

What makes a meme successful? Selection criteria for cultural evolution

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To be published in: Proc. 15th Int. Congress on Cybernetics (Association Internat. de Cybernétique, Namur).

ABSTRACT. Meme replication is described as a 4-stage process, consisting of assimilation, retention, expression and transmission. The effect of different objective, subjective, intersubjective and meme-centered selection criteria on these different stages is discussed.

Introduction

Cultural evolution, including the evolution of knowledge, can be modelled through the same basic principles of variation and selection that underlie biological evolution (Boyd & Richerson, 1985; Cavalli-Sforza & Feldman, 1981). This implies a shift from genes as (replicating) units of biological information to a new type of (replicating) units of cultural information: *memes* (Dawkins, 1976). A meme can be defined as an information pattern, held in an individual's memory, which is capable of being copied to another individual's memory. This includes anything that can be learned or remembered: ideas, knowledge, habits, beliefs, skills, images, etc. Memetics can then be defined as the theoretical and empirical science that studies the replication, spread and evolution of memes (Moritz, 1990).

To be replicated, a meme must pass successfully through four subsequent stages: 1) assimilation by an individual, who thereby becomes a *host* of the meme; 2) retention in that individual's memory; 3) expression by the individual in language, behavior or another form that can be perceived by others; 4) transmission of the thus created message or *meme vehicle* to one or more other individuals. This last stage is followed again by stage 1, thus closing the replication loop. At each stage there is selection, meaning that some memes will be eliminated. The present paper will look in more detail at the mechanisms governing these four stages, and present a list of selection criteria that allow us to estimate the fitness of a meme relative to its competitors.

The four stages of meme replication

Assimilation

A successful meme must be able to "infect" a new host, that is, enter into its memory. Let us assume that a meme is presented to a potential new host. "Presented" means either that the individual encounters a meme vehicle, or that he or she independently discovers it, by observation of outside phenomena or by thought, i.e. recombination of existing cognitive elements. To be assimilated, the presented meme must be respectively *noticed*, *understood* and *accepted* by the host. Noticing requires that the meme vehicle be

sufficiently salient to attract the host's attention. Understanding means that the host recognizes the meme as something that can be represented in his or her cognitive system. The mind is not a blank slate on which any idea can be impressed. To be understood, a new idea or phenomenon must connect to cognitive structures that are already available to the individual. Finally, a host that has understood a new idea must also be willing to believe it or to take it serious. For example, although you are likely to understand the proposition that your car was built by little green men from Mars, you are unlikely to accept that proposition without very strong evidence. Therefore, you will in general not memorize it, and the meme will not manage to infect you.

Retention

The second stage of memetic replication is the retention of the meme in memory. By definition, memes must remain some time in memory, otherwise they cannot be called memes. The longer the meme stays, the more opportunities it will have to spread further by infecting other hosts. This is Dawkins's (1976) *longevity* characteristic for replicators.

Just like assimilation, retention is characterized by strong selection, which few memes will survive. Indeed, most of the things we hear, see or understand during the day are not stored in memory for longer than a few hours. Although you may have very clearly assimilated the news that the progressive liberal party won the Swaziland elections with 54% of the votes, you are unlikely to remember anything of this a week later--unless you live in Swaziland, perhaps. Retention will depend on how important the idea is to you, and how often it is repeated, either by recurrent perception or by internal rehearsal. All learning paradigms agree that experiences are encoded more strongly into memory by frequent reinforcement.

Expression

To be communicated to other individuals, a meme must emerge from its storage as memory pattern and enter into a physical shape that can be perceived by others. This process may be called "expression". The most obvious means of expression is speech. Other common means for meme expression are text, pictures, and behavior. Expression does not require the conscious decision of the host to communicate the meme. A meme can be expressed simply by the way somebody walks or manipulates an object, or by what he or she wears.

Some retained memes will never be expressed, for example because the host does not consider the meme interesting enough for others to know, uses it unconsciously without it showing up in his or her behavior, does not know how to express it, or wants to keep it secret. On the other hand, the host may be convinced that the meme is so important that it must be expressed again and again to everybody he or she meets.

Transmission

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

Selection at the transmission stage happens through either elimination of certain memes, when the

vehicle is destroyed or gets corrupted before it is perceived by another individual, or through differential multiplication, when the vehicle is reproduced into many copies. For example, a manuscript may be put into the shredder or it may be turned into a book which is printed in thousands of copies. A radio communication may get lost because of noise, or it may be broadcasted to millions of listeners. Especially since the emergence of mass media, the transmission stage is the one where the contrast between successful and unsuccessful memes is largest, and where selection may have the largest impact.

Meme fitness

The overall survival rate of a meme m can be expressed as the meme *fitness* $F(m)$, which measures the average number of memes at moment t divided by the average number of memes at the previous time step or "generation" $t - 1$. This fitness can be expressed in a simplified model as the product of the fitnesses or survival rates for each of the four stages, respectively assimilation A , retention R , expression E and transmission T :

$$F(m) = A(m) \cdot R(m) \cdot E(m) \cdot T(m)$$

A denotes the proportion of memes vehicles encountered (or memes independently discovered) by the host that are assimilated. R represents the proportion of these assimilated memes that are retained in memory. Therefore, $A \leq 1$, $R \leq 1$. E is the number of times a retained meme is expressed by the host. T is the number of copies of an expression that is transmitted to a potential new host. Unlike A and R , E and T do not have an upper bound, although E is likely to be more restricted than T . Note that F is zero as soon as one of its components (A , R , E , T) is zero. This expresses the fact that a meme must successfully pass through *all* four stages in order to replicate. Also note that for a meme to spread ($F > 1$), you must have $E > 1$ or $T > 1$.

General Selection Criteria for Memes

Which memes will most successfully pass all these stages can be modelled by a series of selection criteria. These criteria are discussed in more detail in earlier papers (Heylighen, 1993, 1997). I will here basically situate them with respect to the four replication stages. The criteria can be grouped into different families, distinguished by the system responsible for the selection. At present, we have no method to derive the value of the fitness components from the degree to which a meme fulfils the different criteria. This does not mean that no predictions can be made, though. All other things being equal, *a meme that scores better on one of these criteria is predicted to become more numerous* in the population than a meme that scores worse.

This is a falsifiable hypothesis, which can be tested through experiments or observations. For that, it suffices to operationalize the tested criterion. This has already been done for criteria such as invariance (Van Overwalle & Heylighen, 1995), formality (Heylighen & Dewaele, 1998) or conformity (cf. Boyd & Richerson, 1985), and seems relatively easy to do for the others as well by using standard social science methodologies, e.g. for developing test for personality traits.

Objective Criteria

Objective criteria denote selection by phenomena or objects independent of the hosts and memes involved in the process. The *distinctiveness* criterion functions mainly during the assimilation stage. It states that phenomena that are distinct, detailed or contrasted are more likely to be noticed and

understood, and therefore assimilated. The *invariance* and *controllability* criteria, on the other hand, apply mainly to the retention stage. According to the invariance criterion, phenomena that recur, independently of the way in which they are perceived, are more likely to be maintained in memory. Controllability notes that phenomena which react differentially to the subject's actions are also more likely to leave a permanent memory trace.

Subjective Criteria

Subjective criteria represent selection by the subject who assimilates the meme. The main criteria at the assimilation stage are *novelty* (facilitates assimilation by attracting the subject's attention) and *simplicity* (requires less processing for the meme to be understood). The criterion of *coherence* (connection, consistency and support between new perception and existing memory trace) facilitates the understanding and acceptance parts of the assimilation stage, since it represents the ease with which the new meme can "fit in" with the memory that is already there. It also facilitates the retention stage since memories that cohere are more easy to retrieve and use and are therefore less likely to be forgotten. The criterion of *utility*, like controllability, functions mainly at the retention stage, since useful memes are more likely to be effectively used and thus reinforced, although it will also help assimilation, by making it more worthwhile for the host to do the effort to assimilate.

Intersubjective Criteria

Intersubjective criteria represent selection through the interactions between different subjects. *Group utility* is an emergent criterion, that is implicit in all four stages: a memes that is useful to the group of all its hosts is more likely to survive because it helps the group itself to survive and grow, and thus to absorb other individuals. *Authority* functions mainly at the assimilation stage: memes from authoritative sources, i.e. hosts or vehicles that are held in high regard or considered to represent expertise in the domain, will be more easily noticed and accepted. *Formality* (i.e. precise, unambiguous expression) too helps assimilation, at least of the original memetic content of the expression. It will contribute basically to what Dawkins (1976) calls copying-fidelity. (On the other hand, informal expression, because it tends to be simpler, may facilitate assimilation, but of an idea different from the one initially expressed). *Conformity*, the reinforcement of the same meme by different hosts belonging to the same group, will boost acceptance and retention (cf. Boyd & Richerson, 1985). *Expressivity*, the ease with which the meme can be expressed in an intersubjective medium, will obviously contribute to the expression stage. *Publicity*, finally, the effort put by the host(s) into the broad distribution of the message, will maximize transmission.

Meme-centered Criteria

Finally, the meme-centered criteria represent selection on the level of the meme itself. They depend only on the internal structure of the meme, not on its "fit" to external selectors, such as subjects, objects, or groups. These criteria will typically select for "selfish" (cf. Heylighen, 1992) or "parasitic" (cf. Cullen, 1998) memes, whose only goal is to spread themselves, "infecting" a maximum of hosts without regard for their hosts' well-being. This does not imply that the same meme cannot satisfy both selfish and non-selfish criteria. Religions often have this mixture of parasitic and beneficial traits (cf. Cullen, 1998)

Self-justification, the degree to which the components of a meme mutually support each other, will facilitate understanding and acceptance. *Self-reinforcement*, the degree to which the meme stimulates its host to rehearse itself, e.g. by repetition, meditation, prayer, etc., will strengthen retention. *Intolerance*,

the degree to which a meme excludes rival memes from being assimilated or retained, will also help the meme to retain a stable position in memory. *Proselytism*, the degree to which the meme urges its host to maximally spread the meme to other hosts, will increase the rates of expression and transmission.

<i>stages\selectors</i>	Objective	Subjective	Inter-subjective	Meme-centered
Assimilation	distinctiveness	novelty simplicity coherence	authority formality	self-justification
Retention	invariance controllability	coherence utility	conformity	self-reinforcement intolerance
Expression			expressivity	proselytism
Transmission			publicity	proselytism

Table 1: a summary of the main selection criteria for memes, classified according to the stage during which they are most active, and the system responsible for the selection.

Conclusion

This simple four stage model helps us to analyse the mechanics of meme replication, and the different requirements a meme must satisfy to spread successfully. It moreover helps us to situate and to systematize a more intuitively developed list of objective, subjective, intersubjective and meme-centered selection criteria. Although the four stage model suggests a formula for calculating memetic fitness, the theory is as yet insufficiently developed to unambiguously determine the parameters of the equation. However, the list of selection criteria does produce a range of qualitative predictions, which can be empirically tested.

Acknowledgments:

Francis Heylighen has been supported during these investigations by the Fund for Scientific Research - Flanders (FWO) as a Research Associate.

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