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Studying culture from an evolutionary psychological perspective: approaches, achievements, and prospects

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> Culture is not simply human psychology, not even evolutionary psychology, "writ large". We still need the social sciences. But psychology underlies culture and society, and biological evolution underlies psychology.
> (Barkow, 1992, p. 635)

It can feel as if evolutionary psychology and the study of culture are at odds with one another. Evolutionary psychology's account of the mind is a tale of a small set of mental mechanisms shared by all humans, shaped by natural selection in an ancestral population, and with clear functional organization. It is a story about what we all share. The study of culture is a tale of different communities doing many things in different ways, for reasons that have nothing to do with differences in their genes. It is a story about differences between communities that seem opaque, baffling and arbitrary. Perhaps unsurprisingly, then, some discussions pit biological evolution and culture against one another in a kind of zero-sum game of explanatory power: more relevance for biological evolution must mean less relevance for culture, and vice versa. Some critics of evolutionary psychology have even claimed that a general prediction of the evolutionary psychology paradigm is that there will not be much cultural variation (Levy, 2004; see Nettle & Scott-Phillips, 2023 for discussion). This would make the obvious fact that different communities have different cultural traditions a refutation of the evolutionary psychology approach.

The zero-sum view is wrong. The existence of diverse, rich, varied cultural traditions is not just compatible with the evolutionary psychological approach; it requires an evolved psychology to make it possible. It is ironic that the perceived tension between evolutionary-psychological and cultural approaches to human life persists. Over thirty years ago, one of the seminal documents of evolutionary psychology, Tooby and Cosmides' 'The psychological foundations of culture' (1992), was exactly devoted to the question of how evolved minds produce culture. They dubbed their conceptual approach the 'integrated causal model' (ICM), but indicated at the time (p. 114) that they could do no more than sketch its bare bones. This chapter therefore takes the ICM as its point of departure: what is it; is it a useful approach; and how has it been elaborated and applied in the intervening years?

In section 2, we review the ICM. In section 3, we unpack and elaborate in several ways, not to revise it (we have no major disagreements), so much as to put some flesh on the bare bones. In section 4, we review three empirical case studies of areas of research where the ICM or ideas like it have been useful. Before turning to these sections, it is necessary, in section 1, to revisit the definition and key characteristics of (human) culture. We do this with some apology since these issues have been discussed before; and awareness that writing on culture tends to get bogged down in a morass of definitional issues. It is however important for clarity of the material that follows that we are clear on which phenomena lie in our scope.

1. What is culture?

'Culture', in the sense that is relevant here, is neither a natural kind nor any specific human capacity. The term itself is quite a recent invention from one particular cultural tradition. Historically it had only an agricultural meaning: culture meant cultivation, the process of turning natural or wild land into land fit for human production. Only in 1871 did Tylor write his famous definition in terms of the 'capabilities and habits acquired by man as a member of society'. T S Eliot cites Tylor in his *Notes Towards a Definition of Culture,* and states:

> [culture] includes all the characteristic activities and interests of a people: Derby Day, Henley Regatta, Cowes, the 12th of August, a cup final, the dog races, the pin table, the dart board, Wensleydale cheese, boiled cabbage cut into sections, beetroot in vinegar, 19th-century Gothic churches and the music of Elgar (Eliot, 1948, p. 51).

Something is cultural to the extent it is characteristic of, or at least widely distributed in, some community. Culture is often invoked contrastively; to pick out the things that are widely distributed in the community of interest that are *not* found in some other community. Cultural activities have some degree of historical stability: Henley Regatta has existed in England for more than a human lifetime, and people expect it to recur each year. It would be news if it did not. This does not of course exclude that Henley Regatta was deliberately invented (in 1839 in fact) and was not at that moment 'culture'; nor that at some point it may be discontinued.

In evolutionary thought, a frequently-encountered definition of culture is: information acquired through social learning (Boyd & Richerson, 1985). This definition is both too broad and too restrictive (Sperber & Claidière, 2008). It is too broad because most things that people learn socially are not culture; they are local and idiosyncratic. For example, when you tell your partner in which compartment of your fridge to find the cheese, you cause them to acquire a belief through social learning, but it would be strange to call it a cultural belief. The definition is too restrictive because we can be affected by culture in the absence of social learning. Chairs that are found in Japan are lower than standard European chairs. This causes a cultural diversity in sitting practices. But people who sit close to the ground in Japan did not 'learn' to do this from other sitters, or even from the people who made the chairs.

Instead, then, a minimal definition of culture is: beliefs, practices or representations that are widely distributed in a population, different from those found in other populations, and somewhat stable over time. Note that this definition makes 'culturality' a continuum (Sperber & Claidière, 2008). Cultural beliefs, practices or representations are not a special kind of belief, practice or representation; they are just beliefs, practices or representations that have come to have a certain distribution (Morin, 2011). They are dealt with by the mind as other beliefs, practices or representations are.

Culture, defined as above, is not restricted to humans. There are dialects in the songs of songbirds and the calls of cetaceans, and population-specific tool use practices in chimpanzees, among many other examples (Whiten, 2019). Although the number of empirical examples of animal culture is mounting, and their study is thriving, most authors have stressed that there is something rather different about human culture.

A standard way of characterising this difference is that some aspects of human culture are cumulative, whereas this is not true in other animals. In domains such as technology, human cultural artifacts show a clear progression over time in their efficiency and productive capacity. Humans are able to 'stand on the shoulders of giants', taking the best outputs of earlier makers and ratcheting up performance through directed innovation. Exactly what constitutes evidence of cumulativeness, and which aspects of the human mind permit human culture to be cumulative is still debated (Mesoudi & Thornton, 2018; Miton & Charbonneau, 2018; Osiurak et al., 2023). We note, though, that many cultural domains in humans are not obviously cumulative, or it is hard to tell in what sense they are (spoken languages do not seem to be getting more complex over time, nor do kinship terminologies). Moreover, some non-human research has shown evidence of cumulativeness in certain cases (Gunasekaram et al., 2024).

We wish to foreground a different unique feature of human as opposed to non-human culture: *normativity*. For many, perhaps most, human cultural practices, failure to do them is not just statistically unusual in the relevant population: it is *frowned upon*. Goodenough (1957, p. 167) defined culture as "whatever it is one needs to know or believe in order to operate in a manner *acceptable* to [the population's] members" (our emphasis). Keesing (1974, p. 89) stressed that

cultural knowledge is not a person's knowledge about the world, but rather, their knowledge about what their fellow members of society *expect*: "[Culture is a community member's] theory of what his fellows know, believe and mean….It is to this theory he refers…in interacting with strangers….and in other settings peripheral to the familiarity of mundane everyday life space." This conception stresses that culture is not just a fixed list of 'do's and 'don't's, but, rather, a generative cognitive system that the culturally competent person can use to produce behaviours or statements likely to meet the expectations of others in the surrounding community; that is, normatively compliant behaviour. We stress normativity as a key and typical feature of human culture (section 3.3).

2. The Integrated Causal Model

In this section we briefly present the ICM (as summarised by Tooby & Cosmides, 1992, p. 24), and discuss what it implies and does not imply about human cultural patterns and their explanation. The ICM begins with a familiar statement of the evolutionary psychological view. The brain is an organ that processes information, and has been shaped by natural selection to produce behaviour that makes the individual more likely to be successful at key tasks related to survival and reproduction (choosing food, mate selection, family relations, cooperation, and so on). We can usefully characterize these circuits at a cognitive level of analysis, that abstracts away from the neural instantiation and instead considers the computational principles that the circuits instantiate. This is what we do when we talk about evolved *minds*; we are considering evolved brains at a cognitive or psychological level of analysis.

Evolved psychological mechanisms do three things: *infer* states of the local environment from the partial evidence entering the senses; *compute* strategies or representations concerning the challenges presented by the inferred environment; and *enact* behavioural outputs accordingly (action). Evolved cognitive mechanisms produce behavior that is contingent on the local environment and context. This environment-behavior contingency is precisely what gives cognitive mechanisms their adaptive value. Their evolutionary advantage lies in their capacity to generate contextually adaptive responses by processing local environmental information through evolved computational procedures and goals.

The behaviours enacted by human psychological mechanisms include many that can contribute to cultural traditions: linguistic utterances, dances, techniques of food preparation and so on. The outputs of one individual's psychological mechanisms often become available as the inputs of someone else's, to be interpreted and responded to. This process - one person's output is part of the input set to the next person's psychological mechanisms - sets up the potential for the epidemiological and historical processes at the population level that we often call 'cultural evolution'. Cultural evolution thus involves repeated cycles, distributed across multiple people and over time, of psychological mechanisms inferring states of the world, computing responses to those states, and enacting behaviours, behaviours that then contribute to the environment

over which psychological mechanisms in other individuals make inferences. The computational principles of the psychological mechanisms - their priors, biases, and inferential principles, their recurrent motivational responses and preferences, their motor tendencies, will thus shape the tradition at every stage. The reshaping contribution of any single mind may be small, but over the cycles of cultural evolution, the content of traditions will gradually converge to forms that have been shaped by human cognitive architecture, tastes and motivations. Languages will culturally evolved so as to be learnable, paintings eye-catching, tunes singable, moral systems acceptable, through the repeated operations of minds. This is the obvious way in which the evolved mind 'generates' culture.

To reflect on what the ICM offers to the study of culture, what it requires, and what it rules out, it is worth breaking down its name into the constituent parts: it is *integrated*, it is *causal*, and it is a *model.*

2.1 I is for integrated

The ICM is not an attempt to reduce culture to psychology. Far from being reductionist or monocausal, it allows for, and even advocates, causal and methodological pluralism (Heintz et al., 2019). Still, it insists that psychology must be considered in trying to understand culture, just as evolution must be considered in trying to understand psychology. What the ICM requires of us is to try to integrate understandings across three disciplines: sociocultural anthropology, psychology, and evolutionary biology. Hypotheses have to make sense from all three perspectives: they have to account for the observed features of the cultural traditions; they have to specify the cognitive or motivational principles that shape the activities involved in the stabilization of the tradition; and those cognitive or motivational principles must themselves make evolutionary sense. Thus, the ICM invites us to make bridges between various types of analysis that have often been pursued in siloes. Psychological knowledge plays a special role in the integration: cultural traditions were not produced directly by natural selection. Rather, natural selection shaped psychological mechanisms, and psychological mechanisms shaped culture. The call for the integration of psychological processes into the analysis of cultural patterns was certainly not new; it was advocated by Sperber (1985), drawing on the work of Malinoswki written 50 years earlier. The ICM reinvigorated those calls, and added a strong link to evolutionary thinking.

The promise of integration is both exciting and demanding. New bodies of knowledge, methodology and literature become relevant to understanding culture: cognitive science experiments, studies of infant cognition, and models of the evolution of cooperation. Thus, the 'integration' of the ICM increases the set of tools and explanatory resources. Importantly, it also constrains theorizing: good hypotheses have to provide explanations of cultural phenomena, but they also have to be compatible with what we know about the mind, and this in turn has to be compatible with what we know of biological evolution. The integration thus forces us to produce understandings that are consilient across multiple perspectives.

The ICM is a big tent. Although it requires us to integrate cultural-historical knowledge with knowledge of the underlying psychology, the balance of explanatory work is likely to be very different for different questions and grains of analysis. There might be cases where the psychological properties are such that any community in any environment is going to end up with very similar culturally stabilized content, and get there very rapidly. The main observation would be cross-cultural commonality, and the main explanation would be in terms of individual cognition. At the other end of the spectrum are cases where the psychological properties have little effect on the cultural success of ideas or practices, meaning that many different traditions can be stabilized with equal likelihood. The main observation here would be diversity, and the burden of explanation would lie either in historical contingency or local socioecological circumstances. Depending on our perspective, we might be more interested in the cross-culturally recurrent patterns, or the local specificities. In short, many possible positions, from some domain of culture actually being (more or less) psychology writ large, to a more traditional social science position where psychology enables but hardly constrains cultural contents, could all claim compatibility with the ICM.

The ICM thus does not rule out cases where the constraints on cultural content imposed by evolved psychology are quite weak. What it rules out is the position that evolved psychological mechanisms are *a priori* irrelevant to understanding cultural traditions. In all cases: psychology plays a role; the mechanisms must be specified; and cultural theorists cannot propose hypotheses that are incompatible with what we know about the mind, just as the psychological theorist cannot sustain hypotheses that are evolutionarily implausible. The ICM also created the general expectation that psychological factors will turn out to produce identifiable shaping and constraining forces in cultural evolution, an expectation that has turned out to be fruitful in the case studies we review in section 4.

2.2 C is for causal

The ICM involves providing and testing causal explanations for cultural patterns. How does this relate to its ambition to integrate psychology and sociocultural anthropology? One of the foundations of cognitive psychology is the idea that causal accounts can be given of mental phenomena, by treating the cognitive level as a legitimate level of scientific analysis. The cognitive level of analysis refers to functionally-organised features of neurochemical states and events implemented in the brain. This functional approach to mental phenomena gains its scientific legitimacy from evolutionary considerations. When we describe brain states in terms of their computational properties and functional roles, we are describing features that exist and events that happen *because* they process information for the organism, eventually making behaviour contingent on the environment. The evolutionary justification for functional descriptions is that organisms whose cognitive mechanisms successfully computed

solutions to recurrent adaptive problems have outcompeted those whose mechanisms computed less successful solutions. This provides the naturalistic foundation for treating computational and representational descriptions as well-grounded rather than merely convenient fictions.

The ICM's epistemic goal of providing causal explanations therefore fits well with the rest of cognitive psychology. To make the bridge to culture, the next move is to investigate how these cognitive causal chains extend across members of a community (via interaction and communication—see section 3.2), and how they scale up at the population level. This further step represents a different programme from prominent approaches in sociocultural anthropology, which see the epistemic goal as providing understanding through interpretation, but eschew causal analysis.

According to Geertz(1973), what sociocultural anthropologists should seek to provide is 'thick description'. Thick description consists in revealing cultural meanings which, according to Geertz, do not reduce to ascribing mental states to members of the community. For Geertz, culture exists in the public, intersubjective realm of symbolic interaction, rather than as collections of individual mental contents: culture "does not exist in someone's head; though unphysical it is not an occult entity" (p. 10). Thick description focuses on interpreting the publicly available symbolic meanings embedded in cultural practices. Geertz views cultural meanings as emerging from and existing within webs of public significance that people create through symbolic interaction.

From an ICM perspective, cultural meanings can and should be understood as mental representations shared within a community, alongside the public productions that express and transmit them. From this perspective, traditional ethnographic work can be viewed as fundamentally consisting in ascribing mental states—beliefs, desires, intentions, conceptual frameworks—to members of the communities under study. When anthropologists engage in "thick description" or interpret the meaning of cultural practices, they are essentially hypothesizing about the mental representations and cognitive processes that guide community members' behavior. This process of mental state ascription is methodologically sophisticated and requires long periods of participant observation. How can the ensuing insights be integrated into ICM-type explanations? Doing so involves giving up an ontology that gives cultural meanings a special status: culture does exist in heads, and is shaped by the way the bearers of those heads interact.

The ICM thus does not stop at the identification of the mental contents that participants happen to hold: it goes on to seek causal explanations for those contents and their

distribution. Still, identifying those contents, including how social events are being interpreted, is a crucial pre-requisite. In our opinion, the careful work of ethnographers is fully compatible in principle with the ICM. That work is still not sufficiently integrated with causal accounts of culture as advocated by the ICM. Responsibility partly lies in the failure of evolutionary psychologists to properly explain and advocate the ICM and its richness to social scientists. We hope this chapter might help begin to redress this failure.

The ICM's focus on causal explanations of cultural phenomena also helps distinguish it from other evolutionarily-inspired approaches to culture, notably Dual Inheritance Theory (DIT; Boyd & Richerson, 1985). For DIT, the epistemic goal is to explain human adaptation(see Henrich & McElreath, 2003 for a clear statement). Humans are able to survive in the Arctic and in the desert, make kayaks or detoxify cassava, as their local environment requires. They have not come by these adaptive patterns directly through genetic evolution. DIT is concerned with the causal role that cultural transmission can play in leading to these non-genetic behavioural adaptations (as well as in some of the signature cases of non-genetic maladaptation, such as the spread and maintenance of arbitrary or damaging ideas). Of course, cultural transmission must operate in tandem with individual innovation, but it can lead to patterns of evolution, spread and stability not reducible to individual-level processes.

For the ICM, on the other hand, the epistemic goal is to identify specific psychological mechanisms that causally shape patterns of culture. Because the goals are different, the two bodies of literature concentrate on different things, and importantly, they blackbox different processes. The ICM blackboxes the biological implementation of mental representations and processes, treating cognitive mechanisms at a functional level without requiring detailed knowledge of their neural substrates. DIT goes further and blackboxes the transmission processes themselves—the specific cognitive mechanisms by which cultural information is acquired by community members—focusing instead on population-level patterns of cultural change and adaptation (as will be further explained in section 3.2). These different levels of abstraction reflect the distinct explanatory targets of each approach.

2.3 M is for model

The word model is used in a number of senses in science, some of them specific to a phenomenon or hypothesis, some broader. The ICM is broad. It is a normative model of research practices: it specifies what satisfactory explanations should look like, and which

associated research practices should be implemented. The recipe it proposes is roughly as follows, though the steps do not need to happen in this order:

1. Identification of a cultural phenomenon, which will be the *explanandum*;

2. Formulation of hypotheses concerning the operative principles of the psychological mechanisms involved, which will contribute to the *explanans*.

3. Testing or validation of the hypotheses under 2 using the research methods of cognitive and behavioural science.

4. Generation of novel hypotheses concerning cultural commonalities, variation, or dynamics.

5. Testing and validation of the hypotheses under 5 using a variety of methods including cross-cultural comparison, ethnography, experimental cultural evolution, and other approaches.

This formula so far says nothing about evolution. Yet the ICM specifically claims that *evolutionary* psychology, not just psychology in general, is illuminating for the explanation of culture. However, the relevance of evolution is indirect, and follows automatically from evolutionary psychology's more general principle that taking evolutionary considerations into account (what adaptive problem does the mechanism address; what kinds of things were recurrently true across adaptively relevant environments, and so on) leads to better hypotheses and deeper explanations for all psychological mechanisms, not just those that produce culture. Thus, step 2 is, in effect:

2'. Formulation of hypotheses concerning the operative principles of the psychological mechanisms involved, which will contribute to the *explanans*; this formulation will be enriched by taking evolutionary considerations into account.

This recipe means that carrying out ICM research on cultural traditions will stimulate novel research both in psychology itself (step 3; examining cultural phenomena leads to psychological research we would not otherwise have thought of), and in social science (steps 4 and 5). This highlights the integrative nature of the ICM.

3. Theoretical elaborations of the ICM

The statement of the ICM in Tooby and Cosmides (1992) is incomplete in important ways. In this section, we discuss several ways in which it needs to be unpacked and elaborated. First, observation shows that cultural traditions vary greatly, whilst, according to evolutionary psychology, the human mind has a species-typical evolved structure. Section 3.1 discussed how this can be the case. Section 3.2 unpacks the mechanisms involved in cultural

'transmission'. Section 3.3 tackles the topic of normativity. 'Culture' is not just a repository of things (useful in some cases, not in others) that you might do. Rather, it is a set of things people feel they *should* or *ought to* do. The section tackles the cognitive processes necessary to explain this perceived normative force.

3.1 *Ex uno, plura*: The diversity of culture from a universal mind

Cultural traditions vary strikingly and consequentially. Their possible contents do not seem sharply limited. Thus, there seems to be a paradox at the heart of the ICM: all cultures are underlain by the same psychology, yet cultures look substantively different from one another. The ICM allows for solutions to this paradox, but they are not discussed very fully in the original presentation. This section elaborates on them.

The mind having a universal, species-typical structure does not imply that the behavioural outputs of humans will be everywhere the same, nor that internal cognitive representations will be. That which is 'fixed' by genetic evolution is a description of the mind at the level of *mechanisms* (sets of cognitive processes that operate on information inputs of a delimited kind) and *architecture* (principles by which the different cognitive processes interact to modulate one another and control behaviour). The behavioural outputs are certainly not fixed. That, indeed, is the evolutionary advantage of having cognitive capacities: they enable the organism to tailor its behaviour to its local situation and internal states. Most evolved psychological mechanisms are 'learning mechanisms', in the general sense that they embody procedures for acquiring information of certain kinds from the environment (Sperber & Hirschfeld, 2007). Think of language acquisition mechanisms, for example, or those underlying food choice.

Psychological mechanisms pre-specify the kinds of input information that the mechanism will be sensitive to, the processing principles, and perhaps the goal states represented, but not the precise behavioural output, nor the precise representational content of the mature system. Given that the computations on the input information are complex, and that different mechanisms interact with one another, the list of possible ways in which humans can think and behave is thus effectively open-ended. This does not mean that all ways are equiprobable, or that the list includes all the logically possible ways that an organism could think and behave. Nonetheless, a 'fixed' evolved mind provides the potential for a great variety of beliefs and practices given different situations.

Tooby and Cosmides (1992) is known for introducing the comparison of the human cultural mind to a 'jukebox': it can play many tunes, depending on what is cued by the environment, but the tunes all come from a list pre-specified by natural selection and only 'evoked' by the environment. This jukebox view is sometimes (unfairly) seen as being Tooby and Cosmides', or evolutionary psychology's, view of culture (the 'evoked culture' view, see also section 3.2). However, it is clear that Tooby and Cosmides did not view all of culture as evoked in this simple

way. They describe the jukebox comparison as an ‘unrealistically extreme ... thought experiment’ to clarify the issues (p. 117), and stress that other processes must be invoked to explain the diversity of culture (e.g. p. 116). The ‘jukebox’ model is too impoverished to provide an adequate account of the origins of cultural variation for at least three, related reasons: psychological mechanisms are themselves shaped by experience; people interact; and cultural content changes the environment.

First, the jukebox model implies that the mechanisms are only triggered by experience, but in reality, mature psychological mechanisms are themselves affected by developmental experience. Growing up learning to read involves the ‘cultural recycling’ of cortical maps—neural circuits originally evolved for object recognition are repurposed to process written symbols (Dehaene & Cohen, 2007; McCandliss et al., 2003). Reading mechanisms are ‘acquired mechanisms’, and have not directly been shaped by natural selection. Rather, it is the components that they recycle–visual mechanisms and mechanisms for spoken language–that have a history of evolution by natural selection. The existence of acquired mechanisms allows for more persistent and deeper psychological differences between humans as a result of experience than the jukebox model implies.

Second, people *interact.* One person’s cultural output - the things they make and do - forms part of the environmental input of other people. Those other people, in their turn, do things that affect the first person. This interactivity leads to a dynamic whose consequences we are unable to predict from our knowledge of one mind considered in isolation. Interaction leads to path dependency: my psychological contents end up partially determined by who I have happened to meet and when. Moreover, the traditions stabilized in interaction are not necessarily the ones that would be preferentially selected or processed by one mind operating in a vacuum. This is especially true because people’s interests are not generally aligned; nor are they equally powerful, equally connected, equally motivated, or equally well informed. At the population scale, interaction leads to historical contingency: where in the cultural landscape a community goes next depends where it is now, which in turn depends where it was in the past. This means that two communities differing only in some small and apparently inconsequential way at time *t* can end up sustaining dramatically different traditions a few decades later.

Third, the content of cultural traditions is not just a causally inert readout of evolved minds. Cultural content *changes* the environment of decision and representation for the people who come next. Thus cultural processes have a properly causal impact on what is subsequently possible, and which social and technological paths communities take. This is clear for institutions: by definition, these are mutually-known rules of the game that change the sets of payoffs for everyone as soon as they are widely known (Lie-Panis et al., 2024). There are also many other examples though, such as the traditions of writing and mathematics. Cultural traditions lead to niche construction: once a community has a certain cultural tradition, the individuals within it are operating in a different environment with different incentives, possibilities, and tools. The evolved design of brains does not become irrelevant (it affects how

brains can respond to innovations, and how and whether the possibilities of those innovations can be exploited), but neither can cultural history be reduced to it.

For these three reasons, and others, culture as the ICM sees it is not just psychology writ large: it is psychology plus interaction at the population scale, plus history. As Tooby and Cosmides (1992, p. 115) put it, 'psychological theories do not and cannot constitute theories of culture… They only provide foundations for theories of culture (p. 115, see also Barkow 1992). The ICM does not restrict causal efficacy only to principles of evolved psychology. Whilst psychological constraints are in practice foregrounded (it is a model proposed by psychologists after all), it allows for causal forces arising from interaction, material conditions, contingency, and the history of ideas. Understanding the full diversity of culture requires mapping the universal features of human cognition, but does not stop there. We also need to understand the dynamic, historically contingent processes through which culture emerges, stabilizes, and transforms across generations.

3.2 Cultural causal chains and 'transmission' in culture

The epidemiological character of culture requires that there be some kind of 'transmission': representations and behaviours from one individual have to reappear recognisably in other individuals. The goal of this section is to point out the diversity of evolved mechanisms at work in this transmission process. Research in cultural evolution often invokes 'social learning' as the psychological mechanism underlying transmission, and presumes social learning to more or less automatically produce fidelity in transmission. We view 'social learning' as an insufficient description of the mechanisms involved. Cultural transmission (and cultural change) arise from the complex interplay of multiple psychological mechanisms, each one contributing to the reconstruction and transformation of cultural content.

Tooby and Cosmides (1992) introduced the distinction between evoked culture—where similar outputs arise from psychological mechanisms in different individuals processing similar inputs independently—and epidemiological culture—where outputs arise through chains of social learning. Evoked culture could, in principle, lead to widely-distributed behaviour in a community without any transmission. For example, during periods of resource scarcity, evolved mechanisms for detecting and responding to ecological stress might simultaneously lead many individuals in a community to develop similar attitudes towards risk, and increased emphasis on resource conservation. These newly evoked psychological states would make certain ideas appealing—such as certain techniques for food preservation or strategies for resource allocation — while certain old ideas would become unappealing—such as practices that involve conspicuous consumption or resource waste—causing those practices to be discarded. The response would be the same among members of the community not because people are

copying each other, but because they share the same evolved psychological architecture responding to the same environmental pressures.

The evoked culture concept was useful in drawing attention to the active role of evolved psychological mechanisms, but cultural patterns invariably involve *both* evolved psychological mechanisms and historical chains of social interaction. Even in our hypothetical example above, the evoked psychological changes would operate in the context of techniques for food preservation or form of conspicuous consumption that have been established by, and transmitted from, other people. Culture is always evoked, but also always epidemiological.

Consider language acquisition. At one level, this is clearly epidemiological: whether a child learns English, Mandarin, or Swahili depends entirely on their linguistic environment. But at another level, language acquisition is fundamentally evoked: it results from universal psychological mechanisms for communication, which are triggered in every child by the linguistic environment. The same dual character applies to cooking practices, which reflect both universal taste preferences (evoked) and specific techniques learned from others (epidemiological). Even apparently clear cases become blurred under scrutiny.

Analysing the epidemiological aspects of a cultural phenomenon does not remove the need to identify what evolved cognitive mechanisms are put to work in transmission. ‘Transmission’ is a metaphor, since cognitive representations cannot pass directly from one mind into another. Instead, person A's mental representation (belief, knowledge, intention) causes them to produce some public expression—speech, an artifact, or other behavior; person B perceives this public production and forms their own mental representation in response. This constitutes a *socio-cognitive causal chain* between individuals A and B. When such chains extend and recur across many individuals with the effect of spreading and maintaining ideas or practices in a community, we have a *cultural causal chain* (a cultural causal chain is really a tissue of criss-crossing socio-cognitive causal chains).

A transmission event is any socio-cognitive causal chain that contributes to stabilizing a cultural phenomenon in the community. There can be transmission without high-fidelity copying. Transmission events include those where some transformation occurs, as long as they contribute to the overall stability and spread of the cultural idea or practice. For instance, I can learn archery from a clumsy person. I do not faithfully replicate her behavior, since I quickly figure out how to draw my bow more gracefully. Yet, my learning from her can still contribute to the stability of archery techniques in the community. Cultural stability emerges not because the individual socio-cognitive chains all involve faithful replication, but because the cumulative effects of many socio-cognitive causal chains, in concert with psychological processes operating in each individual, is such as to lead to the persistence of recognizable cultural variants at the community scale.

Cultural evolution researchers have put great emphasis on episodes in which people directly learn a behaviour from others. One popular account proposes that this kind of transmission is

based on evolved adaptations whose function is to acquire the environment-relevant information already gathered by other people (Boyd & Richerson, 1985; Rogers, 1988). Acquiring adaptive information through personal experience can be costly, time-consuming, and potentially dangerous. Learning from others who have already solved similar problems can provide shortcuts to adaptive solutions while avoiding the costs of individual learning. This creates selection pressure for psychological mechanisms that can effectively extract useful information from the behaviour of others.

However, when we consider the chains of events through which people learn a behaviour from others, we observe a rich variety of cognitive processes involving diverse underlying capacities and mechanisms, including at least the following:

(a) Learning from artifacts and environmental modifications. People can learn from things in their environment that have been produced by others, regardless of whether these were created with pedagogical intent. Someone might observe a shelter built by others and attempt to construct a similar one, reverse-engineering the design principles from the finished product. Tools often embody their proper use through their physical structure—handles indicate where to grip, sharp edges suggest cutting functions.

(b) Learning instrumental behaviours through observation. People can observe others' behaviours and recognize them as effective means for achieving their own goals. Watching an expert archer may reveal that a particular stance or grip improves accuracy. Observing which plants others gather and eat provides information about which foods are safe and nutritious. In these cases, the learner extracts functional information from others' behaviour patterns.

(c) Learning coordination strategies. Much learning from others involves understanding how to coordinate behaviour rather than simply copying effective techniques. Observing that others drive on the right side of the road provides crucial information about the coordination equilibrium in that community—the value lies not in any intrinsic superiority of right-side driving, but in matching what others do. Similarly, learning local customs for greetings, gift-giving, or turn-taking in conversation allows smooth social coordination.

(d) Learning through communication. People can recognize that others are engaging in communicative behaviour—intentionally providing information—and use this recognition to guide learning. When someone demonstrates a technique while making eye contact and using pedagogical cues, observers can infer that the demonstrator intends to teach them something useful. This allows learners to focus attention on aspects of the behaviour that might otherwise seem irrelevant, trusting that the communicator has highlighted the important elements.

(e) Learning what others expect from us. People can infer from observation and interaction what behaviours others in their community expect them to perform in various situations. Combined with a motivation to abide by these expectations, this process generates cultural phenomena

where individuals conform to community standards not because these behaviours are intrinsically optimal, but because deviation would result in social costs. We will expand on this process in section 3.3.

All these types of social learning depend on active inference using psychological mechanisms whose function is broader than social learning. For example, (a) and (b) require intuitive physics, our cognitive mechanisms for understanding causation in the physical world. Many of them involve theory of mind and the naive utility calculus: the inferences we make concerning others' goals, intentions and choice of means to satisfy those intentions (Jara-Ettinger et al., 2020). All of them will involve computing the affordances of the information on offer in the light of our own motivations and goals. Thus, even a simple case of the direct transmission of a behaviour from one individual to another requires diverse cognitive capacities, including social cognitive ones, in concert with the learner's own causal understandings, goals and motivations (Osiurak et al., 2022). The exact mechanisms and their roles will differ from case to case. This means that there is no particular psychological mechanism 'for' social learning, even though acquiring information from the behaviour of others is adaptive under many circumstances. It also means there are probably no simple generalizations we can make about cultural transmission like 'it is usually faithful', or 'people always copy the majority'. Instead, we must expect a mosaic of studies, each revealing how particular psychological mechanisms contribute to the emergence and maintenance of specific types of cultural phenomena.

Learning through intentional communication ((d) in the list above) might be of special interest since it is sustained by cognitive capacities that are specific to humans, and especially potent for the transmission of ideas. Human-like communication supercharges the potential to learn from others. The human capacity for intentional communication has been studied from both cognitive and evolutionary perspectives, with important developments since the Tooby and Cosmides (1992) (Heintz & Scott-Phillips, 2023; Levinson, 2006; Sperber & Wilson, 2002; Tomasello, 2010). A crucial insight from this research is that open-ended human communication is evolutionarily stable because it is combined with a set of cognitive capacities that identify what to trust in what is communicated. The capacities that evaluate the reliability of communicated information have been studied under the name of epistemic vigilance.

This reveals an important contrast between two different approaches to understanding cultural transmission and its consequences. 'Social learning strategies' research (Henrich & McElreath, 2003; Laland, 2004) posits evolved tendencies to copy faithfully ideas and behaviour, with simple heuristic principles governing whom to copy (such as "copy the majority" or "copy high-status individuals"), and only weak psychological evaluation of the content. In contrast, the epistemic vigilance approach assumes that belief updating in the light of the communications of others depends on more sophisticated principles of evaluation, based on the plausibility of the content, as well as trustworthiness and competence of the communicator. Where social learning strategies describe relatively uncritical copying guided by simple social cues, epistemic vigilance describes sophisticated evaluation and very selective acceptance of transmitted information.

These two views lead to quite different predictions about cultural evolution, including about the spread of misinformation. Social learning strategies would predict that false information should spread readily if it comes from prestigious sources or represents majority opinion, whereas epistemic vigilance predicts that false information should be filtered out through critical evaluation unless the content is cognitively compelling or the consequences convenient for a person's goals. Debates on these issues are still ongoing (Mercier, 2017).

The complexity of the transmission process has important implications for understanding the cognitive and social causal chains that constitute cultural phenomena. These chains involve reconstructive processes where culturally transmitted information is actively interpreted, evaluated, and integrated with existing knowledge through multiple psychological mechanisms. The specific combination of mechanisms involved—artifact interpretation, goal inference, coordination reasoning, communicative understanding, selective trust—will influence both the fidelity and the systematic transformations that characterize each step in the cultural causal chain. The main consequences for our understanding of culture are threefold:

First, epidemiological culture actually depends on evoked processes. Transmission is a kind of evocation, where the triggering stimuli have been produced or shaped by human actions. The distinction between transmitted and evoked culture dissolves once we recognize that cultural transmission always involves psychological mechanisms responding to culturally-shaped environmental inputs.

Second, social cognitive capacities whose functions are not limited to cultural transmission or social learning are necessary deployed in cultural transmission. Such capacities include the intuitive psychology that allow us to infer goals and intentions, but also capacities for communication that enable the extraction of intended meanings from ostensive demonstrations and verbal expression.

Third, an ICM approach to transmitted culture opens the black box of the mechanisms that cause people to reproduce or adopt (or modify or reject) the behaviours and ideas of others. Black-boxing those mechanisms on the assumption that transmission is basically faithful copying will tend to miss the interpretive and reconstructive processes by which psychology systematically shapes cultural content.

In this section, we have identified epistemic vigilance as one of the numerous mechanisms lying in this black box. In the next section, we focus more specifically on the mechanisms at work when people abide by social norms—a crucial aspect of human culture that requires additional psychological machinery beyond that which we have discussed so far.

3.3 The evolution of normativity

The terms 'norm' and 'normative' appear nowhere in the 119 pages of Tooby and Cosmides (1992). The omission is surprising, because of the centrality of punishment and reputation,

which are related to norms, in their own empirical research (Krasnow et al., 2012); and because norms and normativity are central to sociocultural anthropologists' conceptions of culture and to social theory. Departing from a cultural regularity, even an apparently arbitrary one, can be badly received, deprecated, or punished. Individuals know this and have to incorporate it into their computations regarding choice of action. Normative expectations in the surrounding community constitute a very important aspect of the environment within which one operates. Violating them feels highly stressful; one has a sense one 'should' fulfill those expectations, without necessarily being able to say why (Theriault et al., 2021). People will follow arbitrary rules, at cost to themselves, just because they are told they are the rules; and are more prone to do so the more they believe others expect it (Gächter et al., 2025). As far as we know, cultural practices in, say, chimpanzees are not the targets of normative evaluation or a 'sense of should' in this way.

A norm is something stronger than just an empirical regularity in the behaviour of people in a community. Doing behaviour B in situation S is normative when individuals believe that important others *expect* them to do B in S; and that failing to meet these expectations would generate negative evaluations (Bicchieri, 2005). Those negative evaluations could further cause the others to sanction the actor (impose direct costs somehow), or simply avoid, mistrust, or dislike them. Thus, there is a potential or actual social cost to violating a normative expectation.

From this definition, it is clear that norms are complexes of cognitive representations, and thus require a psychological explanation. Moreover, the notion of norm is closely related to that of culture. Given the definitions of culture we offered in section 1, all norms are culture (since they involve beliefs or practices that are widely distributed in a community). It is not clear that all human culture carries normative force, but a large amount of it does. Most obviously, moral principles are, necessarily, strongly normative (see section 4.2). But normative evaluation becomes attached to all kinds of community-specific behavioural regularities. Reproductive decisions (see 4.3) seem like personal matters that are nobody else's business, but in fact they are the subject of a great deal of normative evaluation. So is the way we dress, the way we speak, the way we sing a song, even the way we cut a cheese. People routinely say of someone that 'they did it wrong'.

Much of the literature on normativity has focussed on the consequences of norms. These consequences can be extremely positive: norms are sometimes efficient means for achieving social welfare (Akerlof, 1976); norms underpin the large-scale cooperation which characterizes human societies (Chudek & Henrich, 2011); norms allow the solution of coordination problems (Schelling, 1960), and so on. Norms can also have negative consequences on social welfare. Norms that are oppressive, inefficient, disadvantageous, or harmful to certain groups are widespread, and hard to dislodge because of their self-reinforcing character. The ICM encourages us to think about not just the consequences, but the psychological causes, of norms. Following the ICM methodology, the first step involves analyzing social norms as distributions of mental representations and public productions within cultural communities.

Social norms involve expectations that are widely distributed among community members, and known to be so. This characterization identifies the key psychological factors underlying the cultural success of social norms: humans appear readily disposed to form normative expectations; and they are intrinsically motivated to fulfill the normative expectations of other people with whom they might cooperate. In ICM spirit, this raises the further question of the evolutionary origins of these psychological tendencies. We suggest they are evolved adaptations that enable individuals to navigate partner choice ecologies successfully.

To generate norms, there must be specific sets of computations in both the actor and audience. In the audience, there must be a disposition to evaluate others in terms of their actions, and to store and update such evaluations. Where does this evaluative psychology come from? Humans have evolved in socioecologies in which there was an important prevalence of coordinated action (communal child-rearing, coordinated foraging and defence). Moreover, there was generally a degree of partner choice. By this, we mean, specifically, that potential collaboration partners generally had the option of entering into the collaboration, or not doing so. This creates an adaptive advantage, in the chooser, to forming evaluations of the potential profitability of particular relationships; and in the actor, to being motivated to make those evaluations in others as positive as possible.

As we will discuss in section 4.2, the evolution of mechanisms of moral evaluation is comprehensible in this context. We don't want to cooperate with a cheater or a killer. But why should we normatively evaluate individuals on dimensions that appear irrelevant to cooperation, such as how they dress or part their hair? In choosing to enter a potentially mutually profitable interaction, one consideration is: how easy will it be to coordinate? Being able to predict what an interaction partner will do without the need for extensive discussion or negation significantly reduces the cost of coordination. Having a partner whose behaviour I cannot easily predict generates a great degree of cognitively and metabolically costly prediction error (Theriault et al., 2021), back and forth communication, and may lead to coordination failing altogether. Both partners sharing the same expectations, will reduce this cost (see Fu et al., 2012). If Daniel wishes Christophe to dine with him, it is laborious to ask him when he might like to come, what courses he would like in what order, and so on. It is much simpler if we can both fall back on the focal point provided by the behaviour of Parisians in general (the 'culture'): Daniel will invite him for 20:00, Christophe will actually come at 20:15, Daniel will serve the cheese after the main course but before the dessert, and so on. A partner who, all else equal, does what others in the same community do is a low-effort partner, as long as I too have knowledge of that community. Apparently arbitrary signs such as how someone dresses or part their hair actually give me a lot of information about what they know about the regularities of my community, and how motivated they are to uphold them.

From the point of view of the actor, it is advantageous to take potential evaluations by others into account. Actors have goals from their immediate decisions (get food when I am hungry, get money, and so on), but they are also tracking the longer term goal of having strong and

supportive collaborative partners. This requires that they be seen as desirable and predictable by the relevant people. The actor's immediate individual goal may often pull in the direction of not following cultural regularities (I am starving, I am going to cut that camembert however I like); whereas the longer-term social goals favour fitting in, and that means not causing disagreeable surprise. I might not attach any purely personal importance to maintaining some regularity or allegiance, but knowing that enough of my social network has expectations in that domain is enough to make it potentially costly to not maintain it. Some norms are described as purely conventional: in these cases, the norm is maintained entirely by the belief that others expect it, and not grounded in any independent beliefs or intuitions about rightness or utility.

Decision-making mechanisms in humans are constantly computing the evaluative consequences of acts or statements, alongside any other kinds of payoffs that might be relevant. This is why psychological experiments have shown people to be highly sensitive to even subtle cues of what others in the surrounding populations are doing, or expect (Keizer et al., 2008). The weight people give to following normative expectations, though definitely not zero, is not always enough to make them the dominant considerations. People are often acutely aware of norms, calculate the payoffs, and decide to violate them anyway. Some things are so injurious to one's goals that one is prepared to risk negative evaluations from a lot of other people in order to not do them. Moreover, people often contest current norms, and argue eloquently for alternatives; and when enough people have had enough, norms can change, without outside influence, and sometimes quite fast. This shows that people are able to weigh their normative motivation (all else equal, to fulfill the normative expectations in the relevant community) against other factors (the welfare of other individuals, their own non-normative goals) in order to control action (Gintis, 2016).

Norms have something important in their favour: the consequences of sticking to a norm are typically known relatively well: if everyone behaves as they currently do, coordination will go on much as it currently does. The consequences of not sticking to it are not known. If I abandon a norm, others might be appalled or they might be relieved, or some mixture of the two.The community might converge after a period of change on a better norm, but might also converge on a worse one, or fail to converge at all. The social outcomes of norm violation, then, are more risky and uncertain than the outcomes of norm-following. This may well explain why knowingly violating a norm is so stressful (Theriault et al., 2021); psychological stress is the response to acute uncertainty where some of the outcomes could be bad (de Berker et al., 2016). The riskiness and uncertainty inherent in norm change are also central arguments in certain strands of social theory; the status quo may not entirely make sense, but at least it is stable, so we rip it up at our peril.

The account developed above emphasizes the central role of normative expectations, their distribution within communities, and the beliefs and judgments that people form about them. We recognize that humans have a 'norm psychology' (Chudek & Henrich, 2011), but, paralleling our discussion of epistemic vigilance, we stress that people are self-interested agents who assess

the extent to which others' normative expectations are worth fulfilling (Heintz et al., 2015). Thus, our account connects the idea of norm psychology with the literature on reputation management and, ultimately, with the adaptive problems posed by partner choice ecologies (Barclay, 2016). The cultural evolution of what can and cannot legitimately be expected can be likened to a bargaining process. The constant factors in this process are evolved adaptations for reasoning about coordination and social exchange, and the else-equal aversion to disappointing the expectations of important others. The variable factors are the things that affect relative bargaining power. These include outside options, material resources and power, supply and demand, technology and other factors that social scientists have invoked to explain historical change in norms.

4. Case studies of research using the ICM

The ICM is hard to disagree with conceptually; cultural traditions exist and are maintained only because of the activity of minds, so the claim that the properties of those minds are causally important in the evolution of traditions is a truism. The proof of the value of the ICM is, therefore, whether it leads to more illuminating research in practice. This section reviews three empirical examples where we believe it has done.

4.1 Kinship systems

Kinship systems were long taken as a paradigmatic case of how cultural traditions cannot be reduced to evolutionary biology. Every human society has a kinship system, a set of terms for distinguishing pairs of people who relate to each other in special ways. Because of the centrality of inclusive fitness in evolutionary models of social behaviour (Hamilton, 1964), the naive evolutionary expectation was that kinship terminology would be everywhere much the same, and the distinctions people made would roughly track the genetic coefficient of relatedness: a different term for pairs with r = 0.25 from those with r = 0.5, for example.

This naive evolutionary expectation is certainly not met.There is a bewildering diversity of different systems of kinship terminologies. These are clearly cultural in that they differ from community to community and are somewhat stable over time. Some systems equate your father's brother's children with your siblings, while many do not. Some treat your father's brother's children like your mother's sister's children, because both cases stem from siblings of the same sex in the generation above (parallel cousins), but your father's sister's children or your mother's brother's children as something else (cross cousins). Others would see your father's siblings' children as a completely different kind of thing from your mother's siblings' children, who might not be considered kin at all, because they are not in the same patriline. Kinship terminologies can: fail to distinguish people at different degrees of genetic relatedness; completely exclude some people with whom you do share genes; or include many people with

whom you do not. Unrelated people can become kin through marriage, and also in various other ways in different societies that are referred to in anthropology as ‘fictive kinship’ but are quite real to the people involved. In short, kinship terminologies are sets of locally conventional social categories that define certain kinds of salient links between people, and differ widely from society to society. To quote Marshall Sahlins (1976, p. 26): “there is not a single system of marriage, post-marital residence, family organization, interpersonal kinship, or common descent in human societies that does not set up a different calculus of relationship and social action than is indicated by the principles of kin selection.”

It is, however, a complete non-sequitur to go from ‘kinship systems are highly variable and do not closely track the genetic coefficient of relatedness’ to ‘the evolved structure of the mind is irrelevant to explaining the structure of kinship systems’. The naive evolutionary assumption - that the ‘function’ of kinship terminologies is to help inform people about their coefficient of relatedness - is itself dubious. People possess a range of inferential mechanisms for figuring out who shares genes with them that use cues like phenotypic similarity, odour, and observation of maternal perinatal association (Alvergne et al., 2010; Lieberman et al., 2007; Platek et al., 2003; Schäfer et al., 2024). These mechanisms do not seem to require linguistic categories to support them.

Instead, the considerable ICM-compatible literature on kinship terminologies starts from a different premise. In a highly social species, it is fitness-relevant to be able to infer, represent and communicate how particular pairs or sets of people in the environment are likely to behave with respect to one another (Pietraszewski, 2021; Thomas, 2024). Which ones are going to be found together, which ones will come to each others’ aid, and which ones are going to favour one another when it comes to distributing material resources? It is useful to store this information, and also, sometimes, useful to communicate it. Assuming that there are psychological mechanisms to do this, their computational principles will prioritize representing variables that validly predict shared interests and behaviours toward one another. Cultural traditions - kinship terminologies - may well vary, but they will recurrently reproduce the same set of key conceptual distinctions, the ones that actually have, on average over environments, the most predictive validity in human social relations.

In fact, extant kinship terminologies, though variable, are a tiny subset of the logically possible systems (Jones, 2003, 2004; Kemp & Regier, 2012). No system contains the categories ‘son + mother-in-law’, or ‘mother plus person I recently met’. No system distinguishes niblings by sex (e.g. nieces versus nephews), and fails to do the same for siblings (brothers versus sisters). Several approaches to kinship terminologies work on the assumption that observed systems reflect combinatorial possibilities of a small number of cross-culturally recurrent conceptual primitives, which reflect universal cognitive categories. The approaches vary in detail and none is currently exhaustive. One influential model (Kemp & Regier, 2012) assumes the primitives to be a short list of distinctive features: sex of focal individual; the relation of parent to child; the relation of child to parent; relative age; and whether the sexes of a dyad are the same or

different. These primitives can be combined recursively (parent's same sex sibling's children, etc.) to produce complex representations that may or may not attract a linguistic label.

Jones (2004) specifies the principles differently, as a series of processing principles that minds prefer to fulfil (all else equal), as shown in table 1. These principles are grouped into the three superordinate categories of: genealogical distance (are there more genealogical links between the people, or fewer?); social rank (is one individual older than the other or of a different sex?); and group membership (do the two belong to the same clan or not?).

Table 1. Processing priorities structuring human kinship terminologies. Adapted from Jones (2004, table 1). See original source for more elaboration. As stated here the model does not extend to affines (in-laws), which would require additional distinctions. English does not use all the principles to make distinctions, hence the unfamiliarity of some of the English glosses.

Distinction	English gloss	Category
Distinguish lineal from collateral	Father ≠ uncle; daughter ≠ niece	Genealogical distance
Distinguish nearer versus more distant generations	Daughter ≠ grand-daughter	Genealogical distance
Distinguish adjacent generations	Members of generation X ≠ Members of generation X+1	Genealogical distance
Distinguish consanguineal versus step kin	Brother ≠ step-brother	Genealogical distance
Distinguish sex	Brother ≠ sister	Social rank
Distinguish relative age	Senior uncle ≠ junior uncle	Social rank
Distinguish ascending and descending generations	Grandmother ≠ grand-daughter	Social rank
Distinguish maternal and paternal kin	Paternal grandmother ≠ grandmother	Group membership
Distinguish adjacent patrilines	Members of A's patriline ≠ Members of A's brother's patriline	Group membership
Distinguish adjacent matrilines	Members of A's matriline ≠ Members of A's sister's matriline	Group membership

It is easy to see that, to construct a mental representation predicting how person A will behave with respect to person B, the distinctions in table 1 are exactly the kinds of information that would, in many contexts, have some predictive value (in humans or, indeed, in any group-living primate). Shorter genealogical distance would indicate a greater coefficient of relatedness, and, all-else-equal, a greater welfare value placed on each other. Social rank (relative age) could well determine power asymmetry or the direction of resource flow. Group membership (where locally relevant) would indicate whether there are expectations and norms of mutual defence or

resource transmission. The distinctions preferred in talking about kinship are, in short, the plausible building blocks of a representational cognitive system evolved to navigate social life in groups where some pairs of other people have closer relationships to one another than other pairs of people do.

If all kinship systems fulfilled all the priorities in table 1 in all cases, all kinship systems would be rather similar, and they would contain many more terms than we typically observe. The reasons systems differ, and usually have many fewer terms than needed to fulfill all the priorities in table 1, are to do with how the principles are differently weighted and ranked in different communities (see Jones, 2003, 2004 for more detail). All principles compete against a general principle of cognitive and communicational economy. Communicating or even storing a distinction carries a cost, and this cost is only worth paying when the fitness-relevant gain is typically greater than this cost. This can be treated heuristically as the maxim ‘minimize the number of distinctions’. The conceptual space of kinship is topologically organized, with the relations of mother, father, brother and sister at its centre (Jones, 2010). The term-splitting priorities in table 1 are much more likely to overcome the term-merging principle of economy in the centre of the space, presumably where the information gain from making fine distinctions is typically greatest (X might well behave differently towards her son than her daughter, and so sex is worth distinguishing in this central part of the space; X is unlikely to behave much differently towards her male and female third cousin, so sex might not be worth marking at this genealogical distance). This generates strong implicational universals within systems: as one moves out from the centre, fewer and fewer distinctions are encoded. In English we mark sex for siblings and niblings (niece versus nephew), but not for cousins. Indeed, beyond cousins, English does not reliably distinguish further steps of genealogical distance (second cousins, cousins once removed, and so on). The different ordering of the principles in table 1, and the weighting each is given against the principle of economy, gives rise to the great diversity of systems that we observe in practice. In addition, different communities acknowledge locally-relevant ways in which, through shared action and interdependence, people can become close enough that they can be expected to behave ‘as if’ their genealogical distance or group membership was closer than it would otherwise be expected to be. This creates the various forms of fictive kinship such as blood brotherhood and milk brotherhood that further allow for surface diversity in cultural traditions.

Thus, the very rich diversity of possible kinship systems arises from a few computational affinities embedded in human psychology. Moreover, there is emerging evidence that those computational principles are available early in life, and thus form part of the core knowledge that infants can draw on to infer the structure of the world. For example, young children have sophisticated understandings that there are two sexes; that there are special relationships of caregivers to their care-recipients; and that certain individuals are family members even though they do not see them often (Hirschfeld, 2001; Thomas, 2024). Even preverbal infants (around 9 months) make the spontaneous inference that if they have seen individual A sharing food or saliva with individual B–a cue cross-culturally associated with kinship–then a special bond exists

between A and B such that A will comfort B when B is distressed (Thomas et al., 2022). Observing other kinds of shared activities between A and B, such as playing together, does not provoke this inference.

To be sure, each cultural kinship system is transmitted and stabilized by cultural transmission: individual people learn the kinship distinctions that are made in the language around them. (Though, they are not passive culture-takers; sometimes they deploy and extend those distinctions strategically, as when Shakespeare's *Henry V* says 'he to-day that sheds his blood with me/Shall be my brother'.) Which distinctions become habitual to make in any particular community will depend on local factors of interaction such as how people interact, how they coreside, how they transmit material resources, whether they fight in clan groups, and so on. Nonetheless, the actual diversity of cultural traditions is a tiny subset of what it could be, and - as the ICM requires - is strongly constrained by the representational principles and processing priorities of the cognitive system.

4.2 Punitive justice institutions

All human societies have institutions of punitive justice: mutually known procedures to administer punishments for certain actions, actions that are locally deemed wrong. Just like kinship, punitive justice institutions have been something of a test case for the competing views that the content of punitive justice rules arises from universal moral principles attributable to our evolved minds; and that they arise from contingent cultural forces. The principle argument in favour of the latter view is that, in fact, societies vary widely in what actions they proscribe and consider wrong (Braman et al., 2010). Something that is a normal food in one context is forbidden in another; types of violence that would constitute serious offences in one place are accepted or even morally obligatory in another. What is wrong and how it is punished is clearly and importantly a matter of cultural tradition.

However, again, it is a non-sequitur to go from 'institutions of punishment and the list of acts they proscribe are culturally variable' to 'the human mind does not importantly shape or constrain justice institutions'. An increasing body of ICM-inspired research, on the contrary, explores the cognitive principles that structure justice institutions, including their variation. Central to this research are the ideas that: (a) punitive justice institutions operate on acts that moral cognition assesses as wrong; and (b) punitive justice institutions are institutional, even in societies where there are no written laws or formal courts, in the sense that moral sanctions are applied not ad hoc, but in controlled, regular ways that are common knowledge, and carry some degree of socially acknowledged legitimacy.

Human modes of living, foraging and reproducing generate high degrees of fitness interdependence even among non-relatives. One person's actions (or failures to act) can have positive or negative effects on the welfare of others. Moral cognition describes the psychological processes by which acts are evaluated along a dimension of right or wrong in this context. Punitive sentiment results when an actor has behaved in ways that are morally evaluated as

wrong. The violation is assigned a psychological magnitude–some violations are small, some are large–and the relationship (or the standing of the perpetrator) is considered harmed by that amount. Restoration of the relationship requires either that the actor accepts a personal cost of proportionate magnitude (a punishment), or that they transfer a different benefit to the victim (compensation). The relationship is then considered restored, since amends have been made. Punishments any larger than this would place the relationship in imbalance in the other direction, leading to a further cycle of need for restoration. Thus punishments and compensation need, from a psychological perspective, to be large enough to restore the relationship to the point of mutual benefit, but not larger (Fitouchi & Singh, 2023).

The set of acts that come to be tagged as morally wrong depends no doubt on contextual and interactional specificities. The variation is, however, around the margins of the conceptual space. Just as parent-child and sibling relationships are central to the psychological space of kinship, at the heart of the psychological space of moral wrongness are unjustified killing and injury, and alienation of foods or other material resources that people could reasonably expect to have access to. In short, it is always wrong to reduce either the survival or reproduction prospects of another member of the community without good reason; hardly a mystery from an evolutionary point of view. A number of other principles structure moral judgement: acts tend to be judged worse if they are done intentionally than by accident; worse if they are done by commission than omission; less harshly if they are done under duress or through extreme need; and according to the likely consequences if they became common rather than the consequences that actually arose in this instance (Cushman, 2008; Levine et al., 2020; Mikhail, 2007). These principles all make sense, since what is being assessed in morality is not the magnitude of the actual positive or negative consequences of the person's acts, but the *mental valuation* that the person is assigning to the underlying relationship. Estimating this valuation is critical to understanding whether that person is a good relationship partner, and hence whether future interaction will be acceptable. Things done by accident or under duress are poorer indications of the mental valuation than things done deliberately and by choice. The importance of mental valuation of the relationship helps explain why certain acts that apparently cause no harm can nonetheless become moralized: burning a flag that I privately own; privately consuming a taboo food. These can be deemed wrong not because they directly impact the wellbeing of others, but because they indicate a low mental valuation of the preferences of others for whom these things are important; and it is that low valuation that predicts the person is not a good interaction partner.

Moral cognition explains punitive *sentiment*, but, alone, it does not explain punitive justice *institutions*. Punitive justice institutions are sets of broadly agreed procedures by which punitive sentiment will be enacted. Exactly how individual sentiment is transformed into stable institutions is a non-trivial problem. However, it is easy to see why people would often welcome the presence of institutions governing how the punishment is to be done, rather than doing it in an ad hoc way. For one thing, an individual enacting punitive sentiment exposes themselves to risk; perhaps the punished person has a different understanding of the situation and treats this

as an unwarranted attack. Imposing a harm on someone in an institutionally-regulated way is, in part, an expressive choice. It communicates that my intention in harming you is the restoration of our relationship or your standing after you committed an act that was evaluated as wrong in a common-knowledge way. I do it in a way that is mutually understood to be this kind of harming and not some other kind. Fitouchi and Singh (2023, p. 502) describe violent punishment amongst the Yolgnu of Australia that involved throwing spears with their heads removed, or spearing in the thigh. These are not ways you would do things if your intention was simple harm; they communicate the intention to harm only in a special and limited way. Second, the institutionalization of punishment helps mitigate a credibility problem. If I threaten to punish you if you transgress against me, my incentive to actually do so once you have already transgressed may be small, especially if I plan not to interact with you in the future. Thus, the *ex ante* threat of punishment may not be credible. But once punishment is embodied in a matrix of broadly shared expectations–my standing in the community depends on my exacting the punishment, and yours depends on accepting it–then the threat of punishment is absolutely credible as long as each of us wants to continue to operate in this community, even if we will avoid one another. Although these considerations do not explain how punitive institutions develop in communities, they do help explain why people might welcome them and why their consequences for cooperation might be positive.

To maintain legitimacy and stop people 'taking justice into their own hands', punitive justice institutions must deliver outcomes somewhat concordant with spontaneous punitive sentiment. As Oliver Wendell Holmes famously put it: "the first requirement of a sound body of law is that it should correspond to the actual feelings and demands of the community" (cited in Giffin & Lombrozo, 2016, p. 707). Because punitive justice institutions must do this, and do it in apparently non-partial ways, they display certain recurrent features. Notably

1. They involve quantitative judgements of 'seriousness' or 'magnitude' of offences, and require punishments or compensations that are proportionate to this magnitude;

2. They involve phases of assessment of the act and its content, which include not just the harm caused to others, but considerations of the degree of intentionality, duress, need or remorse of the violators; these factors are often as relevant to the magnitude of the punishment or compensation as the actual consequences;

3. They involve 'legitimate' procedures for exerting punishments and resolving epistemic uncertainty. These can be considered as common-knowledge procedures for communicating that the harms imposed on offenders are special 'restorative' harms and not new harms that will themselves trigger a cycle of anger; and procedures for making an adjudication seems impartial in cases where the facts are hard to ascertain (Mercier & Boyer, 2021).

Although the schedule of proscribed acts and their respective penalties varies across traditions, it appears to do so in ways that remain intuitively comprehensible without acculturation in that tradition. Sznycer and Patrick (2020) and Wee et al. (2025) exposed Western participants to schedules of offences from unfamiliar legal codes (e.g. from premodern Sumeria and China). Participants were able to predict the relative magnitudes of the punishment contained in the codes for different offenses much better than chance. Moreover, punishment magnitudes were correlated with assessments of moral wrongness, and amount of shame one would feel from doing the act, from separate groups of participants. Thus, the content of legal codes, whilst variable, does not appear completely arbitrary to people from different cultural traditions.

There are many outstanding issues in the literature on evolved psychological and punitive justice institutions. We touch on two: the variable role of intentionality; and the transition from mainly second-party to mainly-third party institutions.

As discussed, moral judgement responds to information about intentionality: harms done on purpose are judged worse than the same harms done accidentally. This is true across a wide range of societies, albeit with some variation in the scope of acts for which intention is relevant, and the degree to which unintentionality is exculpatory (Barrett et al., 2016). Legal systems mirror this: the importance of intent recurs in different traditions. Common-law systems such as the UK and USA, for example, treat *mens rea* (guilty mind) as central to assessing the degree of criminal liability. First-degree murder requires an act that is wilful, premeditated and deliberate, whereas involuntary manslaughter carries a much lighter penalty. However, legal systems also contain a set of offenses for which liability is strict; ignorance or accident are not valid excuses. In the USA, for example, this set includes exceeding the speed limit while driving and statutory rape (sex with a minor). Giffin and Lombrozo (2016) found that the laypeople made different spontaneous moral judgements about acts that the law treats as strict liability from those for which the law requires *mens rea*. Specifically, doing the act accidentally rather than intentionally had a smaller effect on the judgement of moral wrongness for acts that are strict liability crimes than for acts where the law takes *mens rea* into account. The researchers argued that this was not because the participants were familiar with how the law treated these acts, but rather because the law had evolved culturally to embody an intuitive moral difference.

There is another set of acts for which lack of intention is not judged morally exculpatory: purity violations such as incest and eating a taboo food (Young & Saxe, 2011). It is unclear exactly what the similarity is between purity violations and the set of crimes treated as strict liability (speeding is not obviously a purity violation). The cases share the feature of having a non-obvious dividing line between what is permitted and what is proscribed. The speed limit is 50 km/h, but could have been 55 km/h. The age of consent is 16, but could have been 18. There are many relatives you can marry, and some you really shouldn't (famously, in many societies, you are encouraged to marry your cross cousin, and it is wrong to marry your parallel cousin, even though the coefficient of genetic relatedness is the same, see 4.1). Given this, it is not considered enough not to intentionally cross the line. Rather, people consider there to be a

moral obligation to have active intentions to *avoid* crossing the line, including having the epistemic intention to find out exactly where the line is (Kovacevic et al., 2024). This is not a fully worked-out account, though: the requirement to have an active intention to know about consequences and avoid the bad ones would seem to apply to many acts for which the law requires *mens rea.* The exact cognitive basis of which intentions matter and which do not, and how intentions become embodied in institutions, is an area for future clarification.

Legal systems in large-scale societies are generally third-party systems: sanctions are decided and overseen by impartial high-status authorities. Corporal and capital punishments are not inflicted by victims or their kin (though, we should not forget, much law is civil law, in which compensation is transferred from perpetrators to victims or their families). Fitouchi and Singh (2023) remind us that this feature may not be typical of all punitive justice institutions. In small-scale societies, they argue, the great majority of punishment and compensation occurs directly between victims and perpetrators, rather than being administered by third parties. This does not mean that there are no institutions involved. The societies they discuss have clear, common-knowledge principles for determining the degree of compensation, or allow special, ritualized acts of harm that are obviously punishments and could not be mistaken for fresh offences. But the victim or their kinfolk, rather than some authority, are typically the punishers.
This does not change the account of punitive justice institutions presented here. But it does call for an explanation of the transition from mainly second-party to mainly third-party punishment in large-scale societies. One possibility is that, with an exponential rise in the number of interactions between near-strangers as societies become larger, the negative externalities arising from frequent second-party punishment favour the cultural evolution of impartial punishment authorities, as something that makes people better off on average. Another perspective is that, with the increasing stratification as societies increase in scale, elites commandeer punitive institutions just as they seize control of other kinds of resources: to improve their material condition and better control the populace.

4.3 Women’s reproductive decisions

Women in different human populations behave very differently when it comes to reproduction. Notably, across the world and especially in the most affluent populations, they now tend to begin reproduction later in life than formerly (that is, age at first birth is higher), and give birth to many fewer children in their lifetimes (that is, total fertility is lower). The move to low-total fertility pattern is called the demographic transition, and is one of the most momentous and consequential changes in human history in terms of its implications for economic activity, social structure, and population dynamics.

To earlier generations of researchers, women’s reproductive behaviour was not considered culture, indeed barely considered cognitive. Or, in some cases, reproductive behaviour prior to the demographic transition was considered not to be culture (it was often described as ‘natural

fertility', presumably thought to be controlled by peripheral physiology and nutrition), whereas at the demographic transition, it became 'cultural', in the sense that it was now dictated by the diffusion of contraceptive technologies or other cultural practices associated with industrialization. This division into natural and cultural fertility is misleading. Reproductive behaviour shows marked differences between communities and clear evidence of epidemiological processes, and thus squarely qualifies as culture, on both sides of the demographic transition (Colleran, 2024). Moreover, fertility certainly involves cognitive representations and goals: as it happens, people can articulate intentions and aspirations in the domain of reproduction that are among the strongest predictors of what they go on to do (Nettle et al., 2010; Schoen et al., 1999; Westoff & Ryder, 1977), albeit that those intentions are held uncertainly and strategically reevaluated in context (Johnson□Hanks, 2005). Reproduction is also often the subject of strong normative expectations, as seen most clearly in certain religious groups, but subtly present more widely.

Decisions about when to start childbearing, and how many children to have, are underlain by a motivational psychology specialized for reproductive decision making. Some early arguments in evolutionary psychology contended that evolved motivations extended only to sex, because under ancestral conditions sex reliably led to reproduction (e.g. Pinker, 1997). Whilst reproduction obviously requires sexual motivation, it is not reducible to it. Across many kinds of community, people undertake deliberate actions to regulate, and can articulate aspirations concerning, their fertility outcomes.

Both age at first reproduction and total fertility rate closely track, at the aggregate level, socioecological variables, such as women's healthy life expectancy and their economic opportunities (Low et al., 2008; Nettle, 2011). The main debate in the literature has concerned which of two idealized processes accounts for this tracking (Colleran, 2016). On the one hand, rational-individual or behavioural-ecological approaches have assumed that every person reads their ecology independently, and computes an appropriate reproductive strategy. Thus, the considerable similarity in decisions within communities would be an accidental byproduct of the fact that many people in a given community are facing the same ecological inputs and making the same calculations. On the other side stand the approaches variously known as ideational, cultural or social-interactional. These argue that changes in fertility behaviour have a strongly epidemiological character. Low-fertility patterns, or fertility delay patterns, diffuse from person to person; and in setting their intentions, people are influenced by the behaviour and attitudes of other people that they meet.

Some of the strongest evidence for this cultural-epidemiological view comes from the fact that fertility decline began in rather different economic circumstances in different parts of the world, plausibly due to the diffusion of the model from the places where it was already established. Moreover, the average level of education in a woman's social network predicts her fertility behaviour or intentions, above and beyond her individual education (Colleran et al., 2014). This implies considerable social influence. On the other hand, we cannot assume people to be

passive ‘norm-takers’, unconditional imitators of whatever is prevalent in their social network. This would leave us unable to understand what leads to change in norms in the first place, nor how behaviour ends up coupled as closely as it is to changing socioecological variables.

Instead, in forming their fertility intentions, which influence their actual fertility outcomes, women respond to multiple cues or experiences. Some of these may be received early in life, as early as early childhood, whilst others come in adulthood. Some of the inputs suggested by research are shown in table 2. The inputs include some that would classically be considered cultural or epidemiological - following the example of others - and others that would classically be considered rational or individual. These inputs are weighted in some way by the decision psychology. This suggests that the individual-rational and cultural-epidemiological approaches are both partly right: inputs of both kinds, and some that are hard to classify on this dimension, form part of the set of inputs weighted by the psychological mechanisms. The evidence for the influences suggested in table 2 is mostly correlational, due to the necessity of studying actual reproductive decisions and the impossibility of producing these in the lab.

Table 2. Non-exhaustive list of proposed inputs into reproductive decision making mechanisms, whose operation has the scope to produce cultural variation. In some cases, our characterisation of the variable tracked and the putative cues may be different from the original authors'.

Reproductive behaviour affected	Variable tracked	Putative cues	Exemplary references
Age at first reproduction	Own healthy life expectancy	Own-early somatic state/early-life conditions experienced	(Rickard et al., 2014)
Age at first reproduction, total fertility	Own health life expectancy	Death or disease in social network	(Newmyer et al., 2025; Pepper & Nettle, 2013; Störmer & Lummaa, 2014)
Total fertility, age at first reproduction, contraceptive behaviour	Resource opportunity cost of reproduction	Own education/career prospects	(Alvergne et al., 2011; Kountouris, 2020)
Total fertility	Resource opportunity cost of reproduction	Education/career prospects/behaviour of others	(Colleran et al., 2014; Colleran & Mace, 2015)
Total fertility	Availability of alloparental aid	Whether key kin available, salience of kin relationships, social support	(Chapman et al., 2021; Shaver et al., 2019; Snopkowski & Sear, 2016)
Total fertility, age at first birth, contraceptive behaviour	Reputational or social network consequences	Normative expectations, behaviour of others	Indirect evidence: (Alvergne et al., 2011; Faessler et al., 2024)
Total fertility	Per-child post-birth investment required	Unclear, outcomes of others in surrounding population	(Lawson & Mace, 2011)

Table 2 raises a number of questions. Why would the psychological mechanisms take into account so many different possible inputs? Why would so many of them involve what other people are doing? And why would they include inputs in childhood, years before actual reproductive decisions need to happen?

On the first and second questions, it is important to remember that, from an adaptive point of view, the decision to have a(nother) child is made under massive uncertainty. People are selected to maximise the total reproductive value of their offspring, not the number of births. That is, fitness is higher for an individual who has few children, each of which live to maturity and reproduce in their turn, than for an individual who has many children, very few of whom survive. For a child to thrive into adulthood, the mother must not just be able to gestate successfully, but there must be adequate care and resources for many years, the caregivers must remain in shape, the children must have the phenotypic qualities and social resources to be successful in their turn, and so on. All of these things are variable and hard to predict ahead of time. Thus, it makes sense that the psychology would be attuned to a whole range of cues, including: the mother's own health state; to the future health prospects of women like her; potential post-birth investment from other people; and just what seems to be working for similar people who are a bit further on in the process. None of these cues would be definitive, but each might have partial informational value, allowing the decisions to be better than guessing. Moreover, as with normative expectations generally (3.2), it matters what other people think of your decisions, because you may well need those other people - their investment, their help - later on in order for the reproduction to be successful.

Given that the psychological mechanisms have evolved to assign some weight to inputs from other people, including their opinions, there is the possibility of strategic manipulation of the psychology by others. Notably, kin have different interests regarding an associate's reproductive behaviour than non-kin. This may lead to them exerting different normative pressures, partly explaining why reduced kinship density in social networks coevolves culturally with low-fertility values (Colleran, 2020; Miu & Colleran, 2025; Newson et al., 2007).

As for the childhood influence part, reproductive decisions, particularly those concerning early onset of reproduction, cannot be made by the mind alone. They also require physiological orchestration: the cessation of long-bone growth and the laying down of adipose tissue, hormonal changes and so forth. Some of these may have to be underway in late childhood, meaning that the developing individual must be taking a read on possible reproductive trajectories from very early in life.

The suite of psychological influences suggested by table 2 opens the door to - indeed makes inevitable - the emergence of cultural variation that has a partly ecology-tracking and partly epidemiological character. It is plausible that such an integrative psychology is adaptive, in the sense of having led, under ancestrally relevant conditions, to higher fitness than the output of other psychological decision-making mechanisms. This is not, however, to say that reproductive behaviour in contemporary populations is itself adaptive. Clearly it is not: researchers agree that the current increasingly global pattern of high resources, low mortality and low fertility does not maximize genetic fitness given the abundance of resources available, even taking into account the fact that when families are smaller, parents can increase investment in each child (Goodman et al., 2012).

This clarification - that contemporary fertility behaviour is produced by evolved mechanisms, but is actually maladaptive in its consequences - highlights an important point concerning the ICM's view of culture. Under the ICM, culture is the outcome of psychological mechanisms that were shaped by selection in ancestral environments, in interaction with one another over time in socioecological contexts. The cultural patterns they produce are not necessarily adaptive in themselves. Some might be: medical technologies and agricultural innovations that have kept more people alive increase human survival, and so might be said to be genetically adaptive. Having an appropriate kin terminology may help people achieve important social goals. But many other cultural patterns are clearly genetically maladaptive (like the demographic transition), or have no clear relation to genetic fitness (...Henley Regatta, Cowes, the 12th of August, a cup final, the dog races....19th-century Gothic churches and the music of Elgar…). The ICM shifts the focus of the functional-adaptive lens away from the content of cultural traditions, and onto the psychological mechanisms that, inter alia, generated those cultural patterns.

4.4 Other ICM research

We have briefly reviewed three areas of research where the ICM programme - using knowledge of core cognitive principles of the evolved mind in a domain to provide a microfoundation for the observed set of cultural traditions or variations - has generated productive research. This does not mean that all of the questions have been satisfactorily answered, but rather that the ICM or something like it has proved a useful framework for organizing empirical enquiry.

Our three case studies were by no means not the only examples we could have chosen. Music varies widely across cultures, but its features are constrained by cognitive systems of tonal perception and metrical (rhythm) perception (Mehr, 2025). Colour terminologies vary in elaboration, but they show cross-cultural regularities and map in a non-arbitrarily way onto the perceptual space of colour vision (Kay & Regier, 2003; Regier et al., 2007). The same core features of shamanism recur across highly diverse societies (Singh, 2018). Food taboos across societies attach to those substances (principally meat) which have the most potent disgust reaction (Fessler & Navarrete, 2003). We could multiply examples.

5. Conclusions

The existence of rich and important cultural variation is not, as is sometimes wrongly claimed, problematic for the evolutionary-psychological stance. On the contrary, the evolutionary-psychological stance strongly predicts that such variation should arise, given the kinds of

interactive minds that humans have and the variety of circumstances in which they live. As we have seen, the ICM lays out a roadmap for how to investigate cultural phenomena from an evolutionary-psychological perspective. Human cognition does not just enable culture; it continues to shape it. On the other hand, patterns of culture are not reducible to general principles of how the mind works: there are genuinely emergent, and niche constructing, consequences of many minds interacting iteratively in situated material and demographic contexts.

A longstanding question when psychology intersects with the social sciences is the following: does the structure of the mind keep culture (and institutions, and social structure) on a leash, and how long is that leash? At the one extreme, the leash is short: culture is largely a direct readout of the universal structure of the mind, with only rather superficial variation. On the other extreme is the idea that the leash is non-existent: cultures can vary without assignable limit, and develop according to sui generis principles not constrained by individual psychology. The evolutionary psychology position is often presented as being the short leash position. Evolutionary psychologists are indeed interested in the ways culture is constrained by the principles of the mind. However, our point in this chapter has not been to argue for any particular length of leash. The length of leash, and the importance of processes like cultural niche construction, will vary from case to case. We see the value of the ICM not so much as providing a general answer to the leash question, but, rather, providing a methodology for moving forward with integrated scientific inquiry in different domains of culture. That is, the ICM offers conceptual tools and a roadmap for how to do research. What that research will discover in any particular case is an empirical question.

The value of any framework lies in the additional empirical insights that it generates and connects. We presented empirical examples where, we contend, cultural patterns have been illuminated using knowledge of how the relevant psychological mechanisms are structured. This is challenging work. It requires us to answer questions from three disciplines - anthropology, cognitive science, and evolutionary biology - at the same time, and make those answers consilient. We believe the challenge is worth accepting. We hope to see a greater flowering of research that integrates evolutionary psychological knowledge into understanding patterns of culture in future.

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