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Commentary

Legacy and constraint in the evolution of human culture

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1. Introduction

What is culture? This enduring and deceptively complex question lies at the very foundation of the social sciences, and despite decades of sustained attention, remains a central challenge for anthropology (Birch and Heyes, 2021; Kroeber and Kluckhohn, 1952; Mesoudi, Whiten, and Laland, 2004; Shweder, 2003). Culture (among humans) is difficult to define in part because it is recursive, historically layered, interactive, emergent, and expressed through both material practices and symbolic meanings. In some scientific frameworks (contemporary and historical), culture is conceptualized as a source of explanation, as if it were an independent force driving variation in human behavior (Alexander, 2003; Durkheim, 1893; Janes, 2006; Linton, 1947; Mead, 1964; Meyer, 2010). Evolutionary social science approaches, however, treat culture as a phenomenon requiring explanation, shaped by ecological conditions, constrained by evolved psychology, and subject to evolutionary dynamics (Murdock, 1932; Richerson and Boyd, 2005; Tooby and Cosmides, 1992).

Baumard and André's (2025) target article is one of the most compelling recent efforts to revisit the challenge of conceptualizing culture. Their proposal—to understand culture as the ecological legacy of individual adaptive behavior—presents a refreshingly parsimonious, albeit bold alternative to dual inheritance models. Grounded in inclusive fitness theory, it reframes culture resulting not from a separate inheritance system or as an evoked response to environmental cues, but as an emergent outcome of individuals modifying their environments in ways that influence the behavior of others. This synthesis, integrating ecology, behavior, and culture, is intellectually ambitious and timely.

Drawing on ethnography and evolutionary anthropological theory, I highlight a few domains where their framework might be extended or revised: the cultural construction of kinship, the role of leaders in teaching opaque norms, the enforcement of conformity under social constraints, and further engagement with the cumulative and symbolically mediated character of *human* culture.

2. Kinship, strategic interests, and the cultural mediation of fitness

Baumard and André's framework presumes that individuals identify kin and pattern their behavior toward them accordingly. This assumption is fundamental to their inclusive fitness account, and indeed, humans possess a suite of evolved mechanisms for assessing relatedness, including co-residence, facial resemblance, and olfactory cues (Alvergne, Faurie, and Raymond, 2007; Lieberman, Tooby, and Cosmides, 2007; Mateo, 2015; Platek and Kemp, 2009). These cues, however, can be ambiguous, especially beyond close kin, and are subject to error, cultural reinterpretation, or strategic manipulation (Fox, 1983; Qirko, 2011; Western and Strum, 1983). Socially constructed kinship systems and cross-cutting sodalities can override biological cues, shaping cooperation and affiliation in ways that do not necessarily align with genetic relatedness. Although such systems, including age-sets, territorial sections, and totemism (Evans-Pritchard, 1940; Glowacki, 2020; Levi-Strauss, 1971), as well as adoption (Gibson, 2009), godparenthood, and "milk kinship", may not always reflect biological ties, they may nonetheless advance individuals' inclusive fitness by mobilizing cooperation, alliance-building, or reputational benefits through culturally salient relationships. In some Latin American societies, the institution of *compadrazgo* creates strong bonds between godparents and godchildren, often entailing obligations and emotional ties that rival those of biological kin (Mintz and Wolf, 1950). Similarly, in various

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Islamic societies, milk kinship arises when a woman breastfeeds a child not her own, forming a legally and socially recognized relationship that prohibits marriage between "milk siblings" and carries obligations equivalent to those of blood relatives (Parkes, 2005). Further, in smaller-scale, kin-based societies where multiple extended families live in close proximity and intermarry, individuals can misrecognize biological relatives or rely on culturally constructed categories of kinship, such as affinal ties, fictive kin, or classificatory systems, that do not necessarily correspond to genetic relatedness (Schneider, 1984; personal observation; Lew-Levy, personal communication).

In such contexts, individuals may be unaware of, confuse, or misclassify even close biological relatives, including first cousins or affines. The social salience of genetic relatedness often hinges on the structure of local kinship and descent systems, with some lineages assigning greater importance to classificatory ties than to genealogical proximity (Hughes, 1988; Pasternak, 1976). These culturally defined relationships shape cooperation, resource sharing, and alliance-building, not necessarily through biological recognition, but through socially mediated pathways. This does not undermine inclusive fitness theory, but it highlights how cultural institutions structure the ways in which individuals pursue their reproductive and social interests. I have documented kin-patterned conflict mediation and social relationships among rural pastoralist communities consistent with kin selection predictions (e.g., Garfield & Glowacki, 2023), and numerous studies support similar patterns (e.g., Alvard, 2009; Enke, 2019; Glowacki and Wrangham, 2015; Gurven, 2004). Certainly, kin selection offers a powerful framework for understanding human behavior (Hames, 2015), but among humans, its explanatory power hinges on how kin relations are culturally perceived and socially mediated. Baumard and André might suggest that culturally constructed kinship systems are adaptive strategies that advance individual inclusive fitness by enabling or patterning coalition-building, alliances, and resource exchange. Yet kinship classifications often diverge from genetic relatedness, taking on their own moral and institutional authority. These social structures, of course, ultimately exist as information patterns within individual brains, but they simultaneously operate as collective, public institutions that are actively enforced, taught, and maintained. More explicitly incorporating this institutional and symbolic dimension could be useful in Baumard and André's framework, helping to capture how cultural legacies stabilize and evolve.

3. Leadership and the ecology of teaching

Baumard and André emphasize that culture emerges when individuals leave behind adaptive legacies that subsequently shape the environments of others. But in many societies, not all individuals contribute equally to such legacies—often, it is disproportionately leaders (Garfield, von Rueden, and Hagen, 2019; Henrich, Chudek, and Boyd, 2015).

In recent work, we proposed the leader-directed teaching hypothesis (Garfield & Lew-Levy, 2025), suggesting that among egalitarian societies in particular, knowledgeable community leaders often bear the cost of transmitting opaque, cooperation-enhancing cultural information, including ritual knowledge, kinship structures, moral values, cosmology, and origin narratives to younger, culturally naive community members. Such forms of teaching are not incidental. They are often strategic acts of transmission with fitness relevance, strengthening coalitions, promoting cooperation, enhancing reputations, and supporting kin.

This mechanism is consistent with Baumard and André's inclusive fitness framework and offers a window into how cultural legacies might be stabilized and transmitted across generations. Teaching is not just the repetition or accumulation of adaptive behavior, but is often intentional, costly, extensively coordinated, and concerted or institutionalized (André, Baumard, and Boyer, 2023; Charbonneau, Curioni, McEllin, and Strachan, 2023; Fogarty, Strimling, and Laland, 2011; Garfield, Garfield, and Hewlett, 2016; Thornton and Raihani, 2008). Recognizing leadership dynamics as a structured pathway of transmission that yields inclusive fitness benefits to both teachers and learners could also enhance the ecological model of culture and align well with ethnographic observations.

This view of leadership as a driver of structured transmission also suggests a distinction between human cultural accumulation and standard ecological succession. Baumard and André convincingly note that standard ecological systems, such as coral reefs or oak forests, can accumulate structural changes over generations, similarly to human cumulative cultural evolution. But in human societies—especially those organized around customary law and traditional authority—such accumulation often occurs through explicit reference to historical precedent, symbolic reasoning, and socially sanctioned roles for transmission (Hoebel, 1954). For example, in many pastoralist and kin-based communities, conflict resolution is often guided by elders or groups of individuals with formalized social roles who recall past cases, interpret community norms, and negotiate outcomes (Garfield, 2021; Glowacki and Gonc, 2013; LeVine, 1961; Molho, De Petrillo, Garfield, and Slewe, 2024; Singh and Garfield, 2022; Wiessner, 2020). These systems do not evolve through ecological feedback alone. They are often consciously curated, socially enforced, and culturally legitimized. Cultural succession here is not only the accumulation of past practices, but often the deliberate reinterpretation of history through socially recognized authority.

4. Cumulative culture and collective innovation

A key strength of Baumard and André's framework includes their emphasis on how individual behaviors can generate lasting ecological legacies. However, their account of cultural accumulation downplays how deeply human legacies are shaped by collective intentionality, institutional memory, and symbolic transmission. They rightly note that innovations such as the printing press build on prior modifications across generations. Yet, by framing this accumulation as a form of ecological succession, their account overlooks a core feature of human culture. It is a socially organized, often intentional, and institutionally sustained process.

The Gutenberg press, for example, was not simply the endpoint of successive individual behaviors, or the expression of a joint phenotype, but the product of multiple overlapping knowledge systems—metallurgy, alphabetic writing, papermaking, legal infrastructure, etc. transmitted through institutions and stabilized by norms and archives (Man, 2002). Similar patterns hold for kinship systems, religious traditions, and legal codes, which persist not merely as useful artifacts encountered by individuals in their environment but because influential individuals or groups deliberately manage historical legacies, encoding, enforcing, and transmitting these opaque social structures (Garfield & Lew-Levy, 2025).

Innovations persist and recombine (in part) because they are curated and sustained through structured transmission. They are often taught, institutionalized, and embedded in shared symbolic systems. To fully account for this dimension, Baumard and André's model could engage more directly with mechanisms of social coordination and symbolic mediation, enabling cumulative culture to stabilize and evolve over generations. As one potential mechanism (or class of mechanisms), theoretical and empirical work suggests that inclusive-fitness driven selection may also act across generations, not only through ecological legacy effects but through the trans-generational transmission of norms, roles, and cooperative expectations. Models of descendant-leaving strategies and environmentally mediated fitness effects propose that ancestor influence can shape the behavior of descendants in ways that extend and amplify prosociality beyond the limits of direct inclusive fitness alone (Clark and Walker, 2025; Lehmann, 2008; Mullon, Peña, and Lehmann, 2024). Cultural traditions and institutions ultimately exist as information structures within individual minds, but the

mechanisms by which they mediate selective pressures among humans uniquely span generations. Accounting explicitly for this trans-generational dimension—and the social institutions and norms that stabilize and transmit it—could enhance the ecological model of cultural evolution by capturing selective processes distinctive to humans.

5. Constraint and the cost of nonconformity

Baumard and André suggest that individuals can adopt or ignore the legacies left by others, depending on whether they serve adaptive goals. Although this makes sense for elephants navigating trails or crabs selecting shells (and probably many domains of human adaptive decision-making), it oversimplifies at least some human socio-ecological contexts.

In many pastoralist communities, for example, marriage systems are controlled by elders who manage access to legitimate partners. Young individuals may disagree with the norms, but deviating comes with steep social costs, including exclusion from reproductive opportunities. Nonconformity is not just suboptimal, it is often effectively impossible. For example, reproductive rituals in such contexts often function as mechanisms of political control, allowing dominant male coalitions to regulate fertility, kinship, and alliance formation in ways that preserve their power (Calvert, 2016; Paige and Paige, 1981). This illustrates that cultural conformity, even if not central to Baumard and André's model, can be functionally mandatory due to institutional enforcement. Individuals may conform not because a norm is intrinsically adaptive, but because deviation is harshly punished (Garfield, Buckner, Wrangham, & Glowacki, 2022). These constraint-driven dynamics create cultural stability that resembles inheritance, even if the transmission mechanism is not genetic.

6. Conclusion

Baumard and André offer a bold and innovative theoretical framework for explaining cultural dynamics through the lens of inclusive fitness and ecological legacy. It is a framework I find compelling and one that is likely to stimulate new lines of inquiry at the intersection of ecology and human evolutionary social science. Their rejection of a distinct system of cultural inheritance promotes parsimony and connects cultural phenomena to the core principles of evolutionary biology.

To fully capture the dynamics of human cultural evolution, Baumard and André's framework could benefit from explicitly addressing several key features that make human cultural ecosystems not merely "that complex whole" described by classical anthropological definitions, but structured, recursive, and institutionally mediated in distinctive ways. Kinship is culturally constructed. Leaders teach opaque norms for fitness-relevant reasons. Individuals often conform to social constraints. And innovations accumulate across generations, embedded in symbolic institutions. These elements do not contradict their ecological framing and inclusive fitness focus. But perhaps they can serve to anchor it more securely in anthropological evidence. If human culture is a legacy, it is one that is curated, constrained, and often consciously reproduced.

As an ecologically oriented, ethnographically grounded, evolutionary anthropologist, my perspective inevitably emphasizes certain components of the target article over others and overlooks many elements of the authors' framework. Still, I view this paper as a useful and generative step toward rethinking what culture is and how it changes. A renewed approach to defining culture—one that invites theoretical integration while staying evolutionarily and empirically focused—is both timely and welcomed.

CRediT authorship contribution statement

Zachary Garfield: Conceptualization, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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