

The Productive Mind: Creativity as a Source of Abstract Mental Representations

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According to Gilead et al., abstractum are defined by “criteria of substitutability”. They say that information out of which the mind forms dimensions along which two or more things can be substituted with one another comes from one of three sources: either the information is innate, or it is acquired from personal, subjective experience, or it is acquired from language learning and associated forms of interpersonal communication.

We believe there is a fourth source of the relevant information: the mind’s creativity faculties. Some of the mind’s abstractum are created—or, if you prefer, *constructed*—by the mind of the learner, rather than being derived computationally from some prior informational structure. Yet nearly all of the by-products of the mind’s creative faculties are abstractum. There is a deep connection between abstraction and creativity, therefore.

Yet, this connection is easy to overlook. Gilead et al. show how abstraction allows the mind to leave the “here and now”. The mind returns to the world by making predictions, which can then be falsified by future experience, ensuring that abstractum typically represent reality. However, this line of thinking can make it seem as if the primary function of abstractum is facilitating prediction. That is obviously an important function of abstractum—but it is the metaphysical fact that biological organisms only move forward in time, and not a property essential to abstractum as such, which makes the connection between abstractum and prediction so important.

Abstractum are for more than prediction. The brain/mind is productive, generative as often as it is predictive [cf. (Fedyk & Xu, 2019; Rogoff, 1990; Xu, 2019; Xu & Kushnir, 2012)], and there is probably no better example of the brain’s productive capacities than creativity.

But if creativity isn’t for prediction, what then is it for? We contend that two of creativity’s most important functions are the facilitation of learning and the expression of acquired knowledge by making original constructs. In both cases the construction of novel abstractum is essential to creativity’s ability to achieve these outcomes; some common sense examples can help clarify this claim:

- Asking questions which are not linked by any underlying logic but which generate new inquiry.
- Creating and persisting with a complex counterfactual train of thought.
- Constructing a reason why a historically trusted teacher is mistaken about a new piece of information.
- Constructing hypotheses about what ideas have not yet been considered — and doing so without carrying out an exhaustive, deterministic search of the available hypothesis space.
- Performing of a complex musical masterpiece that is original, not rote, in its performance.
- Condensing a multitude of scientific insights into a single coherent body of writing.
- Crafting a poem which almost perfectly balances form with content.
- Seeing how complex network of equations can possibly be replaced by a single equation.

In all cases, the abstractum-cum-original-construct is used for quite different purposes than prediction—and for many of these examples, a side-effect of the created abstract constructs will be increased, not decreased, surprise.

By linking abstractum with prediction, Gilead et al. are able to explain some of the normativity inherent in abstractum-based cognition: an abstractum is worth preserving in the mind's mental inventory—that is: an abstractum has epistemic value—if something in the world satisfies it, and it will therefore generally support predictions that are based upon it. But since creativity is not for prediction, we need a different explanation of how the abstractum produced by creative mental processes can have value. Our explanation of this is simple. Since the mind/brain is for more than prediction, creativity has value if and when it causally facilitates any of these additional forms of value. The simplest case is when creativity facilitates the acquisition of new knowledge — by inspiring unlikely explorations, questions, or curiosities. But creativity is almost surely at the root of the construction of mental representations leading to thoughts and actions that have aesthetic, mathematical, or even just hedonic value.

We, however, are particularly interested in the connection that creativity has with learning. Specifically, we believe it is important to highlight the powerful compounding effect that can occur when learners are able to creatively deploy their past learning in service of future learning. Elsewhere we have called cases where this occurs “cognitive agency” (Fedyk, Kushnir, & Xu, 2019; Fedyk & Xu, 2018). Relating this back to Gilead et al.'s framework, cognitive agency can be thought of as a complement to the bottom up processes that they describe as generating abstract mental representations—cognitive agency is a top-down (or, better: top-to-top) process by which new abstractum are formed, where the abstractum have a high prior probability than would otherwise be the case of generating new knowledge. The concept of cognitive agency also allows us to capture the idea that it is possible for people to have a degree of control (executive function) over their learning, such that some of their decisions about learning flow partly from knowing how to learn: someone can therefore learn to learn (Lombrozo, in press), and once they know how to learn, they are potentially much more flexible in directing their efforts towards the acquisition of knowledge. And again, the abstractum produced by creativity are essential for achieving this specific outcome.

So, when cognitive scientists confront the question of how abstract mental entities emerge, we hope that they will include “by processes of creative thought” as among the answers. The brain subserves many different cognitive purposes: it is predictive as well as productive; creative as well as logical; symbolic as well as perceptual; and so on. Pluralism about the cognitive functions of the brain is made attractive by placing many of the considerations adduced by Gilead et al. alongside our observations about creativity. But pluralism about the functions of the cognitive system is also an example of the flexibility that you would otherwise predict an organ like the brain to have if you knew that its capacities emerged under the forces of natural selection (West-Eberhard, 1989, 2003).

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