

18

MEMES

Michael P. Schlaile, Walter Veit, and Maarten Boudry

18.1 Introduction

With this chapter, we aim to (re-)introduce the notion of memes into economic theory. For some, this endeavor may seem like flogging a dead horse; for others, a long overdue project of building bridges between different disciplines and fragmented approaches. Are memes nothing but a misleading metaphor for non-existent entities, wrongly alleged to be analogous to genes? Not so, we shall argue.

The idea of memes as the units of cultural evolution has been around for almost half a century now, although most contemporary researchers in cultural evolution prefer to call them “cultural variants” or “cultural traits” (e.g., Schurz, 2021; Wilson, 1998). In a similar manner, evolutionary economists have proposed various candidate units in an economic context, including habits, ideas, modules, routines, rules, and utopias (e.g., Almudi et al., 2017a,b; Beinhocker, 2006; Breslin, 2016; Dopfer et al., 2004; Hodgson & Knudsen, 2010; Markey-Towler, 2019; Nelson & Winter, 1982). Considering the different intellectual histories of these concepts, it is unsurprising that evolutionary economics is a rather fragmented field (e.g., Hodgson & Lamberg, 2018; Witt, 2014). While memes have frequently faced criticism from many of these schools of thought (e.g., Roy, 2017; Chap. 6 in Hodgson & Knudsen, 2010), some have argued that they can serve as a common language for linking several of these concepts and approaches (e.g., Schlaile, 2021). Our chapter aims to shed light on this promise, while remaining cautious about overly ambitious claims to the effect that selfish memes can essentially explain all of human culture, a position Boudry and Hofhuis (2018) have criticized as *panmemetics*.¹ Given the limited space and scope of this chapter, our contribution should be treated as an invitation for further work rather than a comprehensive presentation of a fully developed theory. Readers unfamiliar with the concept are referred to the excellent introductory article by von Bülow (2013), Dennett’s extensive work on memes (1995, 2006, 2017), and Chap. 2 in Schlaile (2021).

The three main points we want to make here is that (i) evolutionary economists have been biased towards mostly intentional and “adaptive” processes of innovation and technological and economic change, neglecting unintentional and “maladaptive” evolutionary processes, (ii) the meme’s eye view (as opposed to an agent-centered view) still offers a

valuable perspective for evolutionary economics, and (iii) memes should best be regarded as units of informational structures—often containing instructions—that can be socially transmitted and recombined, thus affording the emergence of innovations.

The chapter is organized as follows. First, we revisit and summarize important arguments for taking cultural evolution and the meme’s eye view more seriously. The subsequent section highlights the merits of viewing memes as informational entities that often include an element of instruction, thus providing a link to the rule-based approach to evolutionary economics. Next, we dismiss an overly reductionist view of memes as discrete and “independent” cultural elements, by viewing memes as embedded within complex systems. We then briefly turn to the memetics of creativity and innovation before we summarize our arguments in terms of the “five *i*’s of ecomemetics” and conclude our chapter with propositions for future interdisciplinary inquiries.

18.2 Cultural evolution, imitation, and the meme’s eye view

For the purpose of this chapter, we adopt the liberal definition of culture proposed by Boyd and Richerson: “Culture is information capable of affecting individuals’ behavior that they acquire from other members of their species by teaching, imitation, and other forms of social transmission” (Boyd & Richerson, 2005, p. 6, emphasis removed). There is ample literature on how particular cultural values and worldviews (including religious ideologies and practices) have influenced the emergence, success, and continued existence of economic systems and practices such as capitalism (e.g., Henrich, 2020; Hodgson, 2015; Weber, 1930, 2001; Schramm, 2008). However, contemporary evolutionary economists have focused mostly on the technological aspects of innovation and industrial change. By contrast, they have paid relatively little attention to the evolution of cultural value systems and belief systems and how they *interrelate* with technological and economic change.²

Both cultural and economic systems have been argued to evolve analogously to processes known from biological evolution (e.g., Dennett, 2017; Hodgson & Knudsen, 2010; Lewens, 2020; Veit, 2019a; Wilson & Gowdy, 2013; see also the discussions in Gagliardi & Gindis, 2019; Wilson & Kirman, 2016; Witt & Chai, 2019). In fact, as Ginsburg and Jablonka stress with reference to Charles Darwin’s selection theory: “The generality of the idea [of evolution by natural selection] allows it to be applied to disciplines as different as cosmology, economics, culture, and ethics, as well as to processes occurring in the brain” (Ginsburg & Jablonka, 2019, p. 65). This is not to say, however, that evolutionary processes across all systems involve the exact same “mechanism”, since some cultural evolutionary processes are more “Darwinian” than others (Dennett, 2017), for instance by being more or less gradual or more or less goal-directed (Dennett, 2021; Mesoudi, 2021). The next important step is to acknowledge that cultural evolution involves, at least in part, the replication of units of information. In the social environment we live in, information is largely socially distributed not only across different media but also across different minds. To make use of this, humans have become masters of imitation and learning, information sponges that absorb all sorts of information from our social environments. The importance of cultural replication and imitation has also been affirmed by researchers studying adaptive behavior and cognition,³ who have identified several imitation heuristics (e.g., Boyd & Richerson, 2005; see also Chap. 8.3 in Godfrey-Smith, 2009).⁴

A common definition of a meme is an “element of a culture or system of behaviour passed from one individual to another by imitation or other non-genetic means” (Oxford Dictionaries, undated). Though this succinct definition captures the essence of the concept,

it leaves open its ontological status. What sort of thing is a meme exactly, and where should we locate it? This leads us to the first important way to classify memetic approaches. On the one hand, there are approaches that seek to identify memes with some material substrates, such as brain structures, artifacts, or behaviors. A different approach regards memes as abstract and (substrate-neutral) informational entities. We could call this first distinction “material” vs. “informational” approaches.

Meme theorists also differ with respect to how much of human culture they see as “viral” or “parasitical”, and how exactly they define those terms (see also Blute, 2010). For some theorists, all of human culture should be regarded as swarms of viral memes that infect human brains with purposes and interests of their own (e.g., Blackmore, 2000; Stanovich, 2005, for details). Other meme theorists see more room for human intentionality and design and restrict the concept of “viral” memes to certain deleterious cultural beliefs and practices. In order to understand the image of viral or parasitical culture, we have to adopt what meme theorists call the *meme’s eye view* (Dawkins, 1993; Dennett, 1995, 2006). The best way to understand this key concept is to contrast it with its alternatives. In traditional accounts of culture—and even in most evolutionary approaches to culture—it is taken for granted that cultural ideas and artifacts serve some useful function or provide some benefit to human beings (for a critique, see Hofhuis, 2022; Edgerton, 1992). Or more precisely, to the extent that they have some function, we human beings must be the beneficiaries. It is human beings, after all, who select, discard, or retain cultural ideas and artifacts. Who else could benefit? By contrast, the meme’s eye view invites us to adopt the perspective of the cultural items *themselves*. Because cultural items (memes) replicate and form chains of transmission, cultural evolution will select the memes that are most successful at dissemination. This sets up an evolutionary dynamic that is relatively autonomous from human agents and may produce forms of cultural design whose functional rationale is opaque to them. In some cases, the “interests” of memes and their human carriers (or “hosts”) will align pretty well: we select and spread some memes because we find them appealing, and they enhance their own propagation by appealing to us. But in the most interesting cases, the interests of memes and their carriers diverge: “parasitical” memes spread because they are contagious and catchy, despite the fact that they are harmful to their human carriers. For instance, conspiracy theories are prime examples of highly attractive and contagious memplexes because their internal structure renders them self-validating: once you adopt the idea of a grand conspiracy theory, every form of adverse evidence can be turned around and presented as positive evidence (Boudry, 2020, 2022; Law, 2011). Despite these attractive features, conspiracy theories wreak a lot of havoc in society. Other examples of parasitical memes include superstitions, pseudoscience, addictions, bad habits, and ear worms (e.g., Dennett, 2017; Boudry & Hofhuis, 2018). To understand the functional rationale of such viral or parasitical forms of culture, we have to adopt the meme’s eye view. By doing so, memeticists draw out patterns of human culture that are invisible if we only consider the interests of human agents (e.g., Boudry, 2018a; Boudry & Hofhuis, 2018; Hofhuis, 2022).

Note that this discussion also links to a more general debate on functionalism in institutional theory (e.g., Chap. 5 in Krul, 2018): are institutions (such as prevalent rules, norms, laws, and regulation quite generally) always intentionally and consciously established for the benefit of society by (more or less) rational agents, or are they rather the result of often unintentional and historical/path-dependent cultural evolutionary processes (see also Rosenberg, 2021; Runciman, 2015, on a related discussion)? In the latter case, they may also lead to a lock-in of *unsustainable* and destructive practices and socio-technical regimes

(e.g., Geels, 2002; Edgerton, 1992). In the same vein, as the recent literature on responsible innovation highlights, technological innovation, which is arguably a specific type or embodiment/manifestation of cultural evolution (e.g., Richerson & Christiansen, 2013), does not necessarily imply “progress” (e.g., Blok & Lemmens, 2015; Ruse, 1993; Schlaile et al., 2017, 2018).

18.3 Memes as information and instruction

In line with Boyd and Richerson’s definition of culture adopted above, we adopt an informational approach to memes, which is not committed to any particular physical substrate and is therefore better suited for bridging (seemingly) conflicting approaches across disciplines. Following “informationalists” such as Boudry (2018b) and Dennett (2006, 2017), we believe that memes are most usefully thought of as pieces of abstract information, which can be instantiated in different media.

In our view, the informational perspective defuses many of the most common objections against memes. In particular, many theorists have opposed the concept of memes because they claim that, unlike in biological evolution, there is no physical structure that can be identified as the unit of replication (see also Roy, 2017). In other words, there is no physical analogue to the gene in the cultural realm. To talk of memes, according to critics, is to admit a phlogiston-like entity in cultural evolution. Tying the success of cultural evolution to finding the cultural analogue of genes, they fear, is a theoretical dead-end. But to take the gene/meme analogy literally is to misunderstand the role of analogies and metaphors in the sciences. In the history of science, metaphors and analogies have often enabled important breakthroughs despite being treated with suspicion by philosophers of science, especially ones which map concepts across distant domains. Even though no analogy is perfect, they help us to extend the reach of our mind and see connections and relations that were previously invisible (Veit & Ney, 2021; Boudry, Vlerick & Edis, 2022).

Firstly, this opposition to the concept of memes rarely recognizes that the concept of genes itself is far from straightforward. As Wilkins and Bourrat (2022) put it, in many critiques of cultural replication “[a]n overly idealized view of Mendelian genetics is contrasted to a much more realistic view of cultural change”. Various definitions of the gene across the biological sciences appear to be irreconcilable. Pluralism rules. It is true that genes appear more localizable and easier to pinpoint than memes, being associated with a single type of molecule (DNA or RNA), but this is not essential to the notion of a gene. From an evolutionary perspective, the most useful definition of a gene is as an abstract piece of information, not as a particular molecule. Genes, as Williams (1992) and others have pointed out, should not be identified with DNA but with the information carried by DNA. A gene is a piece of abstract information that is relatively stable and can be tracked across generations. It is, as Williams put it, “that which segregates and recombines with appreciable frequency” (Williams, 1966/2019, p. 24), regardless of whether the information is spread across the genome or unified and isolated. Unlike physical definitions of genes, this informational definition can be easily extended to the cultural realm (see also Ball, 1984). A meme of a music tune or an idea is a piece of abstract information that “segregates and recombines with appreciable frequency” in human cultures. It can be stored in a human brain, a digital mp3 file, or on a piece of sheet music. It can be written into a diary or recorded in the form of sound waves. Memes and genes on this view are not mere parallels, they are essentially the same type of abstract entity. To those who reject the meme concept

because it cannot be physically identified—or because it smacks of dualism—it must be asked whether they also deny the informational gene concept defended by Williams and others. Information can be stored in all kinds of different ways. In the case of biology, the carriers are usually DNA or RNA, but this is merely incidental. A digital computer file describing the genetic sequence of, say, the *severe acute respiratory syndrome coronavirus type 2* (SARS-CoV-2), contains the same information as the RNA molecules inside the virus itself, and the information can be transcribed from one medium to another. In the cultural domain, there is a much wider variety of different media, but the evolutionary dynamic is exactly the same.

Memetics, and in particular the meme’s eye view, makes sense of the dynamics of information transfer in the cultural world. How can information move from one physical instantiation to another—whether this is neural, language, pictures, or anything else for that matter—and how does this information evolve? A similar reply can be given to the objection that cultural evolution does not involve simple and straightforward “replication” like in the case of genes, but rather heavily relies on reconstruction (Sperber, 1996, 2000; Hodgson & Knudsen, 2010). This perceived contrast with gene replication, too, underestimates the messiness of biological reality. The genomes of two cells resulting from mitosis are not exact replicas, since they differ in numerous ways (they are wound up and folded differently, and their lower-level molecular structure differs in countless ways). They are only “replicas” of each other to the extent both can be regarded—at the right level of abstraction—as embodying a certain amount of information, and because their differences will be normalized and ignored when they are transcribed and read by ribosomes (Boudry, 2018b).

It is also important to note that in both biological and cultural evolution, replicators have frequently been seen as containing *instructions* (see also Cloak, 1975). Dennett, for instance, argues that memes “are ‘prescriptions’ for ways of doing things” (Dennett, 2017, p. 211). Similarly, Heylighen and Chielens (2009) have likened memes to production rules (*IF condition, THEN action*), and this sentiment is prominently captured by Ostrom’s statement that “rules are sets of instructions for creating an action situation ... As such, rules are broadly analogous to genes, which are sets of instructions for creating a phenotype. Rules are memes rather than genes, but it is helpful to think about some of the similarities between genes and memes” (Ostrom, 2006, p. 116). This brings us to an important connection between memes and the *rule-based approach* (RBA) to evolutionary economics, championed by Dopfer et al. (2004) and Dopfer and Potts (2008, 2019). For the sake of brevity, we cannot go into much detail here, but it should be acknowledged that both memetics and the RBA could gain from more integration. For instance, the elaborate rule taxonomy developed by Dopfer and colleagues, which differentiates between various subject and object rules along an evolutionary micro-meso-macro trajectory (Dopfer et al., 2004, Dopfer & Potts, 2008, 2019), provides an analytical schema that can also help memeticists to focus their attention on the instructional part of a cultural information present at multiple levels ranging from individuals to firms to whole economic systems. In turn, the RBA may profit from taking up some of the analytical instruments available in contemporary meme theory and recent propositions to operationalize memes (e.g., Schlaile, 2021, esp. Chap. 3).

18.4 No meme is an island: Why interconnection is key

Memes exist in complex interrelationships with other memes and their “environment”. In fact, as Dennett (1995, p. 144) puts it, “no meme is an island”, since memes may both

promote or impede the variation, selection, and retention of other replicators (genes and memes alike) (see also von Bülow, 2019, on a related note). In the same vein, Weeks and Galunic stress: “We cannot look at memes in isolation. When conceptualizing how culture evolves through a process of the variation, selection, and retention of memes, we must explicitly take into account the fact that memes only make sense when we look at their patterns of combination” (Weeks & Galunic, 2003, p. 1317). But what does that mean, exactly? By drawing on Hodgson’s (2011) notion of a *complex population system*⁵ in combination with an informational approach to memes (as described above) and Simon’s (1971) well-known statement that the overabundance of information leads to a scarcity of attention, which thus needs to be focused accordingly, memes can be regarded as “competing” for the “scarce resource” of attention. More precisely, the extent to which memes draw our attention depends not only on how attractive their own informational content is but also on how compatible they are with other information sources, especially other memes in the system (Schlaile, 2021, Chap. 3). These compatibility relations can be depicted as links of a meme network.

Despite the fact that economics studies complex systems, economists—especially in the dominant traditions—have been rather reluctant to take up approaches from complexity science, unlike other sciences of complex systems such as ecology, climate science, and evolutionary biology. There has been a temptation in economics to rely on as few models as possible. Much of the opposition to memes in economics, we fear, rests on the idea that “less is better”.⁶ This, we think, is a mistake. What is needed is a recognition that science requires what Veit (2019b, p. 93) calls “model pluralism”, that is, the idea that “for almost any aspect x of phenomenon y , scientists require multiple models to achieve scientific goal z ” (see also Veit, 2021, 2023). What those interested in memes are studying includes the informational aspect as well as the unintentional, potentially even harmful effects of cultural change. These aspects of the economic system are rarely studied explicitly.

By applying the network representation of complex systems, we can observe interconnections at the level of the memes themselves (a network of, e.g., knowledge units embodied in the mental representations of economic agents) as well as the more frequently analyzed social and economic networks of the agents within, say, an innovation system (e.g., Schlaile, 2021, esp. Chap. 5). This interconnectedness of different levels of complex systems present within an economy also links back to the literature on cultural multilevel selection: While we acknowledge that selection processes in an economy can occur at multiple levels (e.g., Field, 2008; Waring et al., 2015), we would also argue that most literature on cultural multilevel selection does not pay much attention to network complexity at the “lower” meme level. In other words, while multilevel selection theory aptly captures the tensions between self-interested and more prosocial behaviors of people (e.g., Atkins et al., 2019), the interconnections among the informational instructions (i.e., memes) embodied within those people are usually not addressed. We thus side with Velikovsky (2016, 2018) in highlighting the nested hierarchy or “holarchy” (Koestler, 1967) of selection processes. In our framework, memes are “holons” or fractal entities that belong to larger memplexes, which are in turn part of complex systems more generally (e.g., Schlaile, 2021, Chap. 3, for details). This is in line with Koestler’s argument that “‘wholes’ and ‘parts’ in ... [an] absolute sense just do not exist anywhere, either in the domain of living organisms or of social organisations. What we find are intermediary structures on a series of levels” (Koestler, 1967, p. 48).

18.5 Is everything a remix? Creativity and innovation from a memetic perspective

One of the most remarkable features of the human mind and our behavioral repertoire is our almost unlimited range of options. We can combine and transform ideas and copy them from others. Indeed, the processes of copying, transforming, and (re-)combining, often summarized under the umbrella of “remix” (Ferguson, 2015), exhibit striking overlaps with Darwinian evolutionary processes, especially variation, selection, recombination, retention, and transmission (Schlaile, 2021, Sect. 7.2). Evolution often results in the increasing creativity of actors—in the sense of their being able to extract information from the environment in new and useful ways in order to respond to their *Umwelt* (Veit, 2022). Memes are *the* units of this information. Memetic creativity can thus be understood as the degree of a human carrier’s “susceptibility” to taking up and recombining memes in novel ways that may help the carriers to learn and flexibly respond in complex social environments, opening a space for innovation and new ideas that can potentially benefit us and those around us (similar to how evolvability helps species to react to changing environments). Or, to use Kauffman’s (2000) terms, evolution (both biological and cultural) is about reaching the “adjacent possible” time and again, thus accumulating creative changes in complex and path-dependent ways (Johnson, 2010; Ridley, 2020).

The meme’s eye view makes these processes less mysterious, putting creativity firmly within a naturalist view of the mind. Yet, some feel unease about this view of how the mind operates (e.g., see also Kronfeldner, 2011; Mesoudi, 2021; Simonton, 2003; Wagner, 2019, on related discussions). Are we merely the breeding ground for ideas (memes) we have picked up somewhere before? Interestingly, in line with the memetic approach to creativity (see also Sect. 7.2 in Schlaile, 2021), Tarde already maintained at the beginning of the 20th century that “every invention and every discovery consists in the interference in somebody’s mind of certain old pieces of information that have generally been handed down by others” (Tarde, 1903, p. 382). Is creative genius mere plagiarism, as somewhat jokingly mentioned by Ball (1984)? In the public imagination, genius and creativity are frequently conceived as inexplicable outbursts of imagination, as if new ideas come down from heaven like a lightning strike. In the same vein, innovation economists have long criticized the neo-classical economists for treating knowledge as an intangible good with some of the features of a public good. In this view, knowledge flows freely between actors or appears to fall “like manna from heaven”, a point that Robert Solow is frequently credited for pointing out (see also Urmetzer et al., 2018, for references and further discussions on this issue). But our minds are not blank slates and are always already teeming with memes. We make do with what we have. And since we are unlike any other animal (though some smart animals like octopuses and corvids engage in similar activities), we are able to absorb all kinds of information from our environment, mixing it into novel ideas and behavioral innovations (see also Dennett, 2021).

As innovation economists have long acknowledged, innovations are often the emergent outcomes of interactions among various different actors weaving complex networks of cooperation, competition, and other forms of interdependence, frequently captured by notions like innovation networks, innovation systems, and innovation ecosystems (e.g., Breslin et al., 2021; Buchmann & Pyka, 2012; Rakas & Hain, 2019). In fact, innovation is often not the work of foresight genius or top-down oversight, but of unplanned trial and error, incremental steps, and endless recombination (Ridley, 2020). A historical and evolutionary approach to innovation takes some of the apparent genius away, or rather

distributes it over many different agents. In cultural and economic evolution, just as much as in biological evolution, Leslie Orgel's second rule applies: evolution is cleverer than you are.

As Potts (2019) has recently argued, this evolutionary, uncertain, and collective nature of innovation makes it a collective action problem, namely of pooling knowledge and resources, establishing institutions for cooperation, and deciding which memes in the sense of knowledge units should be combined. In this regard, a memetic approach to creativity can also provide new impetus to recent discussions on innovation policy and intellectual property rights, and potentially lend a naturalistic support to approaches like open innovation (Chesbrough, 2003) or free innovation (von Hippel, 2017), though in the latter regard by focusing on the meme level of analysis instead of focusing mainly on the human actors. It should go without saying that we do not intend to abolish intellectual property rights or recommend allowing other companies to simply copy an existing product (or process or service, etc.). Rather, we propose to facilitate the selection of an institutional framework within an innovation system that does not unnecessarily impede the merger of memes/knowledge among companies.

18.6 Summary and conclusion

The combination or synergy of memetics and (evolutionary) economics has been called *economemetics* (Schlaile, 2021). This neologism should not be misunderstood as a new discipline but rather as a perspective that aims at consilience and bridging fragmented approaches. In this regard, the key take home messages from the above discussion can be summarized with the *five i's of economemetics*: Memes can be understood as units of *information* that often contain rule-based elements of *instruction*, which may be transmitted via *imitation* and other processes of communication and social learning. Moreover, variation, selection, and retention (and "remix") of memes lead to *innovations* that emerge from the *interconnections* of both memes and economic agents in complex (often multi-level) networks.

Importantly, compared to other evolutionary approaches, memetics is distinctive for adopting the *meme's eye view*, which considers the "interests" of cultural elements themselves. Memes can be useful or beneficial to human agents, but they can also be "parasitical" cultural elements that further their own propagation despite harming their human hosts. With respect to economics, the meme's eye view complements existing approaches, for example, in innovation economics by naturalizing creativity and innovation. Rather than resulting from strokes of genius or virtually falling down from the sky, cultural innovation usually involves many rounds of variation, selection, and recombination within complex networks of cooperating and competing individuals and organizations. In this sense, (econo-)memetics makes creativity less "mysterious" but also less individualistic, bringing it down to earth again.

There are multiple pathways to pursue in future research, including theoretical clarifications on the nature of "information" and further exploration of the potential synergies between memetics and the RBA mentioned near the end of the section on "Memes as information and instruction". Moreover, some striking overlaps seem to exist not only with concepts developed in evolutionary economics (i.e., habits, ideas, routines, rules, etc.) but also with notions like frames and narratives (e.g., Riedy & Waddock, 2022) and findings from adjacent fields such as (bio)semiotics (e.g., Fomin, 2019; Herrmann-Pillath, 2021) that should

be taken up in future conceptual and empirical research (e.g., Schlaile, 2021, Chap. 8). By focusing on memes as the evolutionary foundations (or “building blocks”) of worldviews and belief systems, we may even shed new light on the complex dynamics of “normative dimensions” of economic systems (e.g., Schlaile et al., 2017) and the resulting paradigms that could block or promote transitions towards more sustainable modes of production and consumption (Schlaile et al., 2022). Finally, model pluralism also gives rise to different ways of operationalization. More precisely, empirical studies on memes can resort to a wide variety of tools and methods even beyond those known from evolutionary biology and anthropology, including but not limited to text mining approaches (e.g., sentiment analysis, topic modeling, etc.) that so far had little impact in economics.

In conclusion, we think the time has come for a renewed and interdisciplinary engagement with memes in economics.

Notes

- 1 Our chapter builds on and extends earlier arguments, some of which have been previously published independently by the authors of this chapter, for example, in Schlaile (2021) and Boudry (2018a, b). This work has not received any particular financial support, but Michael Schlaile gratefully acknowledges partial funding through the German Academic Exchange Service (DAAD) (Project ID: 57563063), VolkswagenStiftung (Project ID: 99 116), and the Federal Ministry of Education and Research (grant number 031B0751), Maarten Boudry received support from the Research Foundation Flanders, and Walter Veit has received funding as part of a project from the European Research Council (ERC) under the European Union’s Horizon 2020 research and innovation programme (grant agreement number 101018533).
- 2 Of course, this should not imply that cultural change or even cultural evolution with an explicit Darwinian connotation has received no attention from evolutionary economists (e.g., see Herrmann-Pillath, 2010, 2013, 2021), as also several scholars at the intersection of economic history, institutional economics, and evolutionary economics have shown (for recent examples, see Hodgson, 2019, or contributions in Gagliardi & Gindis, 2019; Witt & Chai, 2019). However, it is fair to say that technological change, the creation and diffusion of economically useful knowledge and innovations, and the dynamics of sectors, industries, and various types of innovation systems have received much more attention from evolutionary economists than the evolutionary dynamics of value(s) and belief systems.
- 3 Note, however, that we are not committed to the existence of any straightforward mechanism of high-fidelity replication, regardless of how that is construed (Charbonneau 2020). To a large extent, cultural transmission events involve a complicated process of reconstruction rather than a straightforward process of copying. If we want to study the evolution of memes or cultural variants on a population level, however, we can abstract from those lower-level complications (Boudry, 2018b; Acerbi 2019). No matter how the process of cultural transmission is achieved, in the aggregate it often results in cultural traditions that are remarkably stable and persistent, and thus “faithfully” preserved. See also von Bülow (2013, 2019) on related discussions.
- 4 Moreover, the French sociologist Gabriel Tarde should be mentioned as an important figure in imitation research (Blute, 2022) as he has been considered a “forefather” of memetics (e.g., Marsden, 2000; Schmid, 2004), of elements of Schumpeter’s works (e.g., Barry & Thrift, 2007; Kobayashi, 2015; Taymans, 1950), and of diffusion research (Katz, 2006; Kinnunen, 1996; Rogers, 2003).
- 5 According to Hodgson (2011, p. 309), “complex population systems contain multiple varied (intentional or non-intentional) entities that interact with the environment and each other. They face immediately scarce resources and struggle to survive, whether through conflict or cooperation. ... They adapt and may pass on information to others, through replication or imitation.”
- 6 Note that this is in line with the ongoing critiques by heterodox economists and initiatives such as *Rethinking Economics* (<https://www.rethinkeconomics.org/>), the German *Network for Pluralist Economics* (<https://www.plurale-oekonomik.de/>), and others.

References

- Acerbi, A. (2019). *Cultural evolution in the digital age*. Oxford: Oxford University Press.
- Almudi, I., Fatas-Villafranca, F., Izquierdo, L. R., & Potts, J. (2017a). The economics of utopia: A co-evolutionary model of ideas, citizenship and socio-political change. *Journal of Evolutionary Economics*, 27, 629–662. DOI: 10.1007/s00191-017-0507-7.
- Almudi, I., Fatas-Villafranca, F., & Potts, J. (2017b). Utopia competition: A new approach to the micro-foundations of sustainability transitions. *Journal of Bioeconomics*, 19, 165–185. DOI: 10.1007/s10818-016-9239-2.
- Atkins, P. W. B., Wilson, D. S., & Hayes, S. C. (2019). *Prosocial: Using evolutionary science to build productive, equitable, and collaborative groups*. Oakland, CA: Context Press.
- Ball, J. A. (1984). Memes as replicators. *Ethology and Sociobiology*, 5, 145–161. DOI: 10.1016/0162-3095(84)90020-7.
- Barry, A., & Thrift, N. (2007). Gabriel Tarde: Imitation, invention and economy. *Economy and Society*, 36, 509–525. DOI: 10.1080/03085140701589497.
- Beinhocker, E. D. (2006). *The origin of wealth: Evolution, complexity, and the radical remaking of economics*. Boston, MA: Harvard Business School Press.
- Blackmore, S. (2000). The meme's eye view. In R. Aunger (Ed.), *Darwinizing culture: The status of memetics as a science* (pp. 25–42). Oxford: Oxford University Press.
- Breslin, D. (2016). What evolves in organizational co-evolution? *Journal of Management & Governance*, 20, 45–67. DOI: 10.1007/s10997-014-9302-0.
- Blok, V., & Lemmens, P. (2015). The emerging concept of responsible innovation. Three reasons why it is questionable and calls for a radical transformation of the concept of innovation. In B.-J. Koops, I. Oosterlaken, H. Romijn, T. Swierstra, & J. van den Hoven (Eds.), *Responsible innovation 2: Concepts, approaches, and applications* (pp. 19–35). Cham: Springer.
- Blute, M. (2010). *Darwinian sociocultural evolution: Solutions to dilemmas in cultural and social theory*. Cambridge: Cambridge University Press.
- Blute, M. (2022). Gabriel Tarde and cultural evolution: The consequence of neglecting our Mendel. *Journal of Classical Sociology*. DOI:10.1177/1468795x221136830.
- Boudry, M. (2018a). Invasion of the mind snatchers. On memes and cultural parasites. *Teorema*, 37, 111–124.
- Boudry, M. (2018b). Replicate after reading: On the extraction and evocation of cultural information. *Biology & Philosophy*, 33, 27. DOI: 10.1007/s10539-018-9637-z.
- Boudry, M., & Hofhuis, S. (2018). Parasites of the mind. Why cultural theorists need the meme's eye view. *Cognitive Systems Research*, 52, 155–167. DOI: 10.1016/j.cogsys.2018.06.010.
- Boudry, M. (2020). The warped epistemology of conspiracy theories, *Blog of the American Philosophical Association*. Retrieved from: <https://blog.apaonline.org/2020/09/08/the-warped-epistemology-of-conspiracy-theories/>.
- Boudry, M. (2022). Why we should be suspicious of conspiracy theories: A novel demarcation problem, *Episteme*. DOI:10.1017/epi.2022.34.
- Boudry, M., Vlerick, M., & Edis, T. (2022). Demystifying mysteries. How metaphors and analogies extend the reach of the human mind. In S. Wuppuluri, & A. C. Grayling (Eds.), *Metaphors and analogies in sciences and humanities: Words and worlds* (pp. 65–83). Cham: Springer.
- Boyd, R., & Richerson, P. J. (2005). *The origin and evolution of cultures*. Oxford: Oxford University Press.
- Breslin, D., Kask, J., Schlaile, M., & Abatecola, G. (2021). Developing a coevolutionary account of innovation ecosystems. *Industrial Marketing Management*, 98, 59–68. DOI: 10.1016/j.indmarman.2021.07.016.
- Buchmann, T., & Pyka, A. (2012). Innovation networks. In M. Dietrich, & J. Krafft (Eds.), *Handbook on the economics and theory of the firm* (pp. 466–482). Cheltenham: Edward Elgar.
- Charbonneau, M. (2020). Understanding cultural fidelity. *The British Journal for the Philosophy of Science*, 71, 1209–1233. DOI: 10.1093/bjps/axy052.
- Chesbrough, H. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Boston: Harvard Business School Press.
- Cloak, F. T. (1975). Is a cultural ethology possible? *Human Ecology*, 3, 161–182. DOI: 10.1007/BF01531639.

- Dawkins, R. (1993). Viruses of the mind. In B. Dahlbom (Ed.), *Dennett and his critics: Demystifying mind* (pp. 13–27). Oxford: Blackwell.
- Dennett, D. C. (1995). *Darwin's dangerous idea: Evolution and the meanings of life*. London: Simon & Schuster.
- Dennett, D. C. (2006). *Breaking the spell: Religion as a natural phenomenon*. New York: Penguin.
- Dennett, D. C. (2017). *From bacteria to Bach and back: The evolution of minds*. New York: W. W. Norton.
- Dennett, D. C. (2021). Foreword to special issue: Cultural evolution and generalized Darwinism: Theory and applications. *American Philosophical Quarterly*, 58, 1–5. DOI: 10.2307/48600681.
- Dopfer, K., Foster, J., & Potts, J. (2004). Micro-meso-macro. *Journal of Evolutionary Economics*, 14, 263–279. DOI: 10.1007/s00191-004-0193-0.
- Dopfer, K., & Potts, J. (2008). *The general theory of economic evolution*. London: Routledge.
- Dopfer, K., & Potts, J. (2019). Why is evolutionary economics not an empirical science? In F. Gagliardi & D. Gindis (Eds.), *Institutions and the evolution of capitalism* (pp. 314–326). Cheltenham: Edward Elgar.
- Edgerton, R. B. (1992). *Sick societies: Challenging the myth of primitive harmony*. New York: Free Press.
- Ferguson, K. (2015). Everything is a remix (remastered). *YouTube*. Retrieved from <https://youtu.be/nJPERZDfyWc>
- Field, A. J. (2008). Why multilevel selection matters. *Journal of Bioeconomics*, 10, 203–238. DOI: 10.1007/s10818-007-9018-1.
- Fomin, I. (2019). Memes, genes, and signs: Semiotics in the conceptual interface of evolutionary biology and memetics. *Semiotica*, 230, 327–340. DOI: 10.1515/sem-2018-0016.
- Gagliardi, F., & Gindis, D. (Eds.) (2019). *Institutions and the evolution of capitalism: Essays in honour of Geoffrey M. Hodgson*. Cheltenham: Edward Elgar.
- Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study. *Research Policy*, 31, 1257–1274. DOI: 10.1016/S0048-7333(02)00062-8.
- Ginsburg, S., & Jablonka, E. (2019). *The evolution of the sensitive soul: Learning and the origins of consciousness*. Cambridge, MA: The MIT Press.
- Godfrey-Smith, P. (2009). *Darwinian populations and natural selection*. Oxford: Oxford University Press.
- Henrich, J. (2020). *The WEIRD people in the world. How the West became psychologically peculiar and particularly prosperous*. New York: Farrar, Straus and Giroux.
- Herrmann-Pillath, C. (2010). *The economics of identity and creativity: A cultural science approach*. New York: Routledge.
- Herrmann-Pillath, C. (2013). *Foundations of economic evolution: A treatise on the natural philosophy of economics*. Cheltenham: Edward Elgar.
- Herrmann-Pillath, C. (2021). Biosemiotic foundations of a Darwinian approach to cultural evolution. *Cultural Science Journal*, 13, 16–33. DOI: 10.2478/csaj-2021-0002.
- Heylighen, F., & Chielens, K. (2009). Evolution of culture, memetics. In R. A. Meyers (Ed.), *Encyclopedia of complexity and systems science* (pp. 3205–3220). New York: Springer.
- Hofhuis, S. T. (2022). *Qualitative Darwinism: An evolutionary history of witch-hunting*, PhD dissertation, Utrecht University. DOI: <https://doi.org/10.33540/1460>.
- Hodgson, G. M. (2011). A philosophical perspective on contemporary evolutionary economics. In J. B. Davis & D. W. Hands (Eds.), *The Elgar companion to recent economic methodology* (pp. 299–318). Cheltenham: Edward Elgar.
- Hodgson, G. M. (2015). *Conceptualizing capitalism: Institutions, evolution, future*. Chicago: The University of Chicago Press.
- Hodgson, G. M. (2019). *Evolutionary economics: Its nature and future*. Cambridge: Cambridge University Press.
- Hodgson, G. M., & Knudsen, T. (2010). *Darwin's conjecture: The search for general principles of social and economic evolution*. Chicago: The University of Chicago Press.
- Hodgson, G. M., & Lamberg, J.-A. (2018). The past and future of evolutionary economics: Some reflections based on new bibliometric evidence. *Evolutionary and Institutional Economics Review*, 15, 167–187. DOI: 10.1007/s40844-016-0044-3.
- Johnson, S. (2010). *Where good ideas come from: The natural history of innovation*. New York: Riverhead Books.

- Katz, E. (2006). Rediscovering Gabriel Tarde. *Political Communication*, 23, 263–270. DOI: 10.1080/10584600600808711.
- Kauffman, S. A. (2000). *Investigations*. New York: Oxford University Press.
- Kinnunen, J. (1996). Gabriel Tarde as a founding father of innovation diffusion research. *Acta Sociologica*, 39, 431–442. DOI: 10.1177/000169939603900404.
- Kobayashi, D. (2015). Schumpeter as a diffusionist: A new interpretation of Schumpeter's theory of socio-cultural evolution. *Evolutionary and Institutional Economics Review*, 12, 265–281. DOI: 10.1007/s40844-015-0018-x.
- Koestler, A. (1967). *The ghost in the machine*. New York: Macmillan.
- Kronfeldner, M. (2011). *Darwinian creativity and memetics*. Durham: Acumen.
- Krul, M. (2018). *The new institutionalist economic history of Douglass C. North: A critical interpretation*. Cham: Palgrave Macmillan.
- Law, S. (2011). *Believing bullshit: How not to get sucked into an intellectual black hole*. New York: Prometheus.
- Lewens, T. (2020). Cultural evolution. In E. N. Zalta (Ed.), *The Stanford encyclopedia of philosophy* (Summer 2020 ed.). Retrieved from: <https://plato.stanford.edu/archives/sum2020/entries/evolution-cultural/>
- Markey-Towler, B. (2019). The competition and evolution of ideas in the public sphere: A new foundation for institutional theory. *Journal of Institutional Economics*, 15, 27–48. DOI: 10.1017/S1744137418000061.
- Marsden, P. (2000). Forefathers of memetics: Gabriel Tarde and the laws of imitation. *Journal of Memetics - Evolutionary Models of Information Transmission*, 4. Retrieved from http://cfpm.org/jom-emit/2000/vol4/marsden_p.html
- Mesoudi, A. (2021). Blind and incremental or directed and disruptive? On the nature of novel variation in human cultural evolution. *American Philosophical Quarterly*, 58, 7–20. DOI: 10.2307/48600682.
- Nelson, R. R., & Winter, S. G. (1982). *An evolutionary theory of economic change*. Cambridge, MA: The Belknap Press of Harvard University Press.
- Ostrom, E. (2006). The complexity of rules and how they may evolve over time. In C. Schubert & G. von Wangenheim (Eds.), *Evolution and design of institutions* (pp. 100–122). London: Routledge.
- Oxford Dictionaries (undated). *Meaning of meme in English*. Retrieved from: <http://www.oxforddictionaries.com/definition/english/meme>.
- Potts, J. (2019). *Innovation Commons: The origin of economic growth*. Oxford: Oxford University Press.
- Rakas, M., & Hain, D. S. (2019). The state of innovation system research: What happens beneath the surface? *Research Policy*, 48, 103787. DOI: 10.1016/j.respol.2019.04.011.
- Richerson, P. J., & Christiansen, M. H. (Eds.) (2013). *Cultural evolution: Society, technology, language, and religion*. Cambridge, MA: The MIT Press.
- Ridley, M. (2020). *How innovation works: And why it flourishes in freedom*. New York: HarperCollins.
- Riedy, C., & Waddock, S. (2022). Imagining transformation: Change agent narratives of sustainable futures. *Futures*, 142, 103010. DOI: 10.1016/j.futures.2022.103010
- Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York: Simon and Schuster.
- Rosenberg, A. (2021). The inevitability of a generalized Darwinian theory of behavior, society, and culture. *American Philosophical Quarterly*, 58, 51–62. DOI: 10.2307/48600685.
- Roy, D. (2017). Myths about memes. *Journal of Bioeconomics*, 19, 281–305. DOI: 10.1007/s10818-017-9250-2.
- Runciman, W. G. (2015). *Very different, but much the same: The evolution of English society since 1714*. Oxford: Oxford University Press.
- Ruse, M. (1993). Evolution and progress. *Trends in Ecology & Evolution*, 8, 55–59. DOI: 10.1016/0169-5347(93)90159-M.
- Schlaile, M. P., Kask, J., Brewer, J., Bogner, K., Urmetzer, S., & De Witt, A. (2022). Proposing a cultural evolutionary perspective for dedicated innovation systems: Bioeconomy transitions and beyond. *Journal of Innovation Economics & Management*, 38, 93–118. DOI: 10.3917/jie.pr1.0108.
- Schlaile, M. P., Mueller, M., Schramm, M., & Pyka, A. (2018). Evolutionary economics, responsible innovation and demand: Making a case for the role of consumers. *Philosophy of Management*, 17, 7–39. DOI: 10.1007/s40926-017-0054-1.

- Schlaile, M. P., Urmetzer, S., Blok, V., Andersen, A. D., Timmermans, J., Mueller, M., Fagerberg, J., & Pyka, A. (2017). Innovation systems for transformations towards sustainability? Taking the normative dimension seriously. *Sustainability*, 9, 2253. DOI: 10.3390/su9122253.
- Schlaile, M. P. (Ed.) (2021). *Memetics and evolutionary economics: To boldly go where no meme has gone before*. Cham: Springer.
- Schmid, H. B. (2004). Evolution by imitation. Gabriel Tarde and the limits of memetics. *Distinktion: Scandinavian Journal of Social Theory*, 5, 103–118. DOI: 10.1080/1600910X.2004.9672894.
- Schramm, M. (2008). *Ökonomische Moralkulturen. Die Ethik differenter Interessen und der plurale Kapitalismus*. Marburg: Metropolis.
- Schurz, G. (2021). Evolution in nature and culture: Prospects and problems of generalized evolution theory. *American Philosophical Quarterly*, 58, 95–110. DOI: 10.2307/48600688.
- Simon, H. A. (1971). Designing organizations for an information-rich world. In M. Greenberger (Ed.), *Computers, communication, and the public interest* (pp. 37–72). Baltimore, MD: Johns Hopkins Press.
- Simonton, D. K. (2003). *Origins of genius: Darwinian perspectives on creativity*. Oxford: Oxford University Press.
- Sperber, D. (1996). *Explaining culture: A naturalistic approach*. Oxford: Blackwell.
- Sperber, D. (2000). An objection to the memetic approach to culture. In R. Aunger (Ed.), *Darwinizing culture: The status of memetics as a science* (pp. 163–173). Oxford: Oxford University Press.
- Stanovich, K. E. (2005). *The robot's rebellion: Finding meaning in the age of Darwin*. Chicago: The University of Chicago Press.
- Tarde, G. (1903). *The laws of imitation*. New York: Henry Holt.
- Taymans, A. C. (1950). Tarde and Schumpeter: A similar vision. *The Quarterly Journal of Economics*, 64, 611–622. DOI: 10.2307/1884391.
- Urmetzer, S., Schlaile, M. P., Bogner, K. B., Mueller, M., & Pyka, A. (2018). Exploring the dedicated knowledge base of a transformation towards a sustainable bioeconomy. *Sustainability*, 10, 1694. DOI: 10.3390/su10061694.
- Velikovskiy, J. T. (2016). The holon/parton theory of the unit of culture (or the meme, and narreme). In A. M. Connor, & S. Marks (Eds.), *Creative technologies for multidisciplinary applications* (pp. 208–246). Hershey, PA: IGI Global.
- Velikovskiy, J. T. (2018). The holon/parton structure of the meme, or the unit of culture. In M. Khosrow-Pour (Ed.), *Encyclopedia of information science and technology* (4th ed., pp. 4666–4678). Hershey, PA: IGI Global.
- Veit, W. (2019a). Modeling morality. In Á. Nepomuceno-Fernández, L. Magnani, F. J. Salguero-Lamillar, C. Barés-Gómez, & M. Fontane (Eds.), *Model-based reasoning in science and technology* (pp. 83–102). Cham: Springer. DOI: 10.1007/978-3-030-32722-4_6.
- Veit, W. (2019b). Model pluralism. *Philosophy of the Social Sciences*, 50, 91–114. DOI: 10.1177/0048393119894897.
- Veit, W. (2023). Model anarchism. *THEORIA*. DOI: 10.1387/theoria.23849.
- Veit, W. (2021). Review of Nancy Cartwright's nature, the artful modeler: lectures on laws, science, how nature arranges the world and how we can arrange it better. *Philosophy of Science*, 88. DOI: 10.1086/711505.
- Veit, W. (2022). *Health, agency, and the evolution of consciousness*. Ph.D. thesis, University of Sydney. <https://hdl.handle.net/2123/29836>
- Veit, W., & Ney, M. (2021). Metaphors in arts and science. *European Journal for Philosophy of Science*, 11, 44. DOI: 10.1007/s13194-021-00351-y
- von Bülow, C. (2013). *Meme*. [English translation of the (German) article “Mem”. In J. Mittelstraß (Ed.), *Enzyklopädie Philosophie und Wissenschaftstheorie* (2nd ed., Vol. 5, pp. 318–324). Stuttgart: Metzler]. Retrieved via ResearchGate: https://www.researchgate.net/publication/255881715_Meme_encyclopedia_article
- von Bülow, C. (2019). *Types of selection, selection of types*. Unpublished manuscript, retrieved via ResearchGate: 10.13140/RG.2.2.16742.27205.
- von Hippel, E. (2017). *Free innovation*. Cambridge, MA: The MIT Press.
- Wagner, A. (2019). *Life finds a way: What evolution teaches us about creativity*. New York: Basic Books.
- Waring, T. M., Kline, M. A., Brooks, J. S., Goff, S. H., Gowdy, J., Janssen, M. A., Smaldino, P. E., & Jacquet, J. (2015). A multilevel evolutionary framework for sustainability analysis. *Ecology and Society*, 20, 34.

- Weber, M. (1930). *The Protestant ethic and the spirit of capitalism*. (Transl. by T. Parsons; with an introduction by A. Giddens). London: Routledge.
- Weeks, J., & Galunic, C. (2003). A theory of the cultural evolution of the firm: The intra-organizational ecology of memes. *Organization Studies*, 24, 1309–1352. DOI: 10.1177/01708406030248005.
- Williams, G. C. (1966/2019). *Adaptation and natural selection*. Princeton: Princeton University Press.
- Williams, G. C. (1992). *Natural selection*. Oxford University Press.
- Wilkins J. S., & Bourrat, P. (2022) Replication and reproduction. In E. N. Zalta (Ed.), *The Stanford encyclopedia of philosophy* (Winter 2022 ed.). Retrieved from: <https://plato.stanford.edu/entries/replication>
- Wilson, D. S., & Gowdy, J. M. (2013). Evolution as a general theoretical framework for economics and public policy. *Journal of Economic Behavior & Organization*, 90S, S3–S10. DOI: 10.1016/j.jebo.2012.12.008.
- Wilson, D. S., & Kirman, A. (Eds.) (2016). *Complexity and evolution: Toward a new synthesis for economics*. Cambridge, MA: The MIT Press.
- Wilson, E. O. (1998). *Consilience: The unity of knowledge*. New York: Random House.
- Witt, U. (2014). The future of evolutionary economics: Why the modalities of explanation matter. *Journal of Institutional Economics*, 10, 645–664. DOI: 10.1017/S1744137414000253.
- Witt, U., & Chai, A. (Eds.) (2019). *Understanding economic change: Advances in evolutionary economics*. Cambridge: Cambridge University Press.