutionary approaches in policy development as a means of analysis, while such approaches are common in understanding conceptual evolution in science. This second part serves as an introduction of such an approach to policy science. The strategy I focus on is an explicitly stated strategy of an organization. Below I shall describe what I mean by such a strategy. After that I shall describe how such a strategy can be said to evolve. Finally I shall focus on different parts of a strategy, and different selective events that have a causal effect on the evolution.

The strategy of an organization

To begin with, I shall give a definition of what I refer to by strategy and stress the connection of such a strategy with an organization[8]. I define a strategy as 'a program of actions to be taken in order to achieve agreed upon goals'. The words 'agreed upon' and 'actions' are usually meant to refer to the members of the organization that holds the strategy. Thus the members of the organization that are in charge agree upon the strategy, and those members of the organization that take actions. By strategy I mean a written or otherwise explicitly stated strategy. This is not to be confused with strategies that an outside-observer might recognize in a system, or personal strategies, consciously held or not. Thus I am referring to a self-description that a particular organization has made about actions to be taken with regard to goals.

A strategy as described above is by definition an intentional plan to change things. It describes particular problems, by defining goals to be solved. But planning actions is not the same as implementing them. It is important to see that the actions planned in a strategy and the actions actually taken are not the same thing. In memetic terms the strategy is a meme-complex (in which different memetic lineages can be recognized) that (partly) instructs for actions. The meme-complex can thus be seen as analogous to genes, and the actions taken, together with a lot of other things, are analogous to the phenotype. According to the definition, a strategy must include both goals and actions to achieve those. The actions stated are connected to the goals by a body of logic, or

knowledge. This knowledge can be included in a written strategy, but often this will not be the case. However when actions are connected to goals, a body of knowledge is necessarily drawn upon. A strategy prescribes actions to achieve changes, which are believed to contribute to the achievement of goals. These goals will usually refer to states of things outside the system (like we want to be number one in our market), but can also refer to changes in the organization (we need to become more efficient). A strategy belongs to a specific organization.

The evolution of a strategy

As stated above my aim is to describe the evolution of a strategy. To do this I assume a situation where there are more 'generations' of such a strategy. If an organization makes a strategy regularly, we can call the different versions of it generations, like the generations of a species. The differences between the different generations can be seen as evolution in the weakest sense of the word, meaning nothing more than simply change in time (for different meanings of the word evolution, see Hodgson, 1993; Modelski and Poznanski, 1995). This is the first step of the approach.

The second step is to divide the changes into new variation, deletions, and substitutions. Introduction of new variation, deletions and substitutions can occur with regard to goals, actions and (parts of) the body of knowledge. Deletions can be taken to be the result of a selective event of some kind. A Substitution is at the same time a deletion and an introduction of new variation of an element of the strategy with a similar function. For example the substitution of a prescribed action that is meant to contribute to the achievement of a goal is equivalent to a selective event where the two actions are interacting in view of the criterium of which one will contribute (the most) to the achievement of the goals, given a great number of particular circumstances of different kinds. When there is a deletion, there has been a weeding out, meaning that a part of the strategy is rejected, but that there is no direct substitution.

If we include the second step of the approach we not only take evolution to refer to change, but we also look at evolution as a selective process. This selection is however only reflected in the change of the strategy, while the real selective processes are taking place in the organization. In memetic terms we can say that the strategy is a (shared) part of the memepool, held by individuals of the unit-pool, which is largely equivalent to individuals in the organization. For this analogy to work it must be added that only a part of the memepool is focused upon. This part is structured around functional aspects of (strategic) issues that are taken to be problems that need to be solved. In fact such an approach is also not uncommon in biology. There is often a strong bias for focusing on genes that spread through the unit-pool, having selective value (or are functional in surviving the selection process), or in other words, being solutions for the problems that we denote to as the selection pressures (Campbell, 1974).

The generations of strategies can be seen as single photographs taken at a different moments. In reality a continuous movie[9] is playing. The selective events, as well as the inclusion of new variation, that we can detect when comparing two generations, have taken place somewhere between the generations. Again, in comparison with biology, genefrequencies in genepools are measured at certain points in time. Step three in the approach involves the interpretation of the found changes. In case of new variation, we can firstly ask where did it come from (from outside the organization or

was it thought up in the organization), and if there was more variation abundant, which was not introduced. That would mean that there have been selective events in the acceptance of new variation, and that other variation that was detected has been rejected. The next question to ask then would be where in the organization did this selection take place, and by what criteria. In the case of deletions we can ask who has taken the decision to delete, and by what criteria. In examples of public policy, a distinction is possible between criteria concerning A) the way a problem can be solved regarding the causes of the problem (to reduce acid rain, you have to reduce the emission of substances that cause it), B) the causal relations and normative aspects of instruments you can use to solve the problem (to shoot the people that are involved in the emission is illegal, and morally unacceptable, while advising them to reduce emissions simply will not work), as well as C) criteria regarding the political situation in which decisions are taken. A good solution might be selected out because the involved politicians thought that such a decision might be bad for their career, for the electorate situation of the party, or doesn't fit into the memetic lineages the party sticks to (concerning ideology).

The evolution of a strategy is a process in which many selective events take place where different sets of criteria, or different selection pressures can be distinguished. These events cannot be seen apart from the different 'players' that are involved in different selective events. Hoppe (1993) for instance, in an essay on policy argumentation and belief systems refers to a distinction between high, middle and low games or levels of political judgement. At the highest level political party elites, think tanks, prestigious political commentators and ideologues, and some top-notch public managers debate issues on levels of rational choice and system vindication. At the middle level the legislature, the upper and middle levels of the executive branch, interest groups, lobbies, journalists and spokesmen of various social and political movements debate issues on policy design/adoption and (the initial stages of) policy implementation. At the low levels middle and lower-level members of the executive branch, with its score of professionals, technicians and experts, and courts debate issues of policy implementation and evaluation processes including technical verification. The specific levels with particular players and criteria are of no concern to this essay, but they illustrate different selective systems operating on parts of a strategy in different parts of an organization. Hoppe seems to assume that the criteria used in decision making at specific levels are separable. In other words, the levels are not only distinguishable by the identity of different players, but also by different criteria used to judge policy issues. This means that players at the lowest level do not use criteria of what Hoppe refers to as 'rational choice' to judge policy issues. However, players at the middle level may anticipate the decisions they believe will be selected out by political criteria in the political process. In this situation the evaluating actors are politicized, or infected by memes consisting political criteria. In addition, politicians can use evaluative, and instrumental criteria for the weeding out of policy issues they do not want to get accepted because this does not suit their political aspirations.

In a memetic perspective it matters which people use which criteria in selective events, because it can have effects on the evolutionary learning potential of an organization with regard to achieving its goals. For instance if new variation in solutions is weeded out by the political process, there will be less chance that new successful solutions will be encountered.

I would like to recall some memetic insights and concepts in our approach for the evolution of a strategy. First the planned actions in a strategy are instructions that can steer the organization toward reaching its goals. In this way the class of planned actions is analogous in its instructional nature to the genotype of an organism, while the class of actually executed actions is analogous to the characteristics of the phenotype (Hull, 1988a). The goals in the strategy are based upon problems to be solved, being a selective system (Campbell, 1974) for the organization. Thus a strategy is seen as instructional toward dealing with selective forces. Secondly, a strategy is followed through time as an evolving memetic entity. Without loosing sight of the causal actors that are involved in all kinds of processes that influence the evolution of the strategy, the main focus of the approach is on a strategy as an entity of its own. This entity reflects agreed upon or social knowledge about what problems are, what actions should be taken, and the causal connections between those two. A third point is that the different parts of a strategy can change (more or less) independently in time, involving new variation, and deletions by selective events. When new variation appears we can ask where the new memes came from, why they, and not others, were selected, why they were not selected before if they were already present for a longer time, etc. When deletions occur we can ask where and by whom they were weeded out, and by what criteria. These questions about variation and selection of parts of the strategy are connected to memetic questions in two ways. First there are questions about the particular routes memes have taken through a unit-pool, or from unit-pool to unit-pool. Secondly there are questions about what selection criteria have been used, and by whom. The last memetic focus is about evolutionary learning occurring between generations of the strategy. As mentioned before, selective events as such do not guarantee that there is any kind of evolutionary learning. In a strategy that has relatively stable goals (compared to the speed with which new knowledge can be acquired) a kind of evolutionary learning can take place. Any problem which a strategy aims to solve, has causal relations that determine what things must be changed to solve it (the emission of acid substances must be changed to solve the acid rain problem). In the case of acid rain, a considerable amount of scientific research has been done to be able to establish which causal relations can, and which can't be influenced. This research can be said to contain a large amount of trial and error learning, in the quality of scientific experiments. This acquired knowledge is used by the makers of acid rain policy to determine and explain what approaches are and are not viable. This example shows that over time, knowledge about the problem can accumulate, and be shared by memetic transmission. In the same way knowledge accumulates about what policy instruments are useful in what conditions. Here policymakers in environmental policy can learn from the trials with those instruments in other policy fields. In this sense we can say that the body of knowledge that connects the actions with the goals in a strategy can evolve by selective evolution, including evolutionary learning transmitted by memetic processes. However other selective events can actually counteract evolutionary learning. For instance the weeding out of possible variation in the political process can counteract evolutionary learning towards the goals in strategy.

CONCLUSION

In this essay I have tried to analyze the basics of the meme-gene analogy and to use the insights gained to describe the selective evolution of a strategy as a memetic entity. In

addition I have shown that different sets of selective criteria may influence the evolutionary learning potential of an organization. Furthermore, the memetic selective analysis yields novel insights into the policy process and places Hoppes' differential selective context and processes in an evolutionary framework. Further research will have to show whether this approach can be helpful in designing effective policies and more efficient processes.

FOOTNOTES

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- [2] In fact this is just one of the ways variation in physical genes can arise. Other processes involved are re-combination of already existing variation by means of sexual reproduction for instance, or mutations in the mould resulting from mutagens, uv-radiation, etc., etc.
- [3] If I use the word physical gene, I am referring to a chunk DNA that codes for a protein, not to a gene as defined by Williams (1966). He, as well as Dawkins, defines genes as the entities that have effect in the selection process: a gene is 'any hereditary information for which there is a favorable or unfavorable selection bias equal to several or many times its rate of endogenous change'.
- [4] According to the Concise Oxford dictionary of Ecology (Allaby, 1994) gene pool is: "The total number of genes or the amount of genetic information possessed by all the reproductive members of a population of sexually reproducing organisms'.
- [5] In describing non-selective situations, the concept niche is useful. A biological niche is characterized by a relative lack of selective pressure for a specific species. Similarly a religion that has no opponents has discovered an empty niche.
- [6] This is a weakness of the words replicator and interactor. These words seem to refer to active entities, thus to matter, and not to symbols (Pattee, 1974). However, in a selective event or in a case of interaction, it can be far from clear whether interactors actually do anything. In the same way replicators like viruses do very little. Their DNA or RNA is replicated and translated by the cell-machinery of the hostcells. In fact we can ask if DNA in general does anything. To do anything DNA needs enzymes, that actually do things. The fact that DNA codes for these enzymes does not change this. If we separate DNA from these enzymes, nothing will happen. In the same way, if we write a book and nobody reads it, nothing happens.
- [7] In most cases evolution in biology means evolution by natural selection, involving a kind of learning-process. For example May (1978) begins an essay on the evolution of ecological systems with the phrase: 'Strictly speaking, ecological systems as such do not evolve. As has been stressed repeatedly in this issue, natural selection acts almost invariably on individuals or on groups of related individuals. Populations, much less communities of interacting populations, cannot be regarded as units subject to Darwinian evolution. Therefore in a sense constellations of species can be viewed as evolving together within a conventional Darwinian framework.' It is clear that May takes 'evolution' to mean evolution by natural selection, and this is probably common for most biologists. This evolution acts on interactors, producing adaptations in the species; only the species evolves in this sense, being the selective retention system.
- [8] An example of a strategy with a body of knowledge. The approach I have developed was with a real life situation in mind. The strategy concerning environmental policy on a national level in the Netherlands has been published under the name National Environmental Policy Plan (NEPP) by the Ministry of Housing Planning and Environment (1989). Since this first version there have been two more generations. In the case of a ministry of Environment the goals aimed at are states outside the organization. Examples of goals mentioned in the NEPP are: to reduce the amount of NO2 emission to x kilotons in the year 1999, or to reduce the imission of Acid substances to y kilo per hectare per year, etc.
- [9] This is not entirely true, since the writing of such a strategy might coincide with a period in which the evaluation of the goals, actions and the body of knowledge is intensified.

ENDNOTES

[I] Replicators, interactors and lineages. The concept 'replicator' used by Dawkins and previously employed by Williams (1966) has been elaborated upon by David Hull (1980, 1988), Heyes and Plotkin (1989) and Brandon (1988) among others. Hull uses the concept alongside the concepts 'interactor' and 'lineage', to describe evolutionary processes involving natural selection in biology (1980); later he showed them to be a useful scheme in cultural evolution also (1982, 1988a, b). Heyes and Plotkin used the replicator-interactor-lineage scheme to criticize Boyd and Richerson (1985) on their work on cultural evolution. In the replicatorinteractor-lineage scheme the concepts are described as follows (Hull, 1980): Processes of replication and interaction result, by definition in evolution of a lineage. The structural entities that are replicated, i.e. the replicators, 'pass on their structure directly from generation to generation. In principle replicators can only replicate themselves, but they can also produce entities that interact and indirectly result in the replication of the replicators (by reproduction). These entities are known as interactors: 'entities that directly interact as a cohesive whole with their environment in such a way that replication is differential. In the paradigm example of evolution by natural selection, a sexual reproducing species, the paradigm replicators are the genes and the paradigm interactors are the organisms. Hull argues that replication or interaction alone cannot account for evolution by natural selection, but that both processes are needed. Selection then becomes defined as: 'a process in which the differential extinction and proliferation of interaction causes the differential perpetuation of the replicators that produced them'. Lineage is the third term in the Hull scheme and refers in this case to the historical changing entity called the species. Notice that Hull thus takes selection to be more than just 'weeding out'. For him selection refers to evolution by selection on replicators that form lineages.

[II] In 'The Selfish Gene' Dawkins focuses on the selfish or parasitic nature genes can have in biological evolution. Accordingly when making the analogy between genes and memes, he focuses on the parasitic features that memes can have, as an explanation for their dissemination in the memepool. He added the virus to the picture that makes the point of multi-parental dissemination, and also strengthens the word parasitic. One of the examples of this parasitical dissemination concerns religions. Dawkins takes the view that they can spread so well, because humans do not test them for the probability that they might be untrue, or detrimental for the humans holding on to it. He gives examples where religions harm the people that hold onto them. This view has led to some confusion, for instance in the case where Dennet (1991. page 204) takes beneficial parasites to exist in the form of bacteria in our digestive systems. Dennet also mentions that memes can be detrimental, but that they can also 'bear gifts that will enhance our powers'. Parasites are however detrimental by definition, in contrast to symbiotic entities that are beneficial by definition. Dennet confuses the multi-parental way of dissemination of parasites, with the detrimental effects they can have. I agree with Dennet that memes can spread because they are beneficial, and add that the focus on their possible parasitical nature, in that they are detrimental to their host, is an artefact of the virus analogy.

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