A Cultural Evolution Framework for Human Creativity

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Introduction: Honing Theory of Creativity

Other species perceive, make decisions, take action, and even create. However, our species is exceptional with respect to our predilection to adapt ideas to our own needs, tastes, and perspectives, and express ourselves through language, technology, art, and other means. I will present ongoing theoretical and empirical research on how the creative process works and how human creativity evolved. What makes this research program unique is that it examines creativity from the perspective of its role in fueling the evolution of culture, and includes both studies with human participants and computational models.

Creativity research has emphasized the generation of multiple ideas over *honing*—recursively reflecting on a question or idea by viewing it from different perspectives (Gabora & Kauffman, 2016; Gabora, 2017). Just as a single object may cast separate shadows when lit from different directions, the mental representation of a creative work-in-progress may be a single entity with the potentiality to be articulated as different prototypes, sketches, or story ideas.

Honing does not encompass additions or modifications to an idea that are tacked on willy-nilly; it refers specifically to modifications that arise in response to an overarching conceptual framework that is shepherding[1] the creative process. The structure of this overarching framework reflects the individual's *worldview:* their self-organizing web of understandings about their world and their place in that world (in other words, the creator's mind as experienced 'from the inside').

The term *psychological entropy* has been used to refer to arousal-provoking uncertainty, which can be experienced not just negatively as anxiety but also positively as a wellspring for creativity (or both) (Gabora, 2017). It is proposed that psychological entropy—a macro-level variable acting at the level of the worldview as a whole—generates emotions that play a role in guiding and monitoring creative tasks. Thus, honing continues until psychological entropy decreases to an acceptable level. In Piagetian terms, during honing the individual assimilates each new understanding of the idea, and the individual's worldview changes to accommodate this new understanding. Insight is then explained in terms of *self-organized criticality* (SOC) (Gabora, 2017), a phenomenon wherein, through simple local interactions, complex systems tend to find a critical state poised at the cusp of a transition between order and chaos, from which a single small perturbation occasionally exerts a disproportionately large effect. Thus, while most thoughts have little effect on one's worldview, an idea we call *insightful* is one for which one thought triggers another, which triggers another, and so forth in a avalanche of conceptual change.

Convergent thought has been defined and measured in terms of the ability to perform on tasks where there is a single correct solution, and *divergent thought* in terms of the ability to generate multiple different solutions. I will explain why *honing theory* (HT) leads us to redefine convergent thought as thought in which the relevant concepts are considered from *conventional contexts,* and divergent thought as thought in which they are considered from *unconventional contexts* (Gabora, 2018).

Implications for Cultural Evolution Theory

I propose that creativity fuels worldview transformation, and that worldviews are what evolve through culture, in a piecemeal fashion, through a process of *Self-Other Reorganization* (SOR) involving (internal) self-organization and (external) interaction with other worldviews (Gabora, 1999, 2013, 2019). SOR solves dilemmas associated with the high degree of human cooperation (Voorhees, Read, & Gabora, in press), which enables the cumulative building of ideas on one another. I will present a set of agent-based model experiments which show, in different ways, that the effectiveness of this cumulative building depends on the balance between continuity (via imitation) and novelty (via creativity) (Gabora & Tseng, 2017).

I propose that creative outputs merely provide evidence concerning the evolutionary states of worldviews (just as shadows provide evidence concerning the shape casting the shadow). This stands in contrast to the traditional view that behaviors, artifacts, or memes, are the objects of cultural evolution, i.e., they are *what* evolves through culture.

Cross-Domain Influence

The view that it is worldviews that evolve through culture follows naturally from studies of *cross-domain influence,* wherein a creative output in one domain (e.g., art) is influenced by another domain (e.g., music). I will report on a set of studies in which creative individuals in multiple disciplines were asked to list as many influences on their creative work as they could. Results indicate that cross-domain influences are surprisingly ubiquitous, particularly in the arts, where they appear to be even more widespread than within-domain influences (Scotney, Weissmeyer, & Gabora, 2018). The discontinuities in cultural lineages that result from cross-domain influence (e.g., Led Zeppelin's use of Tolkien's *Lord of the Rings* as inspiration for the song

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[1] This word is chosen deliberately because it implies that the process is neither entirely top-down nor entirely bottom-up.

"Battle of Evermore") are difficult to account for without resorting to the view that it is not the outputs themselves but the worldviews generating them that evolve through culture.

The Origins of Creative, Cultural Evolution

Like the origin of life, the origin of the kind of integrated worldview needed for cultural evolution has been modeled using an *autocatalytic framework* (Gabora & Steel, 2017). In an autocatalytic network, for each component there exists a means to catalyze the reaction that generates it. Although no component can catalyze its own formation, the network of components as a whole is collectively autocatalytic. In culture, the role of catalysis is played by association and reminding events, and the 'reactions' are between, not catalytic molecules, but concepts and ideas. As parents and others share knowledge with children, an integrated understanding of the world takes shape in their minds, such that they become able to reframe new information in terms of existing mental structure, and become themselves creative contributors to cultural evolution.

I propose that two key steps toward cognitive modernity were (1) onset of *representational redescription* (RR) in *Homo erectus* 2 MYA, and (2) onset in the Middle/Upper Paleolithic of *contextual focus* (CF): the ability to shift between convergent and divergent modes of thought (Gabora & Smith, 2018). In terms of the autocatalytic model, representational redescription entails an interaction or 'catalysis event' between different representations or perspectives, and CF entails the capacity to vary the 'reactivity' of the network. CF may have originated with mutation of the FOXP2 gene, which is known to have undergone human-specific mutations in the Paleolithic (Gabora & Smith, 2019). FOXP2, once thought to be the "language gene", is not uniquely associated with language. In its modern form, FOXP2 may have enabled fine-tuning of the neurological mechanisms underlying the capacity to shift between convergent and divergent processing modes by varying the size of the activated region of memory.

Computer-generated Art and Music

Finally, I will discuss ongoing applications of HT to the development of computer-generated art and music (Bell & Gabora, 2016; DiPaola, & Gabora, & McCaig, 2018; McCaig, DiPaola, & Gabora, 2016). I will show how such efforts are useful for bringing to light the strengths and limitations of our understanding of the creative process.

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