

**Synthetic Anticipation:
On the Evolution of *Wild* Meaning**

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We usually describe *anticipation* as a system's ability to generate forward-looking assumptions, ideas, and models the system uses to guide present behavior. This conceptualization of anticipation is consistent with how we tend to frame it in daily life. It also seems compatible with how different researchers use it in their field. For example, such an approach to anticipation is evident in the work of Seligman, Railton, Baumesiter, and Sripada (2013). These researchers assert that previously dominant schools of psychological thought (i.e., behaviorism and psychoanalysis) ascribed too much explanatory power to the past, and will eventually be replaced by more forward-looking approaches, what they refer to as the new science of *prospection*.

While it is hard to deny that systems capable of generating and using forward-looking models are anticipatory, this seemingly straightforward take on the meaning of *anticipation* can lead us to believe it is something a system *does*, as opposed to being constitutive of what a system *is*. This is an important distinction for the AI community. If, on the one hand, anticipation emerges in the *doing*, and is not constitutive of what we *are*, then it should be possible to engineer an artificial system capable of *doing* what we *do*, including anticipation, regardless of its constitution. Such an approach is, of course, consistent with Marr's (1982) tri-level theory of cognition, the idea that the proper approach to developing a cognitive architecture (and thus explaining cognition) is to (1) determine the computations necessary to completing a cognitive task (e.g., sorting a list of numbers from lowest to highest), (2) generate a representation of the inputs, outputs, and algorithms an information-processing system would need to complete the task, and (3) actually build (i.e., implement) a system capable of executing the algorithms.

While I agree that implementation is, of course, fundamental to research in AI, I'm not so sure that "implementation equals explanation" is a necessary assumption in the

development of synthetic anticipatory systems. For if anticipation is actually constitutive of what we are, and only exists in the *being*, versus only in the *doing*, than “implementation equals explanation” may not be sufficient for a scientific understanding of anticipation. In other words, if anticipation is something we *are*, versus being something we, as physical, bio-cognitive agents, *do*, the science of anticipation will simultaneously be the science of what we *are*. While such an idea might seem radical, it is actually rather consistent with the assertion that certain types of systems are inherently *anticipatory systems*, a position expressed explicitly by complex-systems theorists such as Rosen (1985) and Hofmeyr (2007) and perhaps implicitly by others (Kauffman, 1995; Maturana & Varela, 1980).

The purpose of my talk will be to examine this idea that anticipation is something we *are*, versus something we *do*. Consistent with complex-systems approaches, I will present a position on anticipation that is based on Wild Systems Theory (WST), which conceptualizes living systems as self-sustaining energy-transformation systems that constitute *embodiments of context* (Jordan, 2013, 2017). According to WST, *anticipation* refers to a self-sustaining system’s ability to pre-specify and constrain the dynamic possibilities of its nested transformation systems. In my talk I will describe how *anticipation*, defined as the prospective constraint of context, evolved from the small scale contexts constrained by a single cell, to the full-blown, self-aware pre-specification and constraint of contexts (i.e., forward-looking thinking) exhibited in human anticipation. Specifically, anticipation scaled up because (1) the systems that phylogenetically entailed it (i.e., organisms) were simultaneously energy-transformation systems whose status as such rendered them a possible energy source for potentially emergent energy transformation systems (e.g., plants and herbivores), and (2) as self-sustaining embodiments of context, such systems are naturally and necessarily ‘about’ the contexts they embody. As a result, they are inherently meaningful, and entail what Jordan and Mays (2017) refer to as *wild meaning*. Given this notion of *wild meaning*, WST conceptualizes the phenomenon we refer to as consciousness, or self-awareness, as a phylogenetically scaled-up recursion of the self-sustaining pre-specification and constraint of nested, dynamic possibilities we see in single cell organisms.

In my presentation, I will also examine implications of WST for AI and the notion of synthetic anticipation. Specifically, Cialdella, Laboto, and Jordan (2017) examine three issues that have proven particularly challenging to Marr's (1982) implementation approach to explaining cognition. These issues are consciousness, embodiment, and representation. After examining these challenges, I will propose ways in which WST addresses each challenge, while simultaneously shifting the focus of modeling from looking to biology for inspiration, to looking at a more fundamental property that biological systems share with many other types of systems, including chemical, psychological, and cultural—specifically, the ability of certain far from equilibrium systems to generate catalysts that feedback into and sustain the processes that produced them; what Kauffman (1995) refers to as ‘autocatalytic’ systems, and what Jordan (2013) refers to as self-sustaining, or *wild* systems.

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