DOI: 10.15170/TM.2026.27.K2.8
Tudásmenedzsment Vol. 27, Special Issue 2, 104–122 (2026)

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ON THE EVOLUTION OF HUMAN 'COMMUNITY': AN ECOLOGICAL PERSPECTIVE

Abstract
Given that recent interdisciplinary scholarship in the humanities has extensively documented a major transformation in human communities—specifically regarding the individual's immediate social environment—our work aims to reveal some of the underlying causes of this phenomenon to inform cultural theories research and to offer a new aspect of future disciplinary studies may build on. Drawing on human ethology, this paper builds on the premise that the human community is inherently biological in origin, and as such, a direct product of evolution. Consequently, our primary focus is the fundamental sociability of the human species, which evolved from the ancestral behavioral traits of the great apes. To properly analyze the interplay among the environment, community, and human culture, we introduce a functional model demonstrating how culture has driven human evolution from the emergence of Homo sapiens to the present day. Our model suggests recent alterations in the interaction between community culture—a relatively stable element of our biology—and a rapidly changing ecological environment. Our theoretical investigation posits that following millions of years of cultural evolution, the present community ecology is characterized by the rapid emergence of non-organic environmental realities alongside the traditional organic reality of the human species. Ultimately, this novel ecological system of parallel organic and non-organic realities may trigger challenges for human sociability, for which Homo sapiens appears unprepared at this stage of its history.

Keywords: community, culture, ecology, evolution

Introduction

All theories of culture presuppose the concept of community in one form or another.

In classical cultural theory, this concept is rooted in a holistic Greek paradigm—frequently examined in history, literature, and philosophy—which addresses the complexity of the phenomenon at the intersection of the group, individual belonging, and locality. A defining feature of this classical approach is that it conceptualizes the individual as simultaneously operating within a societal role-set and acting as an autonomous person. At the same time, contemporary research encompasses a wide range of different conceptualisations. These definitions vary significantly based on the chosen analytical focus, timeframe, disciplinary grounding, focal components, and linguistic context. To navigate this conceptual complexity, current cultural studies often categorize and investigate human communities based on shared geography, mutual interests, or intellectual and spiritual alignment.

The concept of 'community' is also investigated across numerous other humanities and social science disciplines, including anthropology, history, sociology, sociobiology, psychology, and communication. A vast body of literature within these fields examines the life of human communities across time and space. These studies analyze the social dynamics governing the emergence, development, and dissolution of groups, explore how member interactions impact individuals across varied contexts, and investigate the cultural values, motivations, and assets of specific communities from the past to the present.

Nevertheless, both theoretical discussions and empirical research concerning human communal behavior converge on the premise that the 'community' is undergoing continuous transformation. Existing literature documents the profound evolution of human communities broadly, while highlighting distinct structural variations among specific empirical groups. This transformation is widely attributed to global and local historical shifts, such as demographic expansion, or major lifestyle innovations, including the historical transition to agriculture and, more recently, urbanization and increased mobility. Currently, accelerated globalization and rapid technological advancement compel researchers to revisit, re-examine, and re-identify the underlying mechanisms driving how human communities form, adapt, dissolve, and reconstitute themselves.

While previous investigations offer valuable insights within the humanities and social sciences, this work expands upon them by examining the biological foundations of the human community through the lens of the natural sciences. Specifically, we aim to uncover the primary biological drivers undergirding both the emergence of human groups and the historical shifts observed in communities, irrespective of their geography, shared interests, or intellectual and spiritual alignment.

This paper does not claim to encapsulate the exhaustive expertise of all existing disciplinary research, however, it intends to synthesize selected interdisciplinary evidence to construct a novel theoretical framework to the study of community in the human world. While following this route, it emphasizes the importance of the ecological approach to the coevolution of human biology and culture. Our argument has implications for humanities and social sciences including cultural theory, and suggests that the method is potentially applicable to all human societies, even postindustrial ones.

Basic concepts and the theoretical framework

Bringing biological thought into social sciences and humanities in the study of human behavior is not new. Subsequent to the first attempt to integrate biological and social aspects in the study of the evolution of man (Wilson, 1975), the novel discipline of sociobiology gained ground with a publication on human nature discussing the evolutionary basis of human aggression, sexual behavior, altruism and some other crucial biological drivers of man (Wilson, 1978).

Our 'community' concept is also formulated by the integration of the biological and social perspectives, utilizing the cultural context as framework. We approach the concept of 'community' from the perspective of human innate traits, which biological framing anchors our conceptualization in the evolutionary theory of Homo sapiens. Within human

ethology, community refers to regularized individual interactions characterized by shared beliefs, shared actions, and shared constructions, while the members of these groups are defined by their group loyalty and the active expression of their group identity (Csányi, 2024). Distinct from non-human animal species, these defining characteristics of the human community also represent humanity's unique capacity for cultural formulation.

Our work is built on a definition of the human ’community’ in accordance with the human ethology perspective. ’Community’ is meant as a human group whose participants cooperate to maintain and formulate their group culture through regular transmission of knowledge among the individual members.

Although culture formulation is anchored in intracommunity dynamics, this interaction simultaneously alters the immediate environment, thereby shifting the community's ecological reality. Our work examines culture as the immediate environmental reality that human communities experience, respond to, and reformulate over time. Furthermore, this immediate environment is conceptualized as an external, complex system of components that shape communal reality. This system encompasses the natural, social, cultural, and technological circumstances within which a community acts to maintain and recreate its environment. Consequently, this study evaluates the external complex system of the communal environment through a distinct ecological lens.

To navigate the complexity of this ecological environment, this work relies on the systematic interpretation of reality formulated by Nikolai Hartmann, a twentieth-century German philosopher of critical realism. Hartmann categorizes reality into four interrelated levels, or strata: (1) the inorganic or inanimate level, (2) the organic level, (3) the psychic or emotional level, and (4) the spiritual or cultural level. Although each stratum possesses distinct phenomena, the transition between categories culminates in the higher level. For example, the organic level builds upon the inorganic level, yet it is simultaneously superseded by the psychic level. While the structure of reality is grounded in the lower strata—which recur within the higher domains—the higher levels display unique qualities fundamentally distinct from those below them (Peterson & Poli, 2022).

This theory—which has significantly influenced studies of human evolution and behavior (Lorenz, 1973, 1988)—is equally relevant to understanding the interaction between the human community and its environment. Accordingly, comprehending the cultural or spiritual environment at a specific stage of human evolution requires uncovering the dominant internal stratification features of that complex system, namely its psychic, organic, and inorganic strata.

In summary, this work operates on two fundamental principles. First, the discussion is grounded in the premise that human culture is a complex system of behavioral patterns developed as products of evolution (Csányi, 2010, 2024). Second, in accordance with human ethology, this paper emphasizes the critical interaction between the biological aspects of communal behavior and the immediate ecological environment—an interplay defined as culture within this framework.

To delineate this relationship, the text first outlines the primary driving forces behind the emergence of the human community, and identifies unique features of early hominids

and Homo sapiens that were stimulated by natural adaptation during evolution. Subsequently, it investigates how the ecological environment has shifted throughout history, focusing on the continuous interaction between the human community and its evolving culture. Finally, the study isolates specific agents within the current ecology of human evolution that may exert their power on the contemporary transformation of the community.

Early human adaptation

For hundreds of millions of years, the survival of the species on our planet relied primarily on genetic transmission of information. However, within the relatively stable baseline of the natural ecosystems even localized landscape transformations, such as the depletion of forestry, necessitated the biological adaptation among extant species. Similarly, natural environmental shifts triggered novel challenges for ancestral hominids, fostering the development of both innovative self-protection strategies and advanced individual competencies.

To start with, the interaction of rudimentary skills in the ancestral hominid minds contributed to the emergence of human conceptual thinking. This cognitive leap was made possible by the development of the ability to navigate space and time in the mind and to recognise structural patterns (Donald, 2001; Tomasello, 2016). This marked a key milestone in the evolution of the human brain.

Both physical fossil endocasts and their virtual counterparts yield vital morphological data regarding cranial volume and configuration, which would otherwise be impossible to obtain for extinct species. Considering the fact that the cultivation and maintenance of social skills demand substantial individual cognitive capacity, a significant expansion of the hominid nerve system became evolutionarily inevitable. Interdisciplinary research into the early phylogenetic stages of hominid evolution identifies several emergent biological features that facilitated critical survival strategies. Decreased intra-group aggression and heightened cooperation among group members likely constituted the initial steps toward cohesive collective action against environmental threats.

In what follows the above will be expanded on with further details considering morphological evidence, details of archeological findings, the emergence of sociability and human learning capacities, and furthermore, references to contemporary theories related to the social brain capacity and human cooperation.

Morphological adaptation

Beyond traditional archaeological methodologies, advanced non-invasive imaging techniques—such as computed tomography (CT) and magnetic resonance analysis—now facilitate the three-dimensional digital rendering of cranial models. These virtual reconstructions offer novel insights into the structural changes of the brain across the hominid lineage. Chronological divergence modeling places the emergence of the genus Homo within a window of 4.30 to 2.56 million years ago, reflecting a gradual yet compounding trajectory of encephalization. For instance, evolutionary ancestral state models utilizing time-scaled phylogenies indicate that early bipedal hominins

experienced a reduction in overall body mass, prior to the dawn of the Homo lineage, which was subsequently reversed by a distinct trend toward elevated body mass (Püschel et. al., 2021). Investigations targeting size-independent morphological features have revealed significant modifications in relative proportions, inclination, outline curvature, circularity, and spatiotemporal dimensions across the hominid lineage (Bisconti & Tartarelli, 2025). These findings corroborate prior scholarship positing a mosaic model of hominid cortical evolution, while simultaneously suggesting that these key structural reorganizations correlate directly with specific functional and behavioral outputs.

Early hominids and the emergent sociability

Evidence of cooperative construction in stone tool manufacture hints at the foundations of essential social capacities operating in early hominid groups millions of years ago (Shipton & Nielsen, 2015). Archeological sites of the Oldowan Industrial Complex – characterized primarily by sharp-edged flakes and the cores dating to about 2.6 million years ago – and the Auchelian Industry producing handaxes and cleavers across the planet from Africa to India and France roughly about 1,75 million years ago required a high level of human cooperation underpinned by advanced imitation abilities. Populations in these cultures effectively developed methodologies for organizing sequential labor stages, skill-based labor division, and coordinated resource transportation. Conversely, while crainal capacity expanded throughout the Homo lineage, the behavioral and material records do not demonstrate a tandem continuity of anatomical and behavioral development over time. Indeed, it is not until the appearance of the first anatomically modern humans in Africa that we see the rapid changes of technological innovations occuring alongside with the appearance of the first unambiguously symbolic artifacts. Archaeological evidence in the form of shell ornaments, pigment utilization, and particularly the geometric engravings recovered in Blombos Cave dating to about 77,000 years ago confirms the capacity to intentionally generate abstract and representational imagery (Henshilwood et al., 2002), signaling the establishment of modern human behavior.

While archeology seeks to uncover evidence of human brain development through observation, contemporary social neuroscience studies aim to explore the neurological processes underlying social actions, thereby offering valuable insights into the historical neurodevelopment of Homo sapiens. Recent results suggest that hominids achieved simple social interactions by observing and imitating others, a process by activation of the mirror neuron system *(*Rizzolatti & Craighero, 2004), a specific genetic feature of the human brain. The specialized network is claimed to enable one to comprehend the actions of others and to acquire those by imitation. Although ambiguities persist regarding the exact operational mechanics of mirror neuron systems, indirect evidence has documented their sparkling conditions, brain localization and activation (Keysers, 2009).

A growing body of literature suggests that the major transformation of the hominid brain drove cognitive advancement, simultaneously improving adaptive capacities within ecological environments, and fostering highly developed individual sociability.

The archeological endocasts and neuroscientific indicators of human brain evolution are further cotextualized by the social brain hypothesis (Dunbar, 1998). This theory demonstrates that hominid encephalization was fundamentally linked to the unique sociability of the lineage, establishing the biological architecture that continues to govern human social capacity today.

The theory posits direct correlation between social group size and neocortical volume, enabling humans to maintain exceptionally large social networks compared to other non-human animal species. Subsequent investigations (Dunbar, 2009, 2024) have further clarified this biological capacity, which has remained largely constant throughout human evolution. The theory claims that the average group size the human brain manages is around 150 members, which comprises the closest relations extending to more distant, yet active relations). This numerical boundary aligns with human ethological analyzes of early cultural evolution (Csányi, 2010, 2024). While these interpersonal layers reflect varying degrees of intimacy and familiarity, they rarely permit an expansion beyond this structural baseline.

The contemporary phase of human evolution continues to validate this model (Forgács, 2008), as the inherent limitations of human neuro-social capacity manifest across modern institutional structures, including the optimal size of military units, the operational ceilings of small businesses, and the structural cohesion of religious congregations

Cumulatively, this evolutionary trajectory was facilitated by the improvement of socio-cognitive abilities that drove the development of communities and communal cultures, which are examined in the following sections.

Knowledge transmission and the community culture

Among the higher level of competencies, the transmission of new knowledge was vital in early human culture development. However, transmission only became possible with the successful acquisition of new behavioral patterns by the imitation of the movements of other individuals, a strategy called emulation, which occurred among early humans at about two million and four hundred thousand years ago (Tomasello, 1999, 2016). The Homo erectus is believed to have possessed the skills for action metaphor, gesture, mime and imitation, which were applicable for transmitting information from one individual to the other (Tomasello, 2016), which provided the basic conditions for formulating dyads, groups, or later, community cultures. By practicing emulation-based knowledge acquisition, early Homo species exceeded the constraints of the biologically determined genetic transmission of information. At the same time, this shift developed the adaptability of our ancestors to environmental changes, a critical survival mechanism, which paved the way for the emergence of a new species, the Homo sapiens.

In addition to the capacity of observing and imitating others' movements, decoding others' intentions to achieve specific objectives was another milestone in human evolution. Although non-human apes can perceive conspecifics as intentional agents for competitive purposes, humans uniquely comprehend others as intentional agents while possessing the skills and motivations to share intentional states with them. Consequently, the primary distinction separating humans from other great apes is that humans operate

with skills and motivations of shared intentionality. To delineate human cooperation, Tomasello (2016) distinguishes between joint intentionality, and collective intentionality, positioning shared intentionality as the superordinate category. While joint intentionality characterizes early hominids, collective, or shared intentionality features modern humans operating in their complex cultural realities.

The emergence of shared intentionality marked a radical departure from the purely individual intentionality and thinking of other great apes, while simultaneously driving the evolutionary transition from emulation to conscious information transfer. The shift occurs because participation in shared intentionality activities requires mutual action, that is beyond powerful forms of intention reading and social learning, it also requires unique motivation to share psychological states with others and unique forms of cognitive representation for doing so (Tomasello et al., 2005). Shared intentionality, wherein individuals pursue a collective goal and coordinate their behaviors to achieve it, is the direct product of human evolution (Csányi, 2024; Tomasello, 1999, 2016; Tomasello et al., 2005). Engaging in these shared activities yielded species-unique forms of cognitive mechanisms and learning (Henrich, 2016). Cultural learning (Henrich, 2016), or cultural transmission (Boyd & Richerson, 1985) means that humans rely on socially transmitted knowledge, which allows generations to build upon innovations, which then drives the process of gene-culture coevolution. Cultural transmission is activated along a complex of three pathways, which are vertical, from parents to offsprings, oblique, from older generations to younger non-descendants, and horizontal, meaning learning within a given generation (Boyd & Richerson, 1985), which leads to a more intensive and fast cultural evolution (Henrich, 2004). This process of self-domestication even increased the level of cooperation and the development of prosocial attitudes and practices at an early stage of human evolution (Henrich, 2016).

In conclusion, the faculties of emulation and intentionality served as foundational social competencies that provided humanity with an effective means of adapting to early evolutionary ecological changes. As individuals began utilizing their capacity for social learning, this cognitive faculty established the ethological baseline for human culture, subsequently enabling cultural evolution through structured human cooperation. This developmental trajectory—spanning from sensory perception to conceptualization and basic communication—culminated in a framework where sustained social interaction and inter-individual knowledge transmission within the community became viable, thereby initiating the process of cultural evolution.

Sociability, cooperation and culture

With the 20th century emergence of the discipline of sociobiology the biological, social and evolutionary aspects of the human species development were integrated. The term was introduced by E. O. Wilson (1975), who intended to explain the evolutionary mechanics behind human social behavior through the study of competition, cooperation and nurturing of the young. Although initially the theory sparkled heated debate among experts, it soon gained ground as a discipline studying the social-psychological and biological aspects of human behavior. While research grew and prospered, most

researchers of human evolution ignored culture or were actively hostile to it until the 80s, since they thought, culture had no independent causal role (Boyd & Richerson, 2024). A subsequent discussion of some human behavioral mechanics, such as aggression or altruism (Wilson, 1978) also inspired further research into the area of human cooperation. Since the topic attracted scholars of anthropology, economics, mathematics, political science, primatology and psychology the same way, an in-depth analysis of cooperation was called for in order to redefine and to model cooperative human behavior employing an evolutionary perspective to the subject. To respond the need, a collection of studies was edited (Hammerstein, 2003) which, among others, features an excellent assessment of the dynamic interdisciplinary field of the genetic and cultural evolution of cooperation.

Although, a synthesis of the theory of cooperation was still not reached in the publication, some synergistic gains were offered. As a result, recent scientific debate on the evolution of human cooperation and culture has provided us with valuable results. Richerson et al. (2003) successfully analyzes the role of conformist decisions in shaping societies. Henrich (2004) explains how our evolved cultural learning capacities created the conditions for the cultural evolution of prosociality. On the other hand, cooperation is often studied in comparison with competition. While humanity evolved the ability to learn from each other to allow cultural evolution to commence, rapid cultural adaptation also leads to persistent differences between local social groups, facilitating competition between groups (Boyd & Richerson, 2009).

On the other hand, our species' extreme reliance on culture also facilitated human cooperation between genetically unrelated individuals. This idea has even paved the way for further studies based on group-level selection theory (Boyd & Richerson, 2010). The idea that culture facilitated human cooperation acting on culturally differentiated populations has even led to the recent development of Cultural Group Selection (CGS) hypothesis (Boyd & Richerson, 2010; Boyd et al., 2011; Richerson et al., 2016), which concludes that culture acts like a system of inheritance (Boyd & Richerson, 2024). Although rigorous testing and solid arguments are still to be presented in order to convince scholars about the details of CGS theory, the claim that culture is of key importance in human evolution is now widely accepted among the researchers of the field.

An ecological approach to human cultural evolution

Advancing from this interdisciplinary baseline our conceptualization of culture integrates the complementary biological and social drivers that catalyzed human evolution and continue to govern the behavioral and cultural dynamics of the existence of Homo sapiens today. Thus we identify culture at the intersection of the individual and the social group.

Human ethology delineates the defining components of human culture through five interrelated elements: (1) shared beliefs, (2) collective actions that facilitate cooperation, (3) the material and abstract creations of the group or community, (4) heightened group loyalty, the result of which is (5) the emergence of the community or group organization

as a distinct, novel entity (Csányi, 2024). Similarly, we define culture emphasizing the fundamental value of cooperation within the community.

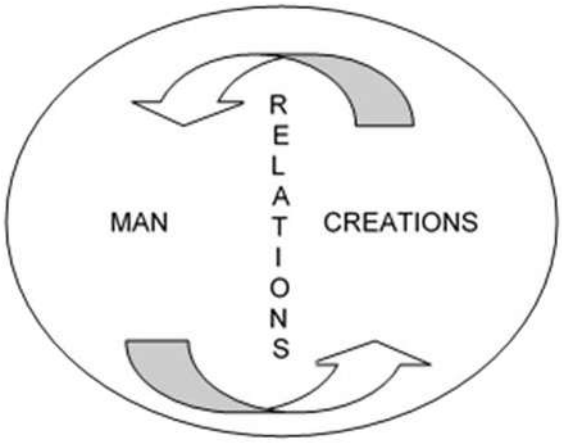
However, along human evolution, the capacity of cultural learning has also contributed to the creation of a broad spectrum of human developments ranging from cultural practices, linguistic symbols through the construction of social norms and rules, and the establishment of social institutions and technical developments (Tomasello et al., 2005; Csányi, 2024; Henrich, 2016; Boyd & Richerson, 2024).

In accordance with the aforementioned taxonomic framework of human ethology, and following an interdisciplinary approach, our functional model of culture is introduced in the following section.

The functional model of culture

Our functional model of culture (Figure 1) synthesizes the primary components of human communal behavior from an evolutionary perspective. Within this framework, human culture is conceptualized as a complex system driven by three core components: (1) the community, designated as MAN within the model; (2) human relational dynamics, which encompass shared beliefs, actions, and collective belonging, designated as RELATIONS and (3) communal products, manifesting both material artifacts or technology, and abstract concepts, designated as CREATIONS.

Figure 1. The functional model of culture



Source: Author's own construction

As indicated by the directional arrows in the model, culture is never static; rather, it operates as an active, dynamic process of continuous self-reformulation. This process is driven by constant intracommunity interaction, wherein members develop and share ideas, actions, and collective identity while simultaneously generating material and abstract entities as products. These communal outputs are progressively integrated into the immediate environment—or community culture—subsequently exerting a reciprocal impact on the population itself. Consequently, community culture is understood as a continuous trajectory sustained by human agency through evaluating, maintaining, and recreating communal reality. This reality encompasses behavioral patterns, internal and

external relational systems, and the immediate ecological context, the elements of which cyclically reinforce the process over time.

The first phase of cultural evolution

During the first period, cultural knowledge was validated and disseminated within small bands of between thirty and fifty adults and some more juveniles (Csányi, 2010, 2024). Based on the aforementioned scientific evidence we hypothesize that the intensity and pace of cultural transformation was exceptionally slow. The primarily experiential knowledge and the foundational elements of cultural reality were systematically adapted to and shared within the local group. For instance, the construction of communal beliefs occurred through individual-level emotional and cognitive processing, and subsequently, these personal perceptions were synthesized into the group's shared belief system through validation. While these collective convictions established the moral foundations of the community, the belief-based shared actions facilitated group cooperation. Furthermore, loyalty manifested as a capacity for adaptive altruism—characterized by a willingness to self-sacrifice for the collective good—which was sustained by the primacy of prosocial traits within the individual personality to ensure group survival.

From an ecological perspective, we assume that the foundational period of cultural evolution was heavily dominated by sociability and group cohesion, resulting in an exceptionally gradual rate of change within the stable cultural reality preserved through shared narratives. The individual functioned both as the agent of the cultural reality and as the subject of that reality. Individuals participated in cultural formulation by driving knowledge transfer across both the psychic and spiritual strata of their immediate social environment.

As far as cultural transmission is concerned, we can also draw some conclusions. This strategy of knowledge transfer yielded beneficial consequences both horizontally within the cultural group and vertically across generations, benefiting both human culture broadly and specific cultural groups in particular. Horizontally, knowledge accumulation facilitated the dissemination of innovative ideas among the intracultural population, thereby securing the collaborative advancement of new insights. Vertically, knowledge developed by preceding cohorts was transmitted and integrated into the cognitive repertoire of successive generations within the community. Through this intergenerational mechanism, cultural elements—including belief systems, traditions, technological innovations, and social practices—were transferred in a highly stable manner, thereby preserving cultural continuity over time.

The progress of the cultural evolution

Demographic expansion within the human population eventually challenged the sustainability of traditional group structures, necessitating the development of novel knowledge transmission strategies through the integration of innovative technologies. This technological shift subsequently initiated a new, significantly more dynamic phase of human cultural evolution.

The comprehensive historical works of Yuval Noah Harari (2014, 2024) expand upon how information networks and technological innovations have driven the gradual transformation of human societies, which we will use as reference here.

Approximately seventy thousand years ago, the highly constrained, localized networks of early human groups expanded into cooperative, inter-band networks. This inter-band commerce and cultural synthesis were significantly accelerated by emerging linguistic capabilities. Crucially, individuals no longer required direct, face-to-face contact to cooperate; instead, alignment was facilitated through adherence to shared narratives that codified the core principles of community survival. This cognitive shift enabled the large-scale organization and flexible cooperation of thousands of strangers, laying the groundwork for complex socio-cultural entities and nations.

Nevertheless, ideological narratives, shared beliefs, and religious frameworks alone proved insufficient for maintaining the administrative cohesion of large populations. This organizational constraint was overcome by the advent of documenting technologies. The written document did not merely preserve social order; it actively institutionalized ownership, state authority, and bureaucracy across all societal domains, ranging from legal systems and public health to systematic knowledge transmission. Consequently, narratives and documents emerged as the primary instruments for constructing a novel iteration of cultural reality. Crucially, this dynamic change often generated artificial or distorted institutional realities, which were validated and enforced by centralized, distant authorities.

Subsequently, another profound institutional innovation emerged, introducing a novel paradigm for validating and sharing knowledge. Through science this intellectual development, the dissemination of factual realities became grounded in robust self-correction mechanisms underpinned by empirical evidence, institutional accountability, the rejection of dogma, and the necessity of collective professional consensus.

From our perspective, it means that simultaneous processes determined the conditions of knowledge transmission. Besides the emerging role of science, communal belief systems continued to exert significant influence, resulting in a duplication of truth-seeking strategies that are likely to have generated socio-cultural and intellectual conflict.

Regarding cultural evolution, based on our functional model of culture, we can claim that a substantial portion of communal knowledge transmission gradually transitioned into a highly regulated process dictated by externally validated information. This phase of cultural evolution was profoundly shaped by the escalating complexity of information transmission technologies. Crucially, this period was characterized by a growing stratification between the roles of cultural innovation and cultural contribution, as well as between information validation and information reception within the social reality. The advent of writing enabled a small elite to monopolize knowledge production and dissemination. Consequently, this monopolization widened the disparity between the select few who actively reconstructed cultural reality and the vast masses who merely existed as its subjects.

Harari (2014, 2024) further analyzes the role of technology in maintaining large population cultures. He claims that technology facilitated the maintenance of social order

through narratives, religious frameworks, and administrative documentation, while simultaneously enabling mass socialization through the dissemination of cultural norms, legal rules, ideologies, and shared beliefs. Despite the advent of the printing press, control over knowledge production remained highly centralized.

We can support the above idea. Although public education became institutionalized, and written communication intensified information transmission at the cultural level, we believe that the social ecology of learning remained stable. Crucially, because this information transfer operated primarily as a unidirectional process, the authority to construct and disseminate novel cultural realities remained the exclusive privilege of a select elite.

In addition, based on the above claims, we can assume that the horizontal and vertical transmission of cultural information, societal norms, and behavioral patterns within groups significantly enhanced cooperative success and adaptive capacity to the environment. The expansion of social groups, the emergence of distinct cultures, and the formation of complex societies catalyzed the reinforcement of specialized rules, methods, and instruments designed to sustain knowledge transmission through formal institutions, such as standardized education systems.

Besides our related remarks above, the former presentation of about two and a half million years of the development of human culture based on Harari (2014, 2024) also allows us some general concluding remarks concerning the ecology of the cultural evolution process, the focal topic our current work.

Throughout the earliest phases of cultural evolution, the transmission of knowledge remained largely constrained by biological determinants. The cognitive capacities critical for learning and social adaptation, such as the neurological architecture underlying information processing, were naturally inherited through genetic transmission.

Over the past few centuries, however, technological advancements have significantly expanded the spatiotemporal boundaries of the social environment of cultural transmission. This expansion introduced a distinct spatial and temporal decoupling among the human creator, the transmitter, and the receiver. Nevertheless, the social dimension of the learning environment remained dominant. Consequently, the biological drivers of human sociability continued to exert a profound influence on learning mechanisms and social adaptation. This stage of cultural evolution occurred predominantly within an organic reality governed by an individual or a collective group within either the immediate or distant environment of the subject.

Currently, however, the rapid acceleration of technological development has established the foundations an alteration of the ecological environment of cultural evolution, the primary characteristics of which are examined in the subsequent section.

The altering ecology of cultural evolution

Most researchers contend that the co-evolutionary dynamics of biology and culture persisting since the early history of humanity has by now lost balance between the two, while an intensive cultural evolution along with the evolution of ideas has commenced. This technologically mediated acceleration in generating, constructing, and disseminating

an information-driven cultural reality has facilitated the rapid evolution of ideas within both organic (social) and non-organic (technological) environments (Figure 2).

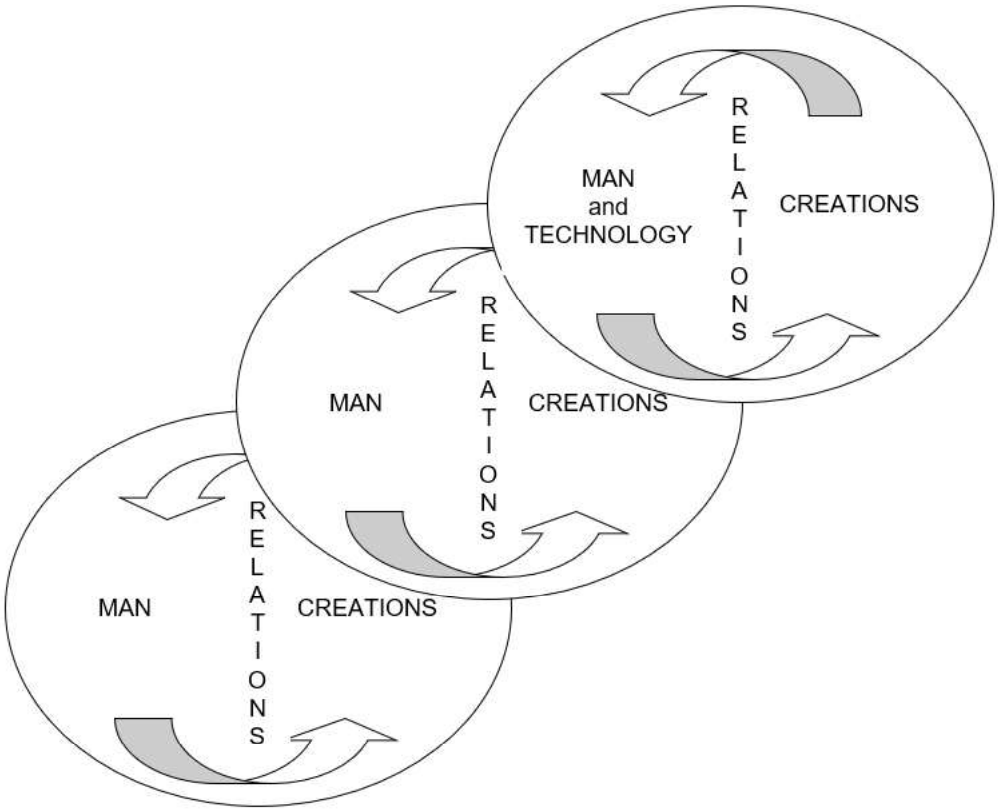
The genesis of this evolutionary shift was first conceptualized by Richard Dawkins (1976), who coined the term 'meme' for a unit of cultural information, claiming that the replication of these units in the modern world follows the model of human cultural evolution. It is based on the notion that culture, like genes, could evolve through replication, that is intergenerational transmission, mutation and selection. It observed that natural selection acts on any pattern of heritable variation, and cultural evolution can lead to cases in which specific traits end up closer to a cultural fitness optimum than the genetic one, even when the general capacity for culture is at the genetic optimum.

Dawkins (1976) promoted a biological approach to culture, which soon triggered positive reaction by researchers of sociobiology (Boyd & Richerson, 1985). As a result, since its inception, the field of memetics has developed into a structured domain focused on how, why and when memes appear, split, reformulate, reappear in different variants, compete with each other, regenerate, maintain themselves, modify, disappear and die, while dissipate in public consciousness. Evolution of ideas today has by and large been detached from adaptation, and has become self-organizing and self-maintaining (Csányi, 2010). In addition, generalized self-replicating ideas are also claimed to give rise to the phenomenon of thought contagion (Lynch, 1991). During a thought contagion process, it is observed that the transition of an idea, or meme, from individual level considerations to population level can act to cancel individual variations and may result in altering population behaviors (Lynch, 2008).

Empirical evidence also suggests that this process has been vastly compounded by recent technological milestones—including distributed computing, global networks, and generative artificial intelligence architectures—which have exponentially accelerated informational drift. Crucially, this technological integration has transformed not only the velocity of informational dissemination but also the systemic mechanics of idea evolution.

More importantly, contemporary dynamics of cultural transmission diverge drastically from the historical frameworks detailed earlier. Rather than human communities actively filtering, evaluating, or validating the epistemic reliability of incoming concepts, autonomous informational units now proliferate across socio-cultural boundaries at unprecedented scales. Consequently, these digital constructs directly engage individual cognitive faculties, entirely bypassing the traditional scaffolding of communal mediation.

Figure 2. Changing agents of cultural evolution



Source: Author's own construction

We contend that a profound shift is occurring within the ecological architecture of the human community for two distinct reasons. (1) A substantial portion of the traditional organic, social environment is transitioning in combination with a technologically driven, non-organic communal landscape. (2) Within this environment in alteration, a major part of the human population is increasingly positioned as passive consumers, receivers, and targets, rather than active agents or co-creators of cultural formulation. This process is driven by the exponential proliferation of digital channels, media platforms, and communication technologies. Crucially, the operational control of these sophisticated systems is increasingly consolidated within a highly restricted elite of technical experts and institutional gatekeepers.

Currently, conventional communal strategies for maintaining social cohesion—namely, the sharing of beliefs, collective actions, and cultural constructions—appear increasingly ineffective. Driven by the escalating complexity and pervasiveness of the technological landscape, individual cultural realities have become saturated with non-human-validated, competing memes distributed across a multitude of variants via multimodal information channels. These discrete information units are subsequently received, perceived, and interpreted through highly diverse cognitive frameworks. Consequently, individuals analyze this incoming data both within and outside traditional community structures at varying velocities, depths, and levels of efficacy. The impact and the role of the organic, offline social environment in sustaining community culture appear

to be diminishing within individual lives, frequently being supplanted by expansive online networks across nearly all societal domains.

Our firm belief is that our biologically derived sociability is increasingly decoupled from the process of cultural knowledge transmission, while technologically mediated cultural intervention becomes prevalent. While science—as a human-operated, organic cultural technology—appears to be losing its monopoly over the validation and mass dissemination of knowledge, it has conversely begun to function as an alternative apparatus for analyzing and evaluating the epistemic truth value of information, operating alongside the profound non-organic technological restructuring of digital realities.

This shift raises a pivotal question regarding whether the biological foundations of human sociability are fundamentally threatened, or if the traditional community faces eventual dissolution under the escalating pressure of this powerful non-organic environment.

'Community' at the nexus of organic and non-organic environments

While some claim the social faculty of man will still be active during the following phases of evolution, however, in new rather than the traditional ways, others believe the individual will further develop their own social capacities facilitated by the adaptable genetic coding they possess.

McLuhan (1964, 1994) advocates the idea that the new environment will stimulate the emergence of new principles of sociability in human communities. He explains how traditional principles fail and illustrates how conventional cultural, civic, state, national or social groups are destroyed and successfully transformed into psychic, social, economic, and political parochialism in the global village through shaping human perception, thought processes, and social interactions.

Boesch and Tomasello (1998) points out how qualitatively different social constraints affect the diffusion and transformation of cultural variants. It concludes that cultural variants available for individuals within the group may exert their effect on the group selection of memes, while it also explains that the success of the process depends on specific features of the group itself. Some examples of influencing group qualities are also mentioned, such as the structure of the social group, the conditions of the social environment, the criticality of norms in the group through free choice, convention or imposition. Considering the dissemination of cultural variants at the level of the individual, five social models of cultural distribution are distinguished, which are the family, the association, the majority and prestige. It is found that the more rigid the social constraints, the more homogeneous the population in a cultural community is.

A positive view proposes that the biology-based evolutionary features have provided a solid foundation for us to tackle the environmental situations until recent times, and this will continue in the future. Csányi (2024), for instance, argues that our biologically stable social capacity has not changed through evolution, which means, it determines individuals' responses to the environment independent of the types of changes in this

environment. That said, the individual will activate their biological sociability in themselves during the interaction with the environment, which means that they will act as group organizations comprising a single member during formulating and structuring their belief systems. Their individual belief systems will then coordinate their actions, and furthermore, they will be loyal to themselves, thus providing a solid ground for maintaining their own single-person social community.

In line with the individual responsibility and autonomy in community maintenance strategies, such as truth seeking and belief formation, education specialists, institutions, and international organizations tend to emphasize the necessity of acquiring and improving novel individual skills of human survival. Among the twenty-first century skills, knowledge and attitudes, critical thinking is often considered to be a key. Consequently, intense research has been carried out to pin down the core meaning of the concept reviewing the philosophical, psychological and educational perspectives (Lai, 2011). While observing the educational principles of Bloom (1956, 1984), the essential elements of critical thinking are also extended in a comprehensive multilevel model of critical thinking (Fábián, 2015, 2017, 2018). The proliferation of individual interactions with the non-organic environmental agents of our cultural ecology has become a significant reason why researchers and educators now focus on identifying, assessing and developing the strategies, competencies and the attributes of critical thinkers internationally.

Conclusion: future prospects

At present it is impossible to make clear claims about what the future holds for human communities. The interaction between the relatively slow biological evolution of humanity on one hand and the immense velocity of the change of the technology immersed complex ecological environment on the other appears to set human groups an incredible challenge. All levels of the reality, comprising inorganic, organic, psychic and cultural levels are under the impact of the altering ecology, while urgent questions related to the interaction between communities and their environment are raised both in scientific research, between humans, individuals and within communities alike.

A leading driver in the alteration of the ecology of communities is the evolution of ideas. Currently we face an intense competition among information units generated by individuals, groups and technology across the globe, which puts human communities into the difficult situation of being surrounded by multiple meanings, beliefs, cultural traditions, scientific claims, ideologies, individual thoughts and other cultural units. Accordingly, communities seem to operate under novel, unexpected conditions. They are influenced by the growing impact of the evolution of memes, mostly outside the control of the individual and the social group, and the growing complexity of the ecological environment surrounding the individual and the community simultaneously.

While the future possibility of cultural evolution demolishing human communities appears to be of improbable, scientific evidence suggests that the fundamentally biological motive of Homo sapiens to survive through relying on their social faculty should allow us some optimistic future expectations.

At the same time, a growing body of scientific evidence seems to cumulate to provide responses to fundamental related questions and delineate significant conditions of cultural evolution. To illustrate, the theory of multilevel selection offers an alternative to individualism in biology and the human sciences alike, while providing a firm scientific foundation for the concept of groups as organisms (Wilson et al., 2007). It also posits that natural selection in evolution acts at the level of the group rather than the individual (Hammerstein, 2003). While maintaining that natural selection operates on a hierarchy of units from genetic elements to multi-species communities, it treats social networks as functionally integrated entities (Wilson, 2007). Although axiomatic statements related to the area of community evolution are still at a distance, multilevel selection thinking seems to act as a possibility that is realized when certain conditions are met.

The current situation and the potential consequences of cultural evolution in the life of human communities is under discussion within the framework of a variety of disciplines, such as human ethology, anthropology, history, social psychology and psychology alike. However, we agree saying that the integration of studies of cultural evolution crossing disciplinary boundaries might produce new insights by bringing ideas and methods from historically disparate fields (Kolodny et al., 2018), and furthermore, might demonstrate synergies on some crucial issues related to our topic.

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