Chapter 37
Current Darwinism in Social Science

Christophe Heintz and Nicolas Claidière

Abstract Darwinian theories concerned with human behaviour come in many forms. They can describe both the biological evolution of human cognition and the evolution of cultural traits in human communities. We briefly review these two types of Darwinian theories, including socio-biology, evolutionary psychology, memetics and dual inheritance theory, and show how insights from both types can be combined in a single framework: cultural epidemiology. We argue, however, that this is profitable only if selectionists models of cultural evolution are replaced by an attractor model.

Evolutionary theories, from Comte to Shalins, have been at the heart of debates and theories in social sciences. In spite of this, since the 1970s, Darwinian- based evolutionary theories have, at best, reached a heterodox status in social sciences. The historical reason is that Darwinism was associated with eugenic theories, which were used as an excuse for the worst crimes including the Shoah. However, the best way to avoid the undue use of Darwinian theories as a "scientific" justification for racist or eugenic theories is to pursue rigorous and careful research projects driven by a Darwinian inspiration.[1] For instance, the evolutionary work of geneticist Cavalli-Sforza (1974) has shown that the notion of "human race" has no explanatory value for, and no scientific relevance in, explaining cultural variations. Modern-day Darwin-inspired research does not try to explain behavioural differences between cultural communities with presumed genetic differences, but rather tries to understand

[1] See Clavien's chapter, Chap. 34, this volume.

C. Heintz (✉)
[AU1] Department of Cognitive Science, Central European University,
Nador u. 9, 1051, Budapest, Hungary

Konrad Lorenz Institute for Evolution and Cognition Research, Klosterneuburg, Austria
e-mail: christophe.heintz@gmail.com; http://christophe.heintz.free.fr

N. Claidière
Laboratoire de psychologie cognitive, Université d'Aix – Marseille, CNRS, Fédération de recherche 3C, 3 Place Victor Hugo, Bât. 9, Case D, 13331 Marseille cedex, France

Institut Jean Nicod, Paris, France
e-mail: nicolas.claidiere@normalesup.org

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how the observed variety of cultures is possible given the extreme genetic similarity between humans and the psychological unity of mankind.

Social Science Darwin-inspired theories are very varied, and the rejection or criticism of one of them cannot easily be generalised to them all. In this chapter, we present some criteria to distinguish between different Darwinian theories of cultural evolution to allow readers to judge their plausibility and their value for themselves. We will, however, argue in favour of a specific theory – cultural epidemiology – which, in our opinion, makes the best use of Darwinism to understand human behaviour and cultural differences.

Some approaches in social science aim at improving our understanding of human behaviour by looking at human biological evolutionary history. This application of biologic Darwinism tries to uncover the human-specific principles underlying human behaviour: those principles should be shared across cultures. Most frequently, this line of research relies on the theoretical principle that organisms' adaptations to their environment result from their evolutionary history. Adaptationism allows analysing the evolution of some organisms' properties relative to the selective pressure they are subjected to.[2] In the first section, we will detail how different Darwinian theories use adaptationism to explain human behaviour, including social behaviour and culture-specific behaviour.

We will see that some Darwinian theories first and foremost underline that the Human Animal produces and contributes to cultural phenomena that can themselves be considered to evolve. Cultural phenomena are mostly produced through the transmission of ideas and practices. This transmission results in the distribution of cultural elements in communities and their habitats. Those distributions can in turn be explained by calling upon various general evolutionary principles. The "universal Darwinism" theory is a specific version of general principles expected to apply to any evolving phenomenon, whatever its nature.[3] In particular, these principles should apply to both biological and cultural evolution. In the second section, we shall analyse the different principles that have been suggested to characterise cultural evolution: principles of population thinking, heritability and selection and reproduction.

Darwinian principles can be used to understand both some general properties of human behaviour and how culture, which also influences human behaviour, evolves. In the third section, we shall present cultural epidemiology as a Darwinian theory that derives both from biological Darwinism as applied to humans and from universal Darwinism as applied to culture.

[2] For further discussion on adaptation, see Grandcolas' chapter, Chap. 5, this volume. For a discussion of adaptationism within psychological theories, please see Downes' chapter, Chap. 31, this volume.

[3] Please also see Huneman's chapter, Chap. 4, this volume, on that topic.

1 What Biological Darwinism Has to Say About Human Behaviour

One of the most revolutionary statements of Darwinism, at least when Darwin published the Origin of Species (1859), was that Man himself was a production of biological evolution. This statement, more than any other, deeply disturbed civil society and may still be at the root of some people's wariness towards the theory of evolution. However, one could consider that this statement is interesting, not because it caused Man to step down from its privileged status in western thinking, but rather because it opened the door to some new scientific investigations on human behaviour. Indeed, Darwinism can be used as a tool to analyse biological functions and anatomy, but also to analyse behaviour as a biological phenomenon. How can behaviour be considered a biological phenomenon? Firstly, because any organism's behaviour is produced as a result of biological mechanisms; secondly, and quite importantly, because behaviour is subject to selection.[4] An animal that flees to escape its predators is more likely to survive than an animal that lets itself be eaten with no reaction – this is a behavioural difference. The literature in ethology exemplifies many mechanisms producing adaptive behaviours. Similarly, which human behaviours can be considered to have an adaptive value? How can adaptationism be used in the behavioural sciences? Different answers have been proposed to these questions in a Darwinian framework: human ethology, human sociobiology, human behavioural ecology and evolutionary psychology are all research programmes that try to enrich studies on human behaviour with insights from evolutionary biology.[5] Each of these programmes has a specific focus, specific methodology and specific scientific history. In this section, we detail how these approaches use Darwinism, both from the methodological and theoretical points of view, to study human behaviour, including when such behaviour can be found only in some communities and not others – i.e. when it is cultural behaviour.

1.1 Fitness Maximisation and Human Behaviour

The most straightforward way of using biological Darwinism to study human behaviour is to analyse how and how much a given behaviour increases inclusive fitness. Inclusive fitness is a measure that takes into account not only individuals' reproductive success, but also their success in multiplying their genes through other bearers of the same genes. This involves their own survival and reproduction but also the ability to improve their relatives' reproduction.[6]

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[4] That is to say that behaviour has an impact on reproduction. The fact that some organisms manage a greater reproductive e[illegible]y allows biological evolution to take place.

[5] See Downes, Chap. 31 [illegible]olume.

[6] See Christine Clavien' chapter: Chap. 34, this volume.

This Darwinian approach thus posits that any behaviour that favours the multiplication of the individual's and his relatives' genes should, ceteris paribus, evolve through natural selection.

We consider that the behaviour of non-human animals results from natural selection and, as such, tends to maximise the organism's inclusive fitness: this paradigm enables the analysis of behaviours such as how a bird sings, builds its nest and feeds its offspring as ways to increase fitness in a given environment. We can apply that same paradigm to human behaviour. Human sociobiology focuses on the functional aspects of strategies underlying human behaviour. It also underlines how natural selection operates on behaviours involved in same- species interactions: mating strategies, parental investment, etc. Human behavioural ecology has a similar programme – it will question to what extent a type of behaviour increases inclusive fitness – , but it relies more on field studies. For instance, Smith (1985) studied how an Inuit hunter makes choices that allow him to maximise the amount of calories he brings back home without risking his life too much. In particular, Smith asked the question of the optimal number of hunters: knowing that any catch will be shared between the hunters, does the catch grow enough in proportion to the number of hunters hunting together? This of course depends on the type of hunting. Smith calculates that for a given method of hunting, three hunters is the optimal number to maximise the quantity of meat per hunter. However, he observes that Inuit hunters generally hunt in larger groups. The adaptationist analysis suggests that there must be other pressures to justify this strategy. Smith shows that there is such a pressure: in terms of meat gain, it's in a hunter's best interest to join a group larger than three rather than to go alone. For the rest of the group, welcoming a new member will of course negatively impact the quantity of meat that they can bring back home, but this cost is lower than the social cost incurred by refusing the new hunter (e.g. community's blame or shortfall for future collaboration). Hunters have a social interest in accepting the supplementary hunter in their group.

Analysing behaviour in terms of the maximisation of inclusive fitness can also be applied to wedding strategies or to how many children individuals choose to have (the idea being that one should not only maximise one's number of children but also their ability to have children themselves). A key aspect of these analyses is that they enable the understanding of cultural differences in terms of adaptive strategies: maximising inclusive fitness should lead to different behaviours or strategies in different environments. For instance, dressing hot in cold parts of the world. Less obviously, polyandry in Tibet can be explained as an adaptive strategy in a situation where arable land is scarce and each patch is fully inherited by the eldest (Crook and Crook 1988).

These analyses make the hypothesis that humans can choose behaviours that are specifically adapted to their inhabited environment. They can adapt to a wide variety of environments. However, they do not detail the kind of mechanism underlying such an ability to adapt. Critics point out that without specifying the causes of behaviours, one cannot posit that they maximise inclusive fitness whatever the environment's characteristics. Those critics generally belong to two Darwinian traditions.

Darwinism applied to cultural evolution (cf. Sects. 1.3 and 2 of this chapter) focuses on beliefs and cultural practices as independent causes of behaviour. But even if some beliefs can result in adapted behaviour, as is the case, for instance, with technical knowledge, many cultural beliefs will result in behaviour that may be hard to reconcile with the maximisation of inclusive fitness – one could think of priests' celibacy for instance. This raises a difficulty for the paradigm spelled out above.

Evolutionary psychologists offer a second criticism: they suggest that the adaptationist analysis should be applied to cognitive mechanisms that have evolved to produce adapted behaviour in an ancestral environment. This theory posits that the current environment might sometimes be so different from the one in which our psychological mechanisms have evolved that there is no reason to believe that these same mechanisms should produce behaviours adapted to a modern environment. Evolutionary psychology underlines that biological evolution is applied *within this ancestral environment* to psychological mechanisms and properties. From this perspective, adaptationism sheds light on human psychology and, indirectly, on human behaviour, but the analysis of fitness maximisation should thus be carried out as relative to the ancestral environment rather than relative to the current one. Such a position faces new methodological challenges, since the ancestral environment cannot be directly observed, but it allows avoiding some pitfalls resulting from what one could consider a "naïve" approach to adaptationism.[7] Tooby and Cosmides (1992) suggest that cultural diversity can be explained in a large part not from the ability of humans to accommodate various environments, but rather because shared cognitive mechanisms throughout the human species result in different behaviours depending on the input each environment provides. This is what they call "evoked culture".

1.2 *The Biological Evolution of Social Transmission Mechanisms*

One area of research in evolutionary psychology lies in determining which cognitive capacities allowed humans to behaviourally differ from other species. Researchers acknowledge that humans have culture in a way that no other species has, and they wonder about the psychological capacities underlying such a trait. Which specifically human abilities allow cultural transmission? Why did this ability evolve?

The most common answer is that the ability to acquire knowledge and know-hows through conspecifics evolved because it allows agents to benefit from that knowledge and know-hows without having to pay the cost of discovering them by themselves. Cultures build up through knowledge and practice transmission, which is made possible by the ability to learn. According to Boyd and Richerson (2005), human choices guide evolution in a direction that most often proves biologically

[7] For a more detailed analysis, see the chapters on evolutionary psychology in this volume.

beneficial to humans. The evolutionary process also allows knowledge to accumulate and get more complex through transmission cycles. Boyd and Richerson give the example of kayaks, which are a complex artefact. Kayak-building requires a high level of technical knowledge, which cannot be acquired by only one man:

> People are smart but individual humans can't learn how to live in the Arctic, the Kalahari or anywhere else. Think about being plunked down on an Arctic beach with a pile of driftwood and seal skins and trying to make a kayak. You already know a lot'- what a kayak looks like, roughly how big it is, and something about its construction. Nonetheless, you would almost certainly fail (We're not trying dis you; we've read a lot about kayak construction, and we'd at best make a poor specimen, without doubt). Even if you could make a passable kayak, you'd still have a dozen or so similar tools to master before you could make a contribution to the Inuit economy. (Richerson and Boyd 2005, p. 130)

Kayaks are so efficient because they result from the progressive selection of micro-alterations that enhanced their efficacy. This progressive enhancement of cultural elements, resulting from individual choices, allows humans to colonise new and widely varied environments. For those supporting the gene-culture co-evolution theory, which states that both genetic and cultural evolutions result mainly from Darwinian selection, the ability to produce and contribute to cultural phenomena is a biological adaptation: culture is the means human use to adapt to very different environments. Boyd and Richerson note that saying that culture is a biological adaptation does not mean that culture *always* evolves towards the biological benefit of humans, as socio-biologists and behavioural ecologists suggest. For Boyd and Richerson, quite the opposite may happen: natural selection selected very general psychological biases that sometimes lead individual to make the wrong choice from a biological standpoint. They suggest that this explains the birth rate decline seen in Western countries: if individuals aim at reaching a high social status and this means dedicating an important part of their energy and time to it, then this preference may lead to a lower birth rate (Boyd and Richerson 2005). Thus, cultural evolution does not result from biological evolution only: it is also partially independent, and sometimes even in conflict with the latter. Interactions between both evolutionary systems should be articulated with a gene-culture co-evolutionary theory.

Whether culture has adaptive consequences or not, cognitive mechanisms allowing cultural transmission must have a genetic basis that is at least partially human-specific: non-human animals do not develop cultural traditions as substantial as human ones. It follows that cultural transmission mechanisms were selected by natural selection and probably have an adaptive value. However, describing these mechanisms is far from being a consensual issue. For instance, Tomasello (1999) suggests that shared attention, between two individuals and towards a third object, is the most important difference between humans and other primates. It is shared attention, itself resulting from the ability to imitate, that ultimately allows cultural transmission. In contrast, Gergely and Csibra (2006) suggest that human communication is based on cognitive mechanisms leading the listener to abstract the generalisable and referential content from communicative behaviour. These mechanisms are human-specific and allow

the transmission of relevant information during social interaction. Csibra and Gergely (2009) suggest that they are an adaptation to the need for transmitting know-hows and techniques that increase and become more and complex and that they are enabling cultural transmission.

Benefiting from cultural knowledge without paying the cost of learning is advantageous. But in a community, adaptive knowledge (i.e. those that allow the knower to enhance their inclusive fitness) can be unequally distributed between individuals. How should one choose whom to believe, and whom to imitate? Quite often choices have to be made while the adaptive value of beliefs and practices remains hard to figure out. Boyd and Richerson suggest that acquiring cultural transmission capacities leads selective biases of the information source to evolve (Boyd and Richerson 1985, 2005). According to these authors, some cognitive biases evolved through natural selection in a variable environment, either spatially or temporally, to facilitate individuals' choices when in doubt.

The *prestige bias* is when individuals choose the behaviour of prestigious individuals among several alternatives. If you learn to play soccer, you may want to adopt Zidane's style to boost your performance. The prestige bias generally leads to adopt adaptive behaviours, since their behaviour (for instance the way they play) most likely contributed to people's success, which in turn is probably why they are prestigious. However, the prestige bias may also lead to adopt those behaviours that *did not* contribute to people's success. For instance, one may be tempted to adopt Zidane's haircut because of the prestige bias. Behaviours are not copied based on their efficacy, but rather based on the level of prestige of those who display them.

Boyd and Richerson also define another evolved bias to make a better and less costly choice of whom to imitate: the *conformity bias*. This bias depends on the relative frequency of cultural elements (Boyd and Richerson 1985). Imagine you land in a country where you have never been before, India for instance, and you observe at the restaurant that 70 % of people eat using their right hand, while only 30 % eat using a knife and fork. If the conformity bias applies, the probability that you decide to eat with your right hand should be more than 0.7, i.e. higher that the frequency of the most frequent behaviour. The conformity bias strengthens a trend already present and decreases behavioural variability. The initial choice of the strengthened trend (for instance eating with your right hand) may be completely arbitrary. The conformity bias may be responsible for maintaining cultural differences between populations (Boyd and Richerson 1985; Richerson and Boyd 2005).

Both the conformity bias and the prestige bias rely on the same general principles: when in doubt, the frequency of a behaviour or the fact that it is used by a successful individual may be clues to its usefulness and its adequacy to the environment. Quite often, the effects of these source-dependant biases are adaptive, but they can also result in maladaptation. If your favourite rock singer abuses drugs, you may be tempted to imitate him due to the prestige bias.

1.3 Conclusion: The Multiple Uses of Adaptationism

What can the evolutionary history of species tell us about human behaviour and its cultural variations? Theories of human behaviour can benefit from our knowledge of biological evolution and natural selection. The most commonly used tool to analyse behaviour within an evolutionary perspective is adaptationism: the idea is to understand how a behaviour or its underlying causes may have contributed to the reproductive success. Answering this question calls upon the theory of evolution, which provides new conceptual tools to analyse human behaviour, in particular the maximisation of inclusive fitness and the biological function of psychological mechanisms.

From this starting point in a research programme, one can derive many subtleties. Amongst the most important are:

1. Maximising fitness always entails compromise with multiple environmental constraints – thus, the analysis of the contribution of each behavioural choice to fitness must take into account the multiple environmental dimensions (for instance: one would rather hunt in a group of three than a group of four, but the cost of refusing an additional participant may limit future collaboration opportunities)
2. The selection process favours a gene's distribution not only if that gene contributes to the survival and the reproductive success of its bearer, but also if it allows other individuals that may bear the same gene to survive and reproduce (e.g. parental investment)
3. Adaptation, which is a key concept in evolutionary analysis, may be used at different levels:
   (a) At the behavioural level: a behaviour may be adaptive or not (sociobiology, behavioural human ecology)
   (b) At the psychological level: psychology evolved to produce behaviour adapted to an environment that might differ from our contemporary environment and nonetheless underlie contemporary behaviour (evolutionary psychology)
   (c) At the learning mechanisms level: in particular, social learning mechanisms for which one can specify adaptive value and that determine which beliefs are held and which know-hows are learned and, in turn, underlie behaviour.

Moreover, the evolution of social transmission abilities gives rise to another evolutionary process: cultural evolution. In the following section, we describe various approaches that rely on Darwinian-inspired thinking to explain cultural evolution.

2 Darwinism Applied to Cultural Evolution

When thinking about cultural evolution, it may be useful to distinguish between two different uses of Darwinism. The literal use refers to biological Darwinism, as applied to human behaviour. This was the subject of the previous section.

The metaphorical one suggests that biological evolution can be used to understand how and why cultural phenomena change or persist. Both uses tie in, since they both call on Darwinism to explain human behaviour and cultural phenomena. For some (Dennett 1995), both uses are in fact the application of the same principles depending on where the information is represented, i.e. in genes or in brains. Genetic or neural structures are merely different media through which Darwinian evolution occurs – This is called Universal Darwinism. However, within human science, there is a tension between biological Darwinism and cultural Darwinism: each approach may be tempted to give more behavioural explanatory value either to biological constraints or to the effects of cultural transmission. To explain this tension we will first describe, in this section, theories which use some Darwinian principle to explain cultural evolution: the theory of cultural epidemiology, double inheritance theory and memetic. We will show that the metaphorical use of Darwinism may underestimate the contribution of biological Darwinism in understanding human behaviour and culture. In the third section, we will show how cultural epidemiology solves this tension.

2.1 Using Populational Thinking to Characterise Culture

2.1.1 Populational Thinking in Biology

Mayr was the first to suggest that the most important contribution of Darwin was not the principle of natural selection, but the replacement of essentialist thinking by populational thinking (Mayr 1959). According to the essentialists, individuals of the same species are similar to each other because they all tend to develop toward the same end state (termed natural state). According to this explanation, in the absence of perturbing forces, if the conditions are ideal, all individuals of a species are exactly the same. But random events disrupt the normal development of individuals. Darwinian thinking is not based on an essentialist model. He considers that the variation between individuals is a necessary constituent of species and the process of natural selection. Differences between individuals are no longer perceived as deviations from an ideal natural state, but as essential to the evolutionary process. Evolution, according to Darwin, proceeds at the population level, not at the individual one, and it is for this reason that Mayr use the terms "population thinking" to refer to this type of evolutionary thinking.

2.1.2 Populational Thinking in Social Science

The purpose of a populational approach to culture is to analyse cultural items (religious rituals, moral behaviour, storytelling, etc.) by using the distribution of micro-events in a population. The idea is to shed light on causal chains

involving individuals, their actions and the cognitive processes underlying cultural and social phenomena (Sperber 1996, 2001). Cultural populational theories characterise cultural phenomena as the distributions of cultural items within communities and their habitat. Cultural items may be ideas, know-hows, behaviours or artefacts that occur frequently within a community and result from social processes.

The idea of a unique god, playing football or the four-prong fork are all cultural items (an idea, a behaviour and a cultural artefact, respectively).

Following the populational approach to culture, an item is cultural only if it results from a social process. Yawning when tired does not result from a social process, but rather from individual biological processes, such as digestion and sleep. However, putting your hand over your mouth when yawning is a cultural practice, since it results from a social process appealing to good manners. Most social processes do not generate cultural phenomena. Most gossip, for instance, will stay within our circle of closest acquaintances; the distribution of the ideas communicated is limited to a few people and these ideas will not persist. Some gossip, however, is shared by everyone and thus become cultural: that involving Nicolas Sarkozy in France, for instance. There is a continuum starting from local social phenomena, such as gossip involving family members, to cultural phenomena, which are nothing but extensions of the same social interactions – such as gossiping – reproduced on a large scale. In other words, items resulting from social processes can be more or less cultural depending on their impact in the population. Wine, for instance, is strongly cultural in France, but is only weakly cultural in India as only a minority of people are interested in this product.

This populational characterisation of culture is operational: it allows a Darwinian analysis of cultural phenomena, which aims at understanding why some items become or stay largely distributed while others do not. For instance, why is the Hop-o'-My-Thumb known by virtually all French people? Why have people not ceased telling it, since the seventeenth century? Answering these questions amounts to finding the factors that make the difference between a story told only a few times and known to a few people and a story, like Hop-o'-My- Thumb, that will be told to children for generations. Studying cultural evolution explains why a cultural item remains stable or becomes more or less frequent.

This research programme is both historical and empirical in that it focuses on particular cultural items and their evolution in a given place and time, as well as theoretical, in that it looks for general principles resulting in the recurrent involvement of some items in social processes. The populational characterisation of culture enables the description of cultural evolution as a temporal change in the frequency of cultural items, in the same way that Darwinian theories describe a temporal change in the frequency of genes or traits. Is it possible to go further in the Darwinian analysis of cultural evolution? We could indeed hypothesise that a process of selection of cultural items exists. This in turn would explain why some items become more or less frequent than others.

2.2 *Selecting Cultural Items*

2.2.1 Natural Selection in Biology

Darwin is well known for his discovery of the principle of natural selection. Natural selection relies on three necessary and sufficient conditions, as described by Lewontin (1970):

> As seen by present-day evolutionists, Darwin's scheme embodies three principles:
> Different individuals in a population have different morphologies, physiologies, and behaviours
> (phenotypic variation).
> Different phenotypes have different rates of survival and reproduction in different environments
> (differential fitness).
> There is a correlation between parents and offspring in the contribution of each to future generations
> (fitness is heritable).
> These three principles embody the principle of evolution by natural selection. (Lewontin 1970)

One should note that these conditions do not in any way constrain the mechanisms responsible for the variation and heredity. The philosopher Dennett (1995) evokes the "Darwinian algorithm", underlying that this is a formal procedure, which has no link to any specific object or mechanism. At this level of abstraction, nowhere in the Darwinian theory is it specified what exactly it is that evolves: it could be genetic evolution, epigenetic evolution (heritable cellular factors that are not encoded in the DNA sequence), or cultural evolution (Jablonka and Lamb 2005). There is no specification either of the level at which evolution is at work: it could be at the molecular, cellular, individual, group, population or species levels (Lewontin 1970). The theory only formulates that if those three conditions are met, then the process of natural selection can operate, but nothing tells us whether this process is particularly important or simply an accessory to evolution. This may explain why natural selection was only recognised in the 1930s as the driving force in the evolution of organisms. The recognition came when researchers linked discoveries in genetics on heritability to the Darwinian theory, which resulted in the "evolutionary synthesis". These discoveries showed that the heritability of traits relied on elementary molecules: genes. By linking the very general principle of natural selection to the biological mechanisms of heredity, the evolutionary synthesis created an operational version of Darwinism with wide implications.

We will call this version, at the heart of population genetics models, selectionist Darwinism.[8]

[8] For further details please refer to the chapters on selection and heritability in this volume.

2.2.2 Natural Selection in Culture

Many evolutionists think that natural selection is a fundamental mechanism in the cultural domain and that cultural evolution and biological evolution derive from identical principles. For instance, Mesoudi et al. (2004) state that if cultural items are inherited, variable and compete with each other, then it follows that cultural evolution is Darwinian. They argue the following: if natural selection operating on cultural items exists, then cultural evolution is basically Darwinian.

Boyd and Richerson (1985, 2005) argue that the natural selection of cultural items partly derives from individual choices. For instance, we tend to imitate prestigious people or to adopt frequent items (cf. Sect. 1.3). All things being equal, if an element is frequent, people will more readily adopt it, and it will propagate faster than alternate choices, which will progressively disappear. Cultural selection differs from biological selection because there are specific constraints that play a role in cultural evolution. For instance, the conformist or prestige biases do not have an equivalent in biology, but they do constitute "evolutionary forces" in cultural evolution: they contribute to the selection process.

It is quite exciting to think that there are psychological mechanisms resulting in the selection of cultural items. However, both in the cultural and biological domain, the effects of selection at the population level depend on heritability (Eigen 1971; Williams 1966). In biology, traits of heritability are guaranteed by the replication of genetic material. But in the cultural domain, one could wonder which mechanisms are responsible for the transmission of cultural items and whether they comply with the conditions that allow cultural selection to be efficient. Memetics is a theory of cultural evolution that states that imitation indeed enables the reliable replication of cultural items. Memetics goes a step further in the analogy between cultural and biological evolution.

2.3 *Memes Are Cultural Replicators*

2.3.1 Replicators' Theory in Biology

Replicators' theory, as synthesised by Dawkins (1976) is a popular version of the theory of evolution. Dawkins explains that genes are the fundamental unit of evolution, because they are the only items stable enough to be selected. Other units, like organisms, groups or species, only exist transiently and as such cannot be submitted to natural selection. Genes are stable, not because of their thermodynamic properties like other molecular constructions, but because they replicate: they produce very high fidelity copies of themselves. In Dawkin's opinion, this is how natural selection, and thus evolution, begins:

> At some point a particularly remarkable molecule was formed by accident. We will call it the Replicator. It may not necessarily have been the biggest or the most complex molecule around, but it had the extraordinary property of being able to create copies of itself. (Dawkins 1976 p. 15)

When replicators have different replication rates and compete for resources, those that replicate most often will cause the disappearance of others which replicate more slowly. This is natural selection. In the replicators' theory, evolution through natural selection can operate only if there is a new form of stability derived from the process of replication. This theory aims at defining which principles are required for Darwinian evolution to operate, factoring in the process of replication. It specifies two essential conditions for replication to result in natural selection: replication should be faithful and replication should be independent from the objects it operates on.

Replication is faithful The mutation rates of organisms may vary quite considerably: for instance some viruses have mutation rates as high as 10–2 while other organisms, like mammals, have very low mutation rates, close to 10–8 (Drake et al. 1998). At worst, the probability of a gene not being identically replicated is one out of a hundred. This high fidelity is essential for evolution by natural selection. Indeed, natural selection cannot operate if replication is not faithful. To understand this statement, let us imagine a gene G which, every time, produces ten copies of itself. If fidelity is high, most of G's copies are also G genes, and G genes remain present in the genes population. However, if gene G mutates so often that it only produces different genes, then G genes disappear in a few generations independently of any other constraints, and thus independently of selection processes. Consequently, a threshold mutation rate exists below which natural selection can operate and above which it does not affect evolution anymore.

Replication is independent of what it operates on. Replication cannot identify or transform a gene depending on its effects. If G is a gene providing a benefit and G* provokes a disease, no mechanism in the cell can recognise G* as a dysfunctional gene and suppress it or change it into G. G and G* are replicated in the same way, using the same enzymes. The disappearance of G* will be a consequence of selection rather than production processes.

If replicat necessary to Darwinian evolution, how does this apply to cultural evolution?

Dawkins and memeticians suggest that there are cultural replicators: they call them memes. Memes are to cultural evolution what genes are to biological evolution: fundamental units of evolution.

2.3.2 The Replicators' Theory Applied to Culture

In Dawkins' opinion, memes are patterns of cerebral activity that can be transmitted from brain to brain through communication (Dawkins 1976). Let's look at written stories, for instance. Dawkins suggests that a book is the phenotype of memes present in the writer's brain. Readers of the book acquire the writer's memes except when a mutation occurs, in this case either a writing mistake or an interpretation mistake. Different memes coming from different writers are transmitted through books with more or less success. Memes are therefore competing for transmission (through reading). What makes a meme more successful than another? There are multiple

reasons for one meme to reproduce more than others, the most pleasant or most shocking memes, for instance, should replicate more than their competitors, which would then disappear. People's memory is the environment in which the differential reproduction of memes operates. Thus, there is competition between memes for cognitive resources, which are limited in every individual by time, attention and memory capacities.

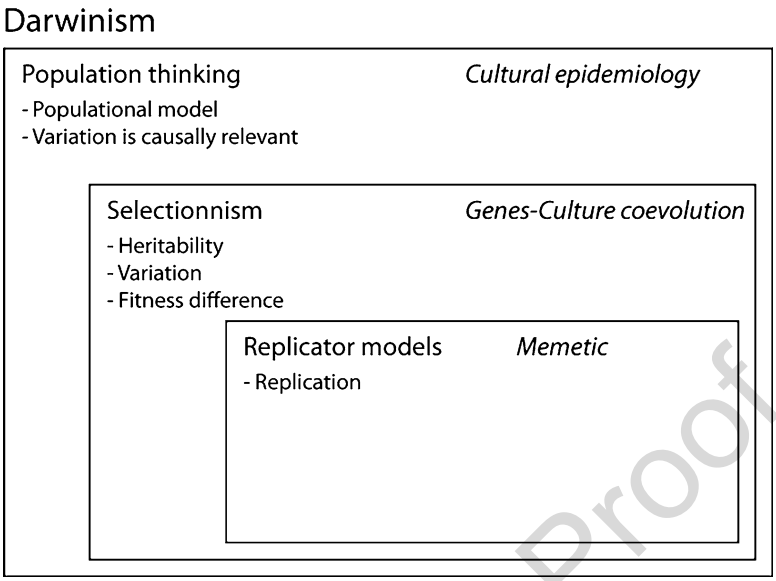
Dawkins developed the memetic theory in response to human sociobiology (Dawkins 1976). Indeed, Dawkins considers that genes are but an example of replicators (other examples include computer viruses or prions) and that the principles of Darwinian evolution will apply whenever a new replicator appears. The Darwinian theory of cultural evolution derived from the replicators' theory as described by Dawkins has had a wide progeny and sparked off many debates (Aunger 2002; Dennett 1995). Memetic is an original theory which combines replication as a diffusion mechanism and natural selection as an adaptive process to propose a very close analogy between cultural phenomena and biological phenomena: both eventually derive from similar principles, differing only in the units on which selection applies.

However, the concept of meme relies on the hypothesis that a psychological process exists which has similar properties to replication, i.e. high fidelity and independence from the replicated content. To prove that cultural replicators (memes) exist, one should demonstrate that such a psychological mechanism exists. In the next paragraph, we shall see that memeticians consider that human imitation provide the basis for this mechanism.

2.4 Conclusion: Types of Universal Darwinism and How They Apply to Theories of Culture

One can classify Darwinian theories of cultural evolution depending on which Darwinian principles they use. Cultural epidemiology relies on populational thinking: cultural evolution depends on changes in the distribution of cultural items. The dual inheritance theory requires both populational thinking and selectionism: cultural items are selected when each individual chooses to adopt a given cultural item. Memetics goes one step further by using the replicators' models: memeticians posit that there is a psychological mechanism allowing the faithful reproduction of cultural items, independently of what those items may be. We can use the following diagram to represent the relationships between the different theories (cf. Fig. 37.1).

Memetics is the theory that makes the strongest analogy between biological and cultural evolution: it supposes that both are in fact perfectly equivalent. The strength of this argument makes it easier to refute: the psychological mechanisms that memetics suppose exist do not in fact describe empirical observations well. In the next section, we will discuss the equivalence between imitation and replication and how this impacts memetics and the dual inheritance theory. We shall also present mechanisms other than natural selection that may explain the distribution of cultural items.



[AU5] **Fig. 37.1** Different Darwinian theories (*bold*) and their cultural evolution counterparts (*italics*) (Adapted from Godfrey-Smith 2007)

3 Why Do Cultural Elements Stabilise in Human Communities? 540 541

3.1 Combining and Integrating Darwinian Approaches 542

In the previous two sections, we have presented different ways to use Darwinism to explain human behaviour and its cultural aspects. The first way considers human behaviour to be the behaviour of evolved organisms and draws the consequences of this fact. The second way considers human behaviour to be partially determined by cultural ideas and practices that have evolved in a Darwinian sense (i.e. one of the three senses mentioned above). We called literal Darwinism or biological Darwinism the first application of Darwinian theory, and metaphorical Darwinism or Universal Darwinism the second application. An important tension exists between the two types of research programmes in the human science: each programme can be tempted, when explaining human behaviour, to give an exclusive explanatory role to either the biological constraints operating on evolved organisms, or to the effects of cultural transmission and evolution on human behaviour. In particular, some works in evolutionary psychology tend to reduce cultural phenomena and their diversity to the simple result of evolved cognitive mechanisms operating in diverse environments. This underestimates the role of cultural transmission. Conversely, some evolutionary approaches to culture have a tendency to underestimate biological constraints in 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558

cultural evolution, assuming that humans will be nothing but substrates for memes to reproduce. Cultural transmission is then thought of as a process that depends little on the biological constraints. In this section we will show that human cognition– as constrained by biological evolution– participates in the production of cultural items.

Is it necessary to choose between cultural transmission and biological evolution in order to explain human behaviour? For Dawkins, memes determine human behaviour and can, in some cases, render the biological determinants of behaviour inoperative. Admittedly, the tensions between theories of cultural evolution and theories of the biological evolution of human psychology sometimes have counterparts in the real world: think about biologically determined drives towards having sex and the cultural transmission of the practice of celibacy or the drive to eat greasy and sweet food and the cultural transmission of ideas regulating food consumption (e.g. ideas about healthy diets). A central work, however, consists in showing how social transmission and the biologically evolved characteristics of humans actually *combine* to yield cultural phenomena. Human behaviour can be analysed as the behaviour of evolved organisms taking part in culture. In this section, we advance a resolution of the tension between theories of literal Darwinism and metaphorical Darwinism: it is the one offered by cultural epidemiology.

To be honest, proponents of the approaches of human behaviour described in the two previous sections are all sensitive to both types of Darwinism; they all consider both what cultural transmission and biological evolution can reveal about the principles at work in human behaviour and cultural diversity. Nonetheless, the theories can differ on the properties they ascribe to human nature, on the principles of cultural evolution, on the methodology or on the emphasis. For instance, behavioural ecology recognises, as does evolutionary psychology, that behaviours result from evolved cognitive mechanisms, but the former insists on the primacy of the fitness maxima analysis, while for the latter, the analysis applies only to behaviour as they were produced in the ancestral environment of evolutionary adaptedness. Evolutionary psychology recognises, as does cultural epidemiology, that cultural phenomena can result from social transmission, but its proponents nonetheless abstract social transmission for studying cultural behaviour which result only from variation in the environment (i.e. as if this environment were void of communicative stimuli). The issue is that the theoretical frameworks of these approaches lead one to focus on one dimension only to explain human behaviour; they consequently get stuck in an over-simplistic dichotomy between cultural determinism and genetic determinism. They fail, in practice, to account for the multiple determining factors issued more or less directly from genetic constraints and from environmental input which have been more or less influenced by human actions. Learned skills, for instance, result from both genetically determined learning capacities and from environmental inputs. The environment includes intentionally transmitted information, but also human built affordances that directly influence behaviour– hand knobs for instance. It includes things such as dogs and seedless grapes that are difficult to categorise in a culture-versus-nature dichotomy. The origins of the constraints on behaviour are very much *mixed*: their production is often due to both human activity and non-human causal factors.

Our contention is the following: in order to integrate the multiple factors coming from mixed constraints into an account of behaviour and culture, it is necessary to renounce some Darwinian principles – viz. selection and reproduction, but not population thinking – and to specify the role of biological Darwinism in the analysis of social transmission chains. It is what cultural epidemiology enables.

3.2 Cultural Transmission and Imitation

For the selectionist model of cultural evolution to be implemented, cultural entities must be 'inherited' in a sufficiently faithful way, and this independently of their content or material properties. Two theses can account for the transmission of cultural entities in such a way:

(a) the strong thesis: a mechanism exists that replicates cultural items; it is a cognitive mechanism: imitation in the strict sense of the term (c.f. Sect. 2.3).
(b) the modest thesis: cultural transmission happens to be, whatever the underlying mechanisms, such that cultural features are inherited/reproduced. The term imitation is still used, but with a broader sense (c.f. Sect. 2.2).

Proponents of memetics defend the strong thesis. Proponents of dual inheritance theory adopt the modest thesis. Cultural epidemiology rejects both of theses: imitation, whether in the strict or broad sense, is not a good explanation for cultural stability. Cultural transmission is to be studied as resulting from evolved cognitive mechanisms whose function and effects are not content independent reproduction.

Most of the time cultural transmission is dependent on the content of what is transmitted and most of the time results in low fidelity re-production. During social transmission, representations are generally transformed in the causal transmission chain, which involve multiple constructive processes. The processes are constructive not only in the sense that they construct a new item, but also in the sense that they enrich and select characteristics of the initial stimuli. They are rich in inferences. Instead of a black boxed causal chain where a cultural item is replicated, the detailed causal chain involves a cultural item which, when perceived, provides an input to human cognition and triggers multiple inferences that produce mental representations. One of them might constitute, by itself, a cultural item such as a religious belief. The produced representations might also form cognitive elements on the basis of which a cultural public production is produced. The public production can be, for instance, a ritual, an utterance, or an artefact such as a tool. The construe tive processes might be implemented by evolved cognitive abilities, or by abilities that have been learned on the basis of evolved cognitive abilities. Evolved cognitive mechanisms constitute psychological factors that sometimes lead to the production of cultural phenomena not because they enable faithful copies of the input, but because the constructive processes involved in the transmission will tend to reproduce copies similar to some ideal type cultural entity – called an attractor. The form of the attractor, we will argue, is determined by the properties of the cognitive

mechanisms, which are shared in the community because of human specific and environmental factors (c.f. Sect. 3.3). We argue below that selectionist theories of culture do not take into account the effects of cognitive constructive processes at the population level. They thus underestimate the necessary role of literal Darwinism in the study of cultural transmission.

3.2.1 Cultural Transmission Cannot Be Reduced to the Operation of an Imitation Mechanism

Cultural transmission relies on multiple mechanisms and modalities. For instance, the 'imitation' of a dance step and the learning of one's mother tongue rely on specific capacities, psychomotor and linguistic capacities respectively. These capacities are not just enabling conditions, they constitute re-producing operations. Learning a language is a salient example because it has been shown that the cognitive mechanisms put to work cannot be just those of imitation: from a relatively small number of sentences heard, the child is able to learn a syntax, but this syntax cannot be abstracted from the finite number of heard sentences. The syntax is therefore learned not just on the basis of heard sentences, but also thanks to the constraints and inferences of the language learning capacities, which predate learning events (this is Chomsky's underdetermination argument, see Pinker 2000). Given the importance of the role of these constraints and inferences for linguistic behaviour, we can assert that the cultural transmission of natural languages is, to a significant extent, determined by the cognitive constructive mechanisms instantiated by innate, evolved, cognitive capacities. The case of syntax can be generalised to other cases of cultural transmission, which always involve specific cognitive capacities triggered by cultural input of a given type and then put to work in the re-reproduction of a cultural item of the same type. Learning a dance step – our second example – , involves psychomotor capacities, an initial understanding of space and its properties, a sensitivity to music and rhythm and some artistic sense: these will determine the production of the student as well as the perception of the teacher's step. In spite of the fact that this case of learning event explicitly involves imitation – the student is explicitly asked to do the same as the teacher – the success of the student is measured not so much by the faithfulness of his/her reproduction as by the artistic value of the movement. The student is therefore asked to do much more than simply imitate, but at the same time, also much less, as many aspects of the teacher's movements can and should be ignored.

The psychological mechanisms used in cultural transmission are constructive: they involve numerous psychological processes that transform mental representations in such a way that the initial cultural input is rarely faithfully reproduced. Someone contemplating a painting, for instance, forms a representation of this painting. But this representation is not a mere projection of the painting. It is a mental image that is transformed by the mechanisms of vision, memory, attention, and, probably, emotion. Attention guides what the viewer sees and looks at and is not necessarily equivalent to the visual scenery entering the eye (Simons and Levin 1997). The memorised

representation of the painting will also change with time: many details will fade away while others will become more salient. What the painter transmits is therefore different from a mental image of his painting. Social transmission generally involves such interpretative mechanisms; art is the archetype of cultural productions that generate rich and multiple interpretative representations.

Social transmission is, to a great extent, a matter of communication. People do not generally communicate so that people memorise what has been uttered; they communicate so that the audience forms relevant beliefs. The audience, in doing so, interprets the utterance through specific cognitive mechanisms (Sperber and Wilson 1986). More generally, inputs presented in a communicative context are not processed in the same way as inputs occurring in a non-communicative context (Csibra and Gergely 2009).

3.2.2 Imitation as an Observed Phenomenon Does Not Account for the Production of Cultural Phenomena

Without any cognitive mechanism dedicated to imitation, or to the faithful replication of cultural items, the analogy with genetic reproduction breaks down. It remains, however, that a sufficient heritability of cultural items might be realised by means of the multiple human cognitive capacities. Is there such a heritability warranting the selectionist model? For that to be the case, the only requirement, noted Boyd and Richerson (2000, p. 158) is that "culture constitute a system of heritable variations". In order to have a cultural phenomenon, one must indeed have a distribution of mental representations, practices or artefacts that are sufficiently similar between them. For a tale to become popular, it must be told again and again in a sufficiently similar way. For a clothing fashion to be installed, there must be a sufficient number of people dressing in a sufficiently similar way. How is the similarity obtained? The traditional idea is that the similarity is obtained because, during cultural transmission, the essential characteristics of the initial token are transmitted to the new produced token. There does not need to be a single cognitive mechanism producing resembling items, but the effect is there: the new token inherits the essential characteristics from the first token. We obtain imitation in the broad sense, and the fact that the processes are unspecified is not a problem for the selectionist theory of cultural evolution: note that Darwin managed to develop his selectionist theory for biological evolution with no knowledge of the mechanisms of biological reproduction. What is important is that imitation (in the broad sense) produces a multiplication of tokens of the same type, upon which selection can occur.

An important counter-argument against the selectionist theory of cultural evolution is that imitation, even in a broad sense, has been observed empirically to be too low in fidelity to enable selection: this observation is grounded on the empirical observation that humans are not that good at imitating; they most often change, if only minimally, the behaviour which is to be copied. These changes add up in transmission chains and consequently lead to a series of drifts, rather than to the stabilisation of

cultural items. Because imitation is of too low a fidelity, one must find other causes for the stability of cultural items in communities. Imitation cannot explain the existence of cultural phenomena.

Against the above counter-argument, Henrich, Boyd and Richerson (2008) argue that it is possible to have cultural phenomena arising through low fidelity imitation, provided that people tend to imitate the most common cultural items (conformity bias) and the cultural items produced by the most prestigious individuals (prestige bias). They built a mathematical model with low fidelity imitation and conformity and obtain the stabilisation of cultural items.

Asserting that heritability, and thus imitation in the broad sense, is the source of cultural phenomena means that the characteristics of cultural elements are produced because they were present in the initial imitated input. Consequently, the characteristics of cultural items do not depend on constructive cognitive processes. It is therefore possible to do an analysis of cultural phenomena without peering into these constructive cognitive processes. It is at the selection level, by specifying the differential success of cultural items, that cultural phenomena can be explained. Dual inheritance theory stands on this basis and applies selectionist models drawn from population genetics to cultural evolution.

Cultural epidemiology, by contrast, claims that it is not possible to ignore the details of the cognitive constructive mechanisms that produce cultural items. This is because the characteristics of cultural items are not fully determined by those of the input. They are not fully inherited. They are, in part, determined by the cognitive constructive processes. What cultural phenomena there are is determined at the production rather than at the selection level. Let us consider the example of language again: the reason why it is important to take into consideration the role of evolved capacities for learning syntax is not just to emphasise the enabling role of these capacities, but also to specify how these capacities constrain learning and thus determine the form and content of what is learned. The syntax used by people depends, of course, on the syntax of the people from whom they learned their language, but also, to a significant extent, from human specific psychological properties: *in spite* of the diversity of input heard, people will end up using the same syntax because of the properties of their language learning capacities. Likewise with other cultural items: *in spite of* the diversity of cultural inputs, the cognitive constructive processes build cultural items that are similar to those of the same types. This happens when the cognitive constructive processes are implemented by cognitive capacities that are shared in the community. Evolved capacities are human specific and therefore shared. Learned capacities can also end up being similar in the community, if they have been learned by the members of this community; one cause of the similarity might be because of shared evolved capacities. In any case, the role of inheritance in cultural evolution is thus reduced, and the strength of selectionist models called into question.

The importance of the psychological phenomena in the production of a cultural item has a second consequence against the selectionist model: the model stands on the principle that variations are “blind,” i.e. independent of their future success. For the selectionist model in biology, phenotypical changes are due to blind variations,

which are then differentially reproduced via their genetic basis. The causes of phenotypic variations are genetic mutations and recombinations, which are independent of the adaptive value of the variations.[9]

In turn, the final distribution of phenotypes is due to the adaptive value of their characteristics, but not to the causes of their initial apparition. This is not necessarily the case in cultural evolution. In some cases the same mechanism can account for both the production of new cultural entities and their distribution. For instance, technological innovations are created in order to satisfy or create a demand, which itself constitute the success of the innovation: the idea that mobile phones facilitate communication is at the same time the motivation of the invention and one reason why people buy mobile phones and contribute to its cultural success. The invention of new stories can also be based on factors that will then contribute to their distribution. For instance, contemporary versions of Romeo and Juliet continue to exploit the aspects of the story that have contributed to the success of the initial story; but they will also attempt to be more relevant to our times. In West Side Stories, this is done by replacing the Montaigu and Capulet families of sixteenth century Italy with the Jets and the Shark bands of a New York district in the twentieth century. The renewed relevance of the story is at the same time a cause of the production of the cultural variation and a cause of its wide distribution in the community. This link between the causes of variation and the causes of stability is inconsistent with the principles of natural selection. Yet, guided variation can provide an alternative explanation to cultural stability.

3.3 *Psychological Factors of Distribution and Stabilisation of Cultural Entities*

Factors at work in cultural evolution are ecological or psychological. Ecological factors refer to the effects of the environment on the production of cultural entities. For instance, artefacts made in a community are made of materials available to the community. Ecological factors can have an effect on the means for social interaction: geographical proximity among individuals, for instance, enables communication with all sorts of stimuli (visual, sound, …); which is not the case with epistolar communication. New ICT also has an impact on the content and form of what is communicated.

Psychological factors are of two sorts: factors depending on the content of the cultural items and factors depending on the source producing the cultural item. Source based biases, for instance, can be the prestige and conformity biases mentioned above. Boyd and Richerson suggest that there are two "forces" that are content dependent: guided variation and content (selective) bias. The process of guided variation corresponds to the fact that individuals can modify and better a received

[9] This is the case in the standard models of population genetics used in dual inheritance theory. Subtler accounts of biological evolution are not relevant here because they have not been exploited by metaphorical Darwinisms.

cultural element before they transmit it. Wikipedia articles are a good example. Users of Wikipedia come to read an article and registered members can modify it at will. The modified article is then read and modified by other users. At some point the article reaches a relative stability: users do not find that they have to modify it– at least until some event motivates further changes. In this case cultural elements change via (1) the acquisition of previous elements, (2) modifications in a given direction, (3) transmission of the modified elements.

This process is different from the content-bias, which refers to the fact that individuals choose among existing cultural elements the one they prefer. Choosing to buy a CD instead of a vinyl record helps multiply CDs at the expense of vinyl and therefore creates cultural change. The content bias causes a progressive decrease in the diversity of cultural elements. The system continues to evolve only because the diversity of cultural elements is maintained through random forces or guided variations. In any case, guided variations and content biases stand on processes that depend on the characteristic of cultural elements: their beauty, simplicity, efficiency, etc.

For cultural epidemiologists, cultural phenomena arise mainly from forces that depend on the content. These forces include, they argue, all the effects of the cognitive mechanisms producing cultural items as output, on the basis of cultural items as input. The processes involved in social transmission are always constructive and the similarity and differences between cultural entities are to be explained with these constructive processes. This focus has two consequences:

1. recognising the determining role of cognitive mechanisms and therefore the role of biological evolution applied to human capacities (literal Darwinism, esp. evolutionary psychology)
2. the selectionist model of cultural evolution is replaced by "an attractor model"

We now turn to explaining this attractor model of cultural evolution.

3.3.1 The Attractor Model

One easily recognises when a tune is sang out of tune or in tune. A content-based selective bias will lead us to imitate those that sing in tune and help the propagation of that tune. Yet, another factor leading to the propagation of the same tune is a corrective mechanism: even when one hears the tune sang out of tune, one can recover and a good singer reproduces the "right" tune. In the process of memorising and reconstructing the tune, an ear for music (which is a psychological property) plays an important role. The consequence is that in spite of the diversity of music performance, the hearers will tend to reproduce a performance that is as close as they can to the ideal, in tune, musical performance. At the population level, performance will consequently tend to resemble the ideal one, which is a cultural attractor.

The attractor model consists in a recognition that there are cultural attractors and a formalisation of this fact in probabilistic terms: if an input resembles a cultural attractor, then the output is likely to resemble the attractor even more. With a metric for resemblance, the attractor model claims that the output of a social transmission

event is in the neighbourhood of the input; when the input is close to a cultural attractor, the probability that the output will get closer to the attractor is higher than the probability that it will get away from the attractor. Here is a made-up example of the evolutionary dynamics: a story is told about a friend who has gone to buy a car in Germany in order to bring it back in France. According to German rules, this person gets a car with provisory plates, which are written in red. The speaker says: "the French police arrest him 17 times and ask for his car documents in order to check that the plates are legal." In the story, the buyer is arrested exactly 17 times. If this story is told many times, the number can be transformed as follow:

- The number 17 is always memorised well by listeners, who then tell the story faithfully.
- The number 17 is transformed, increased by some, decreased by others. In this case, the similarity between the stories is not obtained and the case is not one of cultural stabilisation.
- The number 17 is transformed, but through some source-based content bias, the story that is told the most remains the one with the number 17. Supplementary assumptions are then needed: the most plausible is that most people do remember the number 17, which is then stabilised with the help of the conformity bias.
- The number 17 is transformed, but the transformations are such that they tend to use numbers close to 17. This is the attractor explanation.

What would make the last option plausible? Each time the story is told, the speaker will tend to maximise the relevance of his/her story (Sperber and Wilson 1985). Fifteen arrests, for instance, might be more plausible than 17, but speakers might have a slight tendency to exaggerate the number so as to make the story more amusing. The number 20 might still be plausible, but the fact that it is a round number makes it sound like an approximation, so 17 might be preferred because it gives the story an appearance of precision. A person hearing a story with 22 will probably decrease the number for the sake of plausibility. Each storyteller might use a different number, but the number told is not a random number. The number told by a storyteller will be in the proximity of the number she heard and will be plausible, striking, memorable and relevant. The number 17 is, in that made-up example, an attractor, because the value told tends to gravitate around this number. On the basis of such data, one can model attraction and make plausible hypotheses on the psychological and ecological factors of attraction. Distinguishing the attractor model and the selectionist model is important because of two reasons.

Firstly, the two models do not predict the same cultural evolution. In many specific cases, they will predict that different cultural elements will stabilise. Claidière and Sperber (2007) give a salient example of the different predictions with a model of the number of cigarettes smoked per day in a given population. The attractor model will integrate the biological factors at work when deciding to take a cigarette or not in order to locate the attractor, which will drive cultural evolution at the production level. The selection model can take these biological constraints into account, but only at the selection level. The two evolutionary dynamics consequently differ. In particular, the selection model will describe evolutionary paths that are more

dependent on the initial conditions and on historical contingencies, while the attractor model will lead to more robust stabilisations. The attractor model, in the cigarette case, also shows that stabilisation will be achieved more quickly in the attractor model, because it does not need generations to select out alternatives.

Secondly, the selection model and the attractor model stand on different psychological hypotheses. Because integrating psychology, especially evolutionary psychology, in the study of cultural evolution is really the main goal and achievement of cultural epidemiology, we come back once more to this point.

3.3.2 Cultural Transmission and Evolutionary Psychology

Our criticism of the selectionist theories of cultural evolution (memetics and dual inheritance theory) relies on the fact that constructive cognitive mechanisms transform the content of cultural items. The transformations are such that they tend to produce items resembling a kind of ideal type: the attractor.

Our examples of cognitive abilities involved in constructive processes have been the language learning ability and the ability to move in space and some artistic sense (the capacities involved in making artistic judgments). These capacities are cross-cultural. They are evolved human capacities. But we also mentioned that cognitive mechanisms and psychological properties which have a role on cultural production can result from learning and socialisation. For instance, scientists have a set of shared acquired knowledge through which they interpret new facts, discoveries and scientific ideas. Artistic sensibilities can also, to some extent, result from education (think of the differences in musical tastes across generations) as well as culinary tastes (think of it across close countries: the idea of eating snails, as the French do, disgusts the British). However, one still finds the biological basis of human behaviour down the causal chain of socialisation. Going down the causal chain enables one to specify a number of factors of cultural evolution that depend as much on genetic factors as on causes that are cultural or "natural". The relative role of genetic and cultural factors is not an all-or-nothing question, since humans are 'by nature' socialised at a young age. The social and cultural agent is not conceived as a blank slate, as a "meme machine" or as a means of reproduction of cultural items; it is conceived as a complex organism worth studying by evolutionary biology and psychology. It is an agent that is neither naively conceived as fully determined by his genetic make-up, nor radically conceived as the only product of enculturation. Using such an agent when explaining cultural phenomena is possible and fruitful: there is no opposition between well thought out biological Darwinism and the study of social, historical and cultural determination of human behaviour. Furthermore, the human environment is rarely free of past human intervention. In reality, therefore, the dichotomy between transmitted culture and evoked culture (see Sect. 1.1) is never realised: the causal chain leading to the production of a cultural item nearly always involves evolved capacities, antecedent human actions (tokens, artefacts or public representations, or other changes in the environment such as arable lands), and multiple aspects of the natural environment. In these affluent causal chains, it is

fruitful to focus on evolved cognitive abilities, because they are relatively unchanging causal factors and a determinant of the locus of cultural attractor.

Studies in cultural epidemiology (e.g. Atran 2002; Boyer 2001; Hirschfeld and Gelman 1994) have been able to track down the role of evolved cognitive properties in cultural evolution. Boyer, for instance, shows how religious beliefs can attract attention and be memorable by calling on our naïve (evolved) intuitions yet minimally contradicting some of them. These naïve intuitions include our expectations concerning solid objects (naïve mechanics) or beings with intentions (naïve psychology). A ghost, for instance, is an agent with desires and beliefs such as one can expect from any human being, but he can go through walls, which contradicts our intuitions concerning solid objects. Another typical example is the cultural production of masks, which is based on our specific capacity to recognise faces and their expressions (Sperber and Hirschfeld 2004). Another application to a traditional anthropological question is an analysis of kinship traditions as being maintained because of an evolved disposition to favour one's kin (Bloch and Sperber 2002).

4 Conclusion

The most popular Darwinian theories of human behaviour today might be memetics and sociobiology. These two theories are situated respectively at the two extremes of a scale of theories starting from genetic determinism and ending at cultural determinism of human behaviour. They have a tendency to oversimplify the analyses of the causal chains that constitute cultural phenomena, lead their evolutionary dynamics, and determine human behaviour. Dual inheritance theory has the explicit objective of accounting for both the biological and cultural causes of human choices. However, despite the fact that the theory recognises both types of causes, biological and socio-historical, it does not take into account how these two types of causes intermingle in transmission chains. The causes with a genetic origin are not only at work in the selection of cultural items, but also in the perception, interpretation and (re-)production of these items. The cognitive processes are the locus where genetic determination and socio-cultural determination are always present and always partial at the same time.

In order to give its fair share to biological Darwinism and to Darwinism in cultural evolution, we have shown that it is necessary to give some assumptions up: on the one hand, adaptationism can only be applied carefully to human behaviour, because biological selection operates only on genetic inheritance. But genes only indirectly determine human behaviour: one must therefore take into account environmental and social causes of cognitive development when explaining behaviour. On the other hand, the selection of cultural entities applies only in extreme and rare cases of cultural evolution. In most cases, the evolutionary dynamics for culture is determined by the existence of attractors, whose position depends on psychological and ecological factors, intervening in the transmission chains. We further argued that biological evolution of the human brain is the origin of a great number of psychological factors

of attraction. We have presented the attractor model of cultural epidemiology claiming that it takes into account the cognitive constructive processes of cultural items and that it advantageously replace the selectionist model of cultural evolution. For cultural epidemiology and biological Darwinism, a selectionist process informs evolutionary psychology, which itself informs a non selectionist yet Darwinian theory of cultural evolution.

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Christophe Heintz Research topics: Christophe Heintz is working on cultural evolution and its cognitive basis.

He has written on the role of institutions and distributed cognition in cultural evolution. He is especially investigating the cognitive foundations of scientific historical developments, and the biological and cultural evolution of economic rationality.

Nicolas Claidière Cognitive science

I study the social origins of cultural phenomena and more precisely the development and evolution of socio-cognitive capacities involved in the emergence and evolution of culture.

Principal interests: comparative psychology, evolutionary

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