4E Blending in Problem Solving, Collaborative Reasoning, and Teaching

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Abstract

Since Fauconnier and Turner published their report on "Conceptual projection and middle spaces" thirty years ago, a shift has occurred in cognitive science from viewing cognition strictly as internal information processing to debating the roles of the body and the material and social environment in cognitive processes and whether these are causal (external to cognition proper) or constitutive (integral parts of cognition). These broader perspectives have been unified under the umbrella of 4E COGNITION (Newen et al. 2018; Sprevak 2019). Cognition is variously claimed to be:

- EMBODIED, in that mental structures arise from bodily experience (Johnson 1987) and that bodily sensation and action may be part of cognitive processing;
- EMBEDDED, in that cognitive processes may depend on the environment for their functioning;
- ENACTED, in that cognition may be realized in how an organism interacts with its environment; and
- EXTENDED, in that external representations and tools may be part of the cognitive process.

Critics of these views focus on what marks a process as cognitive, on the difference between causal coupling and constitution, and on overextension or 'cognitive bloat'.

One way to examine the 4E nature of cognition is to consider the role of MATERIAL ANCHORS FOR CONCEPTUAL BLENDS in problem-solving (Hutchins 2005, Fauconnier & Turner 2002). From the perspective of distributed cognition (Hutchins 2001), cognitive problems are solved through the functional coordination of representational structures, some of which may be external to the body. Systems that function equivalently—that

solve the same problems—can differ in their conceptual blends and material anchors. Examples from everyday cognition include:

- ways of determining quantity: counting by sequential touching, pointing, or looking; by shifting objects from one location to another; or by using finger proxies;
- ways of determining order of service: standing in line (queueing), noting who is already present, linking to the prior arrival, taking a token, or competing for attention;
- ways of determining presence/absence: calling attendance, scanning a seating chart, using a sign-in sheet, providing tags to be picked up, collecting a signed work, asking others who are present, or using facial recognition technology.

To examine 4E blends, I consider equivalent functional systems in terms of their material and conceptual elements, how they are coordinated to solve the cognitive problem, and how conceptual distinctions are maintained and manipulated in these operations.

After establishing ways that functional systems with anchored blends may be embodied, embedded, enacted, and/or extended, I present some naturally occurring instances of anchored blends from microethnographic studies of problem solving (Williams 2013, 2019), collaborative reasoning (Williams 2022), and teaching (Williams & Harrison 2014, Williams 2019) to see whether and how they reflect the preliminary findings. Finally, I address questions of what makes these processes cognitive, whether they can be explained as causal coupling or whether elements outside the head are partly constitutive of the cognitive process, and of how we might protect against cognitive bloat.

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