**What’s in a meme? The role of replication in cultural evolution**

**Abstract**

Is replication in the cultural domain ubiquitous, rare, or non-existent? And how does this relate to that paradigmatic case of replication, the copying of DNA in living cells? Theorists of cultural evolution are divided on these issues. The most important objection to the replication model has been leveled by Dan Sperber and his colleagues. Cultural transmission, they argue, is almost always reconstructive and transformative, while ‘replication’ can be seen as a rare limiting case at most. Though Sperber’s critique is valuable, I argue that a purely informational and pragmatic approach to replication can clear up some confusion. By means of some thought experiments, I make a distinction between *evocation* and *extraction* of cultural information, and apply these concepts at different levels of abstraction. I conclude that, depending on our theoretical focus and our granularity of analysis, sometimes we can talk about replication in the cultural domain, even after having taken Sperber’s important points on board.

Keywords: cultural evolution; replication; information; granularity; extraction & evocation; selection; cultural transmission; memes

**Introduction**

Many discussions in the burgeoning field of cultural evolution still revolve – in one way or another – around the scope and limitations of the analogy with biological evolution (Henrich, 2015; Lewens, 2015; Mesoudi, 2011; Richerson & Boyd, 2005; Sperber, 1996). How Darwinian is cultural evolution exactly? Is it cumulative, as in in the biological realm? Is it blind or guided? Does the phenotype/genotype distinction hold in the cultural domain? What, if anything, is the theoretical equivalent of a ‘mutation’ in the cultural realm? Perhaps one of the most contentious points of comparison is the following: does cultural evolution happen through a process of replication or copying? And if so, is it useful to break down culture into discrete units, which can play the role of the replicator in the cultural realm, analogous to genes in the biological realm ? Most famously, this idea is associated with ‘memes’, the cultural counterpart of genes that was coined by Richard Dawkins in *The Selfish Gene* (1976).

One of the most forceful objections against the notion of cultural replication has come from the anthropologist Dan Sperber. For many years, Sperber and his colleagues have argued that culture does not evolve by straightforward replication, in spite of what the analogy between genes and memes suggest (Atran, 2001; Boyer, 1994; Claidière, Scott-Phillips, & Sperber, 2014; Scott-Phillips, 2015; Sperber, 1996, 2000). In the cultural realm, replication is a limiting case at best, applicable to only a few isolated phenomena. In all other cases, cultural transmission involves heavy doses of reconstruction and transformation, which undermine the picture of simple replication. Because the memetic approach to culture is committed to “a strict process of replication”, according to Lewens’ (2015, p. 27) and many others, it is thereby immediately ruled out a serious contender for studying culture. But the objections against replication have relevance beyond criticism of memetics. Even other theoretical approaches, though disavowing meme-talk, seem to rely on some version of particularism and replication (Morin, 2015).

In this paper, we provide a conceptual analysis of the term “replication” in both the cultural and biological realm, in order to defend a purely abstract and information-theoretical approach to cultural representations. In order to understand in what sense genes can be treated as ‘replicators’, we have to think of them in terms of abstract information, not physical substrates. Once we adopt *this* definition, however, it becomes clear that some important objections against cultural replication evaporate. In particular, the argument against replication made by Sperber and his colleagues will be shown to rest on an equivocation, with a questionable argument riding piggyback on a good one. We will isolate the valuable part of Sperber’s critique, which relates to the distinction between transmission and evocation, and disentangle it from the contentious part.

Thinking of culture in terms of abstract pieces of information does not make you mind-blind. For certain explanatory purposes, it is perfectly legitimate. Indeed, although many cultural theorists have disowned talk of memes and replicators, their own frameworks covertly rely on the notion of pieces of information being copied/replicated from one person to the next. In other words, it seems that memes have sneaked in through the back door, in all but name. If the standard objections to memes hold water, then the alternative of these authors are in trouble no less. Luckily, they don’t.

**The mathematicians**

A group of mathematicians are at a conference dinner telling jokes. Because they have known each other for a long time and are such avid humorists, they have designed a more efficient system for their amusement. Each joke in their repertoire has a number assigned to it, so they just have to call out that number. So one night at the conference, the first mathematician shouts out: "56!" Boisterous laughter from around the table. The second mathematician has a go: "562!" Everyone cracks up again. A third mathematician shouts "345!" Just a few chuckles and groans, with the exception of one young mathematician, who is rolling over the floor laughing. The third joke-teller turns over to the rookie and asks him: "So you really liked my last joke, didn't you?" The young one responds: “It's just that I had never heard that one before!"

There are different version of this joke. I encountered one variant in Peter de Vries’ satirical novel *The Mackerel Plaza*[[1]](#footnote-1), but this version, for all I know, could’ve been invented by Dan Sperber or one of his collaborators. It nicely illustrates one their major thesis about cultural evolution: the crucial distinction between replication and evocation.

Many models of cultural evolution assume more or less by default that, whenever we see chains of identical or similar representations in a cultural environment, some sort of replication process must be going on. But the joke about the mathematicians illustrates how this is misleading: their system is not based on straightforward transmission. To be sure, some information is indeed transmitted through every ‘telling’: the sender selects a joke and calls out the corresponding number, bringing about the formation of a similar representation in the minds of the receivers. There is a clear causal arrow from sender to receiver, supported by the usual counterfactuals: if you mishear the number that is called out, you will end up with the wrong representation. But it is also clear that hardly any transmission is occurring. The funniness does not inhere in the calling numbers. The latter only provoke laughter because they elicit some previously stored, fully formed semantic content. For the system to work, every mathematician already needs all jokes stored in memory, with corresponding numbers.[[2]](#footnote-2) This, of course, is the point of the punch line: if you laugh, you *must* have heard the joke before.

Sperber himself illustrates the idea with a different thought experiment. Imagine you see a sequence of tape recorders: the first recorder plays a song, then stops. Then the second recorder starts playing the same song. When it has finished, the third sets in, etc. If you witness these events, you may reasonably infer that the devices are recording and then replaying a song. In other words, there seems to be replication going on. But then it is revealed that you are looking at a sequence of jukeboxes, which already have all the songs stored in their internal memory. What really happens is that each jukebox *identifies* the song being played, and then retrieves it from its own repertoire. No replication is taking place, even though an observer would be forgiven for thinking so. Returning to human beings, we could imagine – ruining our punchline – that people are born with an innate repertoire of jokes, each of which can be triggered by a certain stimulus (call-out number). In this way, we can imagine a Chinese whisper chain of people amusing each other with jokes, even though no (or hardly any) transmission is going on.

It goes without saying that Sperber and his colleagues are not suggesting that humans are born with innate knowledge of jokes, or with any other semantically complex representation. But still, this is a useful limiting case to think about cultural transmission. In general terms, Sperber proposes three “minimal conditions for true replication”. For B to be a copy of A,

(1) B must be caused by A (together with background conditions)
(2) B must be similar in relevant respects to A
(3) The process that generates B must obtain the information that makes B similar to A from A. (Sperber, 2000, p. 169)

The third condition is the crucial one, and is generally not fulfilled in the cultural domain, and certainly not in our scenario of the mathematicians.

In a typical act of communication or social learning, people do not copy the representation of the source directly, but “reconstruct” it on the basis of provided clues and knowledge they already possess, whether that knowledge is innate, has been acquired earlier, or is embodied in the environment: “information provided by the stimulus is complemented with information already available in the system.” (Sperber, 2000, p. 171) Indeed, without some element of evocation, cultural transmission could not succeed in the first place. Public expressions or displays of culture almost always underdetermine the representation being transmitted. In the extreme case of the mathematicians, an observer can immediately see this, even without knowing about the details of their system. A three-digit number cannot store all the semantic content that goes into a joke. If the mathematicians all end up laughing (presumably with the same joke), that must have been because the semantic content in question was *already* available to them prior to the calling-out.

Even when a joke is spelled out in the usual way, however, successful transmission depends of substantial prior knowledge on the part of the listeners: knowledge of the language in which the joke is recounted (vocabulary, pronunciation, grammar, etc.), but also folk psychological knowledge, familiarity with the conventions of joke-telling, and perhaps also background knowledge about politics, social life, sex. In a successful recounting of a joke, the utterances of the joke-teller should provide enough clues for the audience to reconstruct the intended meaning and ‘get’ the punch line.

If we are trying to explain the existence of stable cultural traditions through time, we therefore have to take into account both the contributions made by transmission and evocation. Cultural traditions are formed in part because humans beings have universal cognitive predispositions and biases, and live in similar environments. Because of the make-up of the human mind, certain representations are more salient, memorable and inferentially rich than others. In Sperber’s framework, “cultural attractors” are locations in the space of possible representations that are maximally relevant, from the cognitive perspective. In a cultural population, shared representations will gravitate towards those attractors: “to some extent all humans, and to a greater extent all members of the same population at any one time, are attracted in the same direction” (Sperber, 1996, p. 118). In his book on cultural traditions, Olivier Morin (2015) has proposed a spectrum between evoked/transmitted culture. If the mathematicians in our joke were to play a game of Chinese whisper, making use of their coding system, the stability of the transmission chain would be mostly a function of *evocation*, not transmission. We would find ourselves at the ‘evoked’ end of Morin’s spectrum, just like our sequence of jukeboxes. Other cultural traditions may be closer to the transmission end of the spectrum, but it would be rare for any cultural traditions not to involve *any* element of evocation.

**Mathematicians Redux**

Sperber and his colleagues are completely right to call our attention to the role of evocation and reconstruction in cultural traditions. If we see a chain of similar representations that is causally connected, we should not assume by default that some process of straightforward replication is going on, or even that transmission is taking place. In Sperber’s words, cultural theorists should not “take for granted that the co-occurrence of causation and of similarity between cause and effect is sufficient evidence of inheritance” (Sperber, 2000, p. 169)**.** Apart from this conceptual point, I will also grant that Sperber is probably right about the empirical facts. In human culture, virtually *every* form of cultural transmission involves some element of evocation. The respective contributions of transmission/evocation may differ, but the stability of cultural traditions is never exhaustively explained by transmission alone.

But now let us proceed to the areas of disagreement. Imagine that our mathematicians have devised a slightly different way of telling jokes. Suppose they are fond of telling dirty jokes, but they want to keep their wives out of the picture (apologies for the sexist thought experiment). Rather making an inventory of jokes and assigning numbers to each of them, they have devised to numerical code. Each number corresponds to a joke, but the code is generative and allows for the encryption of novel jokes. Now suppose that we form a transmission chain of mathematicians, like in the Chinese whisper game. Each mathematicians tells a joke to his neighbor (in numerical code), who then deciphers it, and then ‘tells’ the same joke to the next one in line.

In many respects, the new scenario resembles the original: a joke-teller utters a number, and the receiver ‘gets’ the joke and cracks up. In both cases, a listener cannot appreciate the jokes without possession of substantial prior knowledge. If you don’t know the code for deciphering the jokes, you will not end up with the original representation in your mind, and communication will fail. The jokes are not simply copied, but have to be *reconstructed* on the basis of prior knowledge.

But in some crucial respects, the new situation is clearly different from the first. Even though the jokes are beings *reconstructed* on the basis of the numbers, we are not dealing with a case of *evocation*, as in the first scenario. It is perfectly possible that some mathematician listening to some rendering of a joke had indeed never heard it before.

Now I propose that we can treat the second system of communication, unlike the first, as a form of replication, despite the fact that heavy reconstruction is involved, and we are not dealing with anything like a straightforward copying mechanism. If we are studying the dissemination of a certain joke in a population of mathematicians, then it does not really matter what communication system is being used in each transmission event. Whether the jokers are spelling out the jokes in the usual way, or using some sort of elaborate code, we will observe the same process of dissemination, mutation, formation of lineages, etc. As long as the encryption system is faithful and reliable, we can stand back and abstract away from the precise mechanism. Notice that we can *not* do that with the jukeboxes. If we black-box the machines and treat them as tape recorders replicating songs, then we are bound to go astray. For instance, a theorist might be led to the prediction that mutations and noise in the “transmission” chain will accumulate over time, and lineages will start to evolve. But this would be wrong: the jukeboxes will keep playing the same song over and over again.

As a real-life example of the second scenario, consider the famous Enigma code, used by Nazi Germany during the Second World War. Enigma encryption was based on a substitution scheme for each individual letter in a message, carried out by an electro-mechanical cipher machine, and coordinated by an elaborate and constantly changing routines. In order to extract the intended message on the receiving end, substantial ‘knowledge’s is already presupposed. First of all, the receiver needs to have another Enigma machine to decipher to message, but she also needs to know the exact instructions for setting it up, based on the daily changing routine. For the British intelligence agencies who intercepted the German messages, but who lacked such prior knowledge, the messages were just gibberish. No transmission (of the semantic content) was taking place.

Does the Enigma system for communication amount to a form of *replication*? Not if you see replication as a process of straightforward and simple copying. But still, in many respects, it is behaviorally *indistinguishable* from replication, as indeed it was designed to be by German cryptographers. In the interest of military coordination, the message coming out at the receiving end had better be an exact copy of the original. What matters is that some semantic content (e.g. plans about a military maneuver) is faithfully transmitted from one location toe the next. For a theorist interested in cultural transmission chains, it would have made no difference if the Germans had relayed un-coded messages (though of course it would have been strategic folly).

If we are right that these are all instances of “replication”, then it seems that replication does not need to be simple and straightforward, and may well involve heavy reconstruction on the basis of prior knowledge. Even though, in the above cases, the information of the stimulus is “complemented with information already available in the system”, and the transmission system would fail completely without such prior information, both scenarios still fulfill Sperber’s third minimal condition of replication: “The process that generates B must obtain the information that makes B similar to A from A.” (Sperber, 2000, p. 169).[[3]](#footnote-3) Let us therefore distinguish between *evocation* and *extraction*. In the case of *evocation*, the final representation is already available to the receiver and is merely being triggered by some simple stimulus. No transmission is taking place, and thus certainly no replication. In the case of *extraction*, prior knowledge on the part of the receiver is needed to complement the information in the message, but this knowledge merely serves to *extract* the target message. That message itself is novel and surprising to the receiver, and hence is being transmitted wholesale, just as in the case of straightforward replication.

**Information**

In our proposal, we rely on an abstract and information-theoretical conception of cultural representations. In the second scenario, but not in the first, there is a significant transfer of information, in line with Shannon’s (2001) conception of information as a reduction of uncertainty. The transmitted information is ‘surprising’ for the receiver, assuming he has not heard the joke before. In the first scenario, there is hardly any reduction of surprise, except for the current choice from the repertoire. This, of course, will be reflected by the length of the numbers being called out. In the original situation, the listener only needs a few bits (i.e. the index number) to “reconstruct” the semantic content of the joke. In the second scenario, however, the numbers need to be significantly longer, as the code is generative, and each individual word in the joke needs to be conveyed.

Many cultural theorists resist this purely abstract approach to cultural representations in terms of information, and this is not inconsequential. They identify cultural representation not with information, but with some sort of physical entity (brain states, behaviors, tools, sound waves, tools). Consequently, when they are talking about ‘replication’, they are thinking of some sort of straightforward physical mechanism for duplicating a physical object, structure or pattern. Many of them see DNA replication as a paradigm case of ‘proper’ replication, because it involves a simple and straightforward copying mechanism. And as nothing remotely similar can be found in the cultural domain, they conclude that cultural ‘replication’ does not exist.

On the informational approach we propose, however, the situation is completely different. Genes should not be identified with physical molecules, but rather, as George Williams and others have argued, with the *information* residing in those molecules. (Durham, 1991; Haig, 2007; Williams, 1992). Even though the mechanism responsible for DNA replication is relatively straightforward and simple, this is not a necessary condition to be able to talk about ‘replication’. It is tempting to think that the entity being copied in a is the physical DNA molecule. DNA is, after all, a discrete and visible physical structure. But on the informational approach, the only thing that matters is that some abstract information (a digital sequence) is recreated in a different physical environment.

A thought experiment will help to see this. Imagine that the replication of genetic information in our bodies is carried out by a cohort of tiny agents. Let’s call them Redundancy Demons. During cell division, the demons unwind a DNA strand, communicate the sequence to each other, and then re-assemble a complement DNA string base pair by base pair (as in the plastic toy models of DNA used for educational purposes). The Redundancy Demons are extremely diligent and achieve almost perfect fidelity, just as in the actual world we live in. Is this still replication? *Ex hypothesi*, the demons’ labor would be indistinguishable from “true” replication. For all we know, such demons could be at work right now, in the same way that some liberal theologians have argued that God may be fiddling with our DNA, all the while making sure that His actions remain statistically undetectable (Haught, 2000; Miller, 2000). And what if it were discovered that Redundancy Demons use a range of different molecules for encrypting the genetic information? That would not make any difference, as long as they make sure that the information carried by the molecules of their choice is eventually properly and reliably transcribed to the right amino acid sequences. And what if they used tiny Enigma machines for secrecy, decoding the information in each transmission event? None of these fanciful scenarios would make a difference to the algorithm of variation and selection: to all intents and purposes, what is going on is still “replication”.

**Level of resolution**

If you identify cultural representation with some sort of physical substrate, you will look in vain for some kind of simple replication machinery that makes copies of those material entities, in the way that DNA strands unwind and assemble a replica. But on an informational approach, what matters is that some piece of information is somehow transmitted from one physical carrier to the next, no matter how roundabout and circuitous the mechanism, and no matter how different the physical carriers. Importantly, abstract information can be identified at different levels of resolution. Take our examples of jokes. In virtue of what do we say, upon hearing someone telling a joke, that we have heard “it” before? Not in virtue of the specific wording, or acoustic qualities, or even the language it was spoken in. We recognize two representations as instantiating the *same* joke in virtue of some higher-level semantic similarities. If we are the one telling the joke, we are usually not 'replicating' the exact wording, but telling the story in our own words.

But replication of a joke can happen at different levels of resolution. The mnemonist Solomon Shereshevsky had such an astounding memory that he could repeat several pages of texts, verbatim, after having heard them once. If someone like Shereshevsky recounts a joke he heard from someone else, he will ‘replicate’ at the level of individual words and phrases.[[4]](#footnote-4) And of course, finer-grained replication is still possible. Even Shereshevsky’s verbatim rendering of a joke abstracts away from lower-level details, for example the specific intonation, phrasing and pitch of the person who told it to him. Professional comedians care about the timing and delivery of a joke, and may tell it in exactly the same way across different performances.

Even in the paradigm case of replication (DNA), we need to settle on the right level of analysis. If we say that two chromosome in two different cells, after the completion of regular (mitotic) cell division, are replicas of one another, we don’t mean to say that they are *exactly* alike. In fact, there will be plenty of differences between them: they are wound up and folded in a different way, have a different spatial orientation, and their molecules are arranged in countless different ways. This is how talk of physical entities rather than abstract information can lead us astray. Two chromosomes are only “replicas” of each other to the extent that both can be seen as embodying a certain amount of abstract information in the way their base pairs are arranged along their doubled helix, abstracting away from everything else. There is much more “information” in a chromosome than that which resides in the arrangement of their base pairs, but that information is not preserved during dell division, so we ignore it. It is a difference that doesn’t make a difference (Dennett, 2017)

**Reconstruction Redux**

If we now (1) adopt an abstract definition of information and (2) distinguish between different levels of abstraction, we can resolve the issues of evocation vs. extraction in the cultural realm. In several publications, Sperber has argued that replication in the cultural domain is not impossible, but should be seen as a *limiting case* of the more general mechanism of cultural attraction: “there are cases of actual memes, though much fewer than is often thought. Chain-letters, for instance, fit the definition.” (Sperber, 2000, p. 163).

We agree that chain letters can be treated as ‘memes’ that replicate in a cultural environment. But in virtue of what can we treat one chain letter as a replica of another, as an instantiation of the same ‘meme’? Two token letters can be different in numerous ways, but still be regarded as instantiating the ‘same’ chain letter. Even in everyday talk about chain letters, we abstract away from type of ink, font, letter spacing, quality of paper, etc. In some contexts, we can move up to a higher level of abstraction: if I translate a chain letter to a different language, or rephrase it in my own wording, we would still arguably call it the ‘same’ chain letter (for instance, because it threatens the reader with the same evil curse).

When thinking of the replication of the chain letter, we also abstract away from the exact physical copying mechanism. Many chain letters contain explicit instructions to ‘copy’ the letter and send it to a certain number of people, but do not specify the copying mechanism, nor the physical substrate to be used. Chain letter memes do not “care” about such trifles, as long as they make it to the next generation. They leave the choice of copying mechanism to their helpful vectors. In earlier days, people used pen and paper to copy chain letters.[[5]](#footnote-5) Later on, some mechanical procedures were developed to speed up the process, such as carbon paper and photocopy machines, or the forward button on an e-mail service. But in any case, strictly speaking, none of these mechanisms amount to straightforward replication, not even photocopying machines. For one thing, all of them rely on a complex intermediate step with heavy doses of Sperberian reconstruction: reading. In particular, the meme needs to wrestle its way into a human brain, so as to trigger the right disposition and enlist it to the memetic cause (for example, exploiting its superstitious fears). Photocopy machines are not superstitious, and do not copy anything out of their own accord.

Now, how about the difference between evocation and extraction? If I copy a handwritten chain letter word by word, using pen and paper, I’m relying on plenty of prior knowledge: the shape of letters in the roman alphabet, my English vocabulary, systems of punctuation, etc. (I would not be capable of copying a handwritten Arabic chain letter, except by using a photocopy machine.) Every time I glance at the paper, such prior knowledge is retrieved from memory. In this sense, at the level of individuals letters and words, we see a process of evocation. I don’t learn anything new about the letters and words out of which the chain letter is composed. Indeed, I rely heavily on my prior knowledge about such things to normalize what I see on the paper. I want to copy the message, not the physical arrangement of ink on the paper, down to the minutest splotch. Consequently, I will correct misshaped letters, typos, crossed-out words etc.

To the extent that replication occurs – as even Sperber seems to agree – it is only at a higher level of abstraction. Each individual letter is being evoked from memory, but the specific sequence of letters that I observe on the page constitutes novel information. It was not already present wholesale in the minds of the receiver. Even though each individual building block (letter) is being evoked rather than transmitted, the specific *arrangement* of building blocks on a higher level is being *extracted*.

But once we admit all of this for the case of chain letters, we will see that there is much more replication in the cultural realm than Sperber admits. In his latest book, Dennett (2017) has discussed digitization schemes for dance, musical notation, weaving, and computer programming. An especially interesting case is Dawkins’ (1999) example of origami folding, in which a student witnesses a folding demonstration by a teacher, and then carries out the steps herself. Dawkins presented the example of origami folding as a solution to the problem of low copying fidelity in a cultural environment. In his account, the instructions in origami are “self-normalizing” (Dawkins, 1999, p. xii) and therefore prevent degeneration and distortion. Imperfect demonstration and small errors will be corrected by the pupil, and will not be preserved in the next generation. Sperber, on the other hand, turned the table on Dawkins, and uses the example of origami folding to show that cultural transmission generally does *not* involve replication. The student, Sperber argues, is not trying to imitate each and every gesture of the teacher. She is reconstructing a set of instructions, by drawing inferences about the plausible intentions of the instructor. In order to identify the quasi-digital steps in the sequence, the student is normalizing the behavior displayed by the teacher, parsing it into discrete steps (e.g. “fold the four corners into the middle of the page”). But in order to do so, the pupil already needs to possess substantial prior knowledge:

Thus the normalisation of the instructions results precisely from the fact that something other than copying is taking place. It results from the fact that the information provided by the stimulus is complemented with information already available in the system. (Sperber, 2000, p. 171)

This is true, but it is not very different from the example of chain letters, which Sperber already admitted as an instance of memetic replication. At a lower level of resolution, what we see is mostly evocation. The student already possesses substantial knowledge about geometric figures, about the general philosophy of origami, and the typical steps out of which origami instructions are composed (fold / upper half / diagonal / turn over / opposite corners). They are the building blocks of origami folding, just as the letters of the roman alphabet (and the words in the English language) are the building blocks out of which chain letters are composed. Aided by inferences about goals and intentions, the pupil identifies the building blocks that she is already familiar with, and ignores the noise and the errors in the demonstration. In that sense, lower-level knowledge about geometric figures is merely evoked by the demonstration, not transmitted by it. For example, when the student observes something approximating a rectangle, she infers that the teacher intends to make a rectangle, and then retrieves this representation from memory, rather than copying the slightly skewed figure displayed by the instructor.

Nevertheless, when we move up to a higher level of abstraction, we see that discrete pieces information are being transmitted from the teacher to the pupil. If the teaching moment is to be successful, the specific sequence of steps (building blocks) must be reproduced by the pupil, in the right order. Now *this* sequence of steps, unlike underlying knowledge about triangles and folding lines, is not merely being evoked. It contains information that is novel and surprising to the pupil, and cannot be retrieved from memory. To be sure, as Sperber points out, there is no straightforward copying mechanism. But neither is there in the case of chain letters. In both cases, the information is being *extracted* from the stimuluson the basis of certain perceptual clues, in conjunction with background knowledge about lower-level building blocks, and possibly also higher-order contextual knowledge. In the case of the original joke about the mathematicians, by contrast, the information is being evoked *wholesale*, at the highest possible level of abstraction. There are no building block out of which the target representation is composed. Or in fact, there is only one building block, which is the complete joke itself.

This analysis in terms of extraction vs. evocation, on different levels of analysis, can be applied to a range of different cultural phenomena. Claidière et al. (2014, p. 5) discuss the example of a student correcting writing errors made by the lecturer, while taking notes. This is not replication, according to Claidière et al., because the student complements the information written on the blackboard with knowledge about the spelling of words that she already possesses. But even though the student already knows how to spell, she did not know the content of what the teacher is writing on the blackboard. Evocation takes place at the lower level, but not (or far less) at higher levels of abstraction. In his own analysis of spelling errors, Dennett (2006) has argued that normalization in cultural evolution can take place at different levels of semantic depth: on the level of orthography (from “sePERaTE" to “separate”), spelling (from “sePERaTE" to “separate”) and at higher semantic levels (from “separate butt equal” to ““separate but equal”[[6]](#footnote-6)). But the fact that humans correct “thinkos” on top of typos, as Dennett put its, does not invalidate the replicative framework: it just makes it slightly more complicating (Dennett, 2006, 2017, pp. 224-233).

As a final example, take a complex cultural representation like a fairy tale in an oral tradition. If someone tells a fairy tale, certain innate expectations about ontological categories (person, animal, inanimate object) will be triggered in the minds of the listeners (Boyer, 1994; Spelke, 1994). Proper appreciation of the story requires knowledge about these ontological categories and the kind of inferences they support, as well as an ability to reconstruct some elements of the story that are left implicit. But again, these are merely the building blocks of the story. Even though lower-level elements are being evoked, the fairy tale itself surely is not.

It is instructive to have another look at that paradigm case of ‘replication’: DNA. It is often argued that DNA copying is ‘true replication’, because it is straightforward and simple, is achieved through a single specifiable mechanism, and does not involve any normalization and correction. But let us look at the gory details of DNA replication. During cell division, the double DNA strands separate, and each strand functions as a template for the assembly of complementary base pairs. Not only does the replication machinery “normalize” at the level of the AGTC alphabet, but living cells also use a variety of DNA repair mechanisms, which are constantly at work to correct occasional errors. Such correcting enzymes, as Dennett writes, normalize to semantic norms just like intelligent human beings, “but just local or proximal semantic norms” (Dennett, 2006, p. 140). And the analogy extends further: there are mechanism for “proofreading” during DNA replication, analogous to what a student would do with errors made by a lecturer. If there is a mutation in a single DNA strand, usually the repair mechanism excises the damaged parts, and recompletes the strand by using the other strand as a template (genes use redundancy to minimize errors, just as in cultural transmission). In other types of repair, no template is needed, as the damage is “known” to occur only in one of the four bases. In the case of double strand breaks, there are different mechanisms for ligating the broken ends, with some mechanisms used as a preferred “first response”, while others only as a “last resort” in case of severe damage. Loss of the genes for proofreading results in hypermutation, and prevents high-fidelity transmission chains.

None is this is to deny that cultural replication, by and large, is a lot more messy and complicated than DNA. But there is no substantial difference. If we adopt an informational approach, we can abstract away from the nitty-gritty of both biological and cultural evolution. Reconstruction is not opposed to replication, as long as we have assured ourselves that we are not dealing with wholesale evocation. As Dennett writes: “You can finesse your ignorance of the 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).

**Decay and distortion**

If we adopt a purely abstract conception of cultural representations, then we can see under which conditions the gory details of cultural transmission can be safely ignored, and when they cannot be. My claim in this paper is that a process of information *extraction* can be safely blackboxed and treated as conceptually equivalent to ‘replication’, provided of course that the information in the target representation instantiates the same information as the source. By contrast, a process of *evocation* cannot be blackboxed, because the appearance of information being transmitted is merely an illusion.

This is important when we look at the psychological details of cultural transmission. Despite what is often assumed, human beings generally are not very good at faithful replication, no matter at what level of resolution you are looking (Atran, 2001; Morin, 2015). We distort information, we leave out details, we embellish and change elements, we mix up fragments and create our own versions. All of these are obstacles to the emergence of stable transmission chains. The children’s game of Chinese whispers is a famous demonstration of this: in a sequence of consecutive, one-shot interactions, a story will degrade so quickly as to be unrecognizable after only a small number of generations. This is the fate of the overwhelming majority of cultural representations. They will never be instantiated in different media, because rapid decay and transformation will prevent them from re-occurring elsewhere, at any level of resolution.

On the other hand, we *know* that stable cultural traditions exist: we have religious rituals, nursery rhymes, poems, urban legends, folk songs, children’s games, technologies for making pots and igloos. The existence of such long-lasting cultural traditions is a given, something that needs to be explained. It is true that human beings are bad copiers, and that most of the representations they transmit are quickly distorted and degraded. But then again, we will never hear of those representations again. Like in biological evolution, we can expect *selection* for stability and persistence, even in the face of overall low-fidelity copying mechanisms. Atran is right to remark that “high fidelity transmission of cultural information is the exception, not the rule” (Atran, 2001, p. 351), but so it is with nature’s molecules. And we only hear about those exceptions (i.e. DNA), not about the molecules that stick to the “rules”.

Faithful replication is not easy to achieve with lousy copiers like human beings, but it is not impossible. If some representations somehow *do* tend to engender similar effects elsewhere, despite the messiness and rapid decay from which human communication suffers, then we can expect *those* representations (or better: the information that they are instantiating) to re-occur over and over again. Representations that don’t possess what it takes to engender similar effects elsewhere, will never attain the status of culture. Most letters are not being copied at all, but some letters will spawn more similar letters, because they cajole human readers into making more copies of themselves. Most stories are never told again, but some make for memorable and salient urban legends, myths and fairy tales. In short, before there is selection *of* memes, there is first selection *for* memes.

A major contribution in this respect is Olivier Morin’s recent book on cultural transmission. In Morin’s model, stability in cultural traditions is achieved through redundancy and repetition. If cultural transmission were composed of a sequence of one-off interactions, like in a Chinese whisper game, representations would quickly decay and disintegrate before they could get the chance to form stable tradition. In real life, however, transmission events are often repeated, and receivers integrate information from different sources. For example, Morin writes that a “spoken word owes the greater share of its survival not to the fidelity of its transmission, but to the frequency of its use” (Morin, 2015, p. 132) By uttering the same words over and over again, errors in transmission are corrected and stable traditions begin to coalesce. For Morin, this is the secret to explaining cultural stability:

“Repetition, redundancy, and proliferation constitute the cultural success of a tradition. Without them, even the most faithful transmission cannot stave off extinction. With success on its side, though, transmission does not even need to be particularly faithful.” (Morin, 2015, p. 8)

Intriguingly, Morin does not construe his own argument as a demonstration of how high-fidelity replication is achievable, but as a *refutation* of the replication hypothesis. From our vantage point, however, this stems from Morin’s refusal to adopt a purely abstract conception of culture. Morin identifies culture with material objects (artefacts, brain structures) rather than with information. In line with this view, he is looking for a discrete physical mechanism that can account for high-fidelity replication, analogous to the mechanism for copying DNA.

But of course there is no such discrete copying mechanism. As Claidière et al. put it: “cultural propagation operates not through one, but through many basic mechanisms of cognition” (Claidière et al., 2014, p. 3). Morin convincingly shows that human beings have no special talent or module designed for faithful imitation/replication. Because Morin fails to find such a high-fidelity mechanism, he concludes that cultural ‘replication’ is a myth. But under Morin’s definition of replication, not even the German’s Enigma communication system would amount to ‘replication’, as there is no straightforward physical mechanism going from parent representation to offspring representation. (Indeed, the mechanism was changing on a daily basis). Even the Redundancy Demons would fail to qualify.

But I think an informational approach to cultural representation can help out Morin. If we identify cultural representations with abstract information, rather than with physical objects, then we can abstract away from the precise physical mechanisms through which transmission occurs. The only thing that you have to bear in mind is Sperber’s point about evocation. To the extent that information was already present in the receiver, and is merely retrieved from memory, there is no transmission taking place at all. But as long as there is a level of abstraction at which this is *not* the case, and at which you see extraction of information, you can talk about replication.

If we adopt such an abstract definition of cultural information, Morin’s powerful model in terms of repetition and redundancy should not be regarded as a *refutation* of the cultural replication hypothesis, but as an account of its *enabling conditions*.[[7]](#footnote-7)

**Conclusion**

In many respects, cultural evolution is completely different from biological evolution. There is nothing in culture that looks remotely like the DNA molecule and the machinery for DNA replication. In biology, there is identifiable molecule that gets replicated, whereas in culture everything is much more messy. This is the main reason why many cultural theorists are suspicious of the term ‘meme’, modeled on the analogy with ‘gene’, and why many of them claim that there is no such thing as ‘replication’ in culture.

If we adopt a purely informational approach to cultural evolution, however, this disanalogy is less important than it seems. Genes should not be identified with the DNA molecule itself, but with the abstract *information* of which the DNA molecule is the carrier. In the case of biological evolution, as it happens, virtually all the information that is transmitted down the generations is carried by this single identifiable molecule, using a single and simple alphabet. But this is coincidental, not a necessary condition for replication to take place. Any physical object can act as a carrier of information, and ‘information’ can be identified at numerous levels of abstraction.

In this paper, we have defended an informational approach to biological and cultural evolution, on the basis of some thought experiments and intuitions pumps. This approach is much more open-ended and flexible, as it does not require any specific physical substrate or specific mechanism for replication. Wherever we can identify information, at some level of abstraction, and see that information re-occurring, forming transmission chains, we can talk about ‘replication’.

The only thing we have to bear in mind, as Sperber has correctly argued, is that we are not misidentifying a process of mere evocation as one of transmission. Just because we observe recurring patterns in a causally connected chain, does not mean that we are dealing with transmission, let alone straightforward replication. On our informational approach, this makes sense: in a process of evocation, there is no reduction of surprise, because the information in question was already in possession of the receiver.

Pace Sperber, however, we have argued that heavy-handed reconstruction does not necessarily stand in the way of replication. Not all reconstructive processes amount to mere evocation. In the case of data encryption, for example, we find elaborate processes of reconstruction, but no evocation. Indeed, in such cases, we can black-box the causal mechanisms, and safely treat them as a form of replication.

Real-life examples of cultural transmission are seldom as rigid as data encryption, but the distinction between evocation and extraction can be applied here as well. Many cultural representations consist of an arrangement of elements. Even though cultural transmission often assumes prior knowledge of these elements, which are thus merely being *evoked*, the specific arrangement of the elements is often not. It is a form of *extraction*. This analysis can be applied to chain letters, jokes, poems, rituals, origami instructions, folk songs, etc.

Both evocation and extraction are forms of ‘reconstruction’, but they are very different. In practical terms, extraction processes can be safely black-boxed and treated as forms of replication. But evocation cannot. We agree with Sperber that explaining the stability of cultural traditions merely in terms of transmission is wrongheaded. In virtually every form of cultural transmission, there is at least *some* element of evocation, at some levels of abstraction. But we part ways with Sperber when it comes to replication. Merely because cultural transmission involves some amount of evocation, does not mean that models of cultural replication have been falsified. Extraction, we argued, is just a more complicated way of transmission, but it is often indistinguishable from straightforward replication. By distinguishing between different levels of abstraction and sticking to an informational approach to culture, we can see that replication models are still useful.

 “Inferring instruction involves much more than the ability to perceive and describe actual movements; it involves the ability to attribute goals and intentions.”

Sperber

 “there is much greater slack between descent and similarity in the case of cultural transmission than there is in the biological case”(Sperber 1996, 108)

 “at least a brief pupal stage in a remarkable sort of meme nest: a human mind” (Dennett 1995, 349)

Sperber himself acknowledges that the existence of “stable cultural types” seems to call for a replication model of culture.

“If memes are ideas, with what are they in competition?” (Sterelny 2006, 155)

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1. In De Vries’s version of the joke, the system is devised by prison inmates. The punchline is actually better, but less interesting for our theoretical purposes: a newbie tries to call out a number from his cell, but is met with dead silence. “The newcomer asked his cell partner, a seasoned inmate who had just got through explaining the system to him, ‘What’s the matter? Isn’t that a good story?’ ‘Oh, sure,’ the cellmate answered, ‘but he don’t tell it right.’” [↑](#footnote-ref-1)
2. It doesn’t have to be memorized: we could imagine that all the mathematicians have been given a sheet of paper, with numbered jokes, and they are just looking up the jokes in the list. [↑](#footnote-ref-2)
3. See also Lewens (2015, p. 28), who has criticized Sperber for being too demanding about what constitutes proper replication. For Lewens, replication in the cultural domain just means that “a given idea [is] causally responsible for the structure of a resembling daughter idea”. We think this is actually closer to Sperber’s third criterion than Lewens suggests, but more importantly, if Lewens has such a relaxed notion of “replication”, it is hard to see why he still dismisses memes, which clearly fulfill his definition. Indeed, it seems that this is exactly what any selectionist approach to cultural evolution does: tracking lineages of cultural items that, each in turn, are causally responsible for the next one’s occurrence, and that have sufficient structural similarity to be treated as instances of the same item. [↑](#footnote-ref-3)
4. Remarkably, he found it hard to understand to replicate a higher level of abstraction, i.e. recount the gist of the story in his own words. Replication at one level of abstraction interfered with another one. [↑](#footnote-ref-4)
5. It has been argued that chain letters did not become truly epidemic until the invention of carbon paper. Memes ride piggyback on available technologies. [↑](#footnote-ref-5)
6. I noticed that the spelling corrector on my Word processor is already intelligent enough to identify errors up at the level of a whole idiom, as in “separate butt equal”, though it is less aggressive than with spelling errors. [↑](#footnote-ref-6)
7. In fact, some of Morin’s own language reveals that he would be better served with a purely abstract approach to culture. For example, his constant use of the words "proliferation" and “transmission” already assumes that there is something to proliferate, in other words, that there are cultural representations which are sufficiently similar to each other (at some level of resolution) to be treated as so many instantiations of the same thing. And this ‘thing’ can only be information. [↑](#footnote-ref-7)