

CULTURAL PRACTICES, EMERGENT PATTERNS, AND COLLECTIVE INTELLIGENCE

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Distributed cognition is an approach to the study of cognition that emphasizes the fact that cognitive phenomena at every scale emerge from systems of interacting elements. The elements in such a system might be neurons in a patch of cortex, areas in a brain, a brain and a body in an individual animal, multiple individuals in a social group, or multiple persons in interaction with one another and artifacts in a cultural activity. This approach holds that legitimate cognitive phenomena emerge at all of these levels. For the past 25 years a number of researchers, including this author, have illustrated this through the study of collective intelligence in small groups. We have shown that groups can have cognitive properties that are different from the cognitive properties of individuals and we have investigated the conditions under which those cognitive properties vary. What makes a group a group is that its members are engaged in a culturally organized activity system, such as grocery shopping, ship navigation, scientific research, airline operations, cooperative gardening, film production, musical performance, legal proceedings, game playing, child care, and so on.

About 20 years ago I applied the principles of distributed cognition to the problem of the evolution of language. How could a shared lexicon emerge from interactions among the members of a community in which there was no teacher? The emergence of shared conventions for representation is a clear example of collective intelligence. At the time, connectionism was the modeling rage. Most cognitive scientists who used connectionist networks were attempting to model aspects of individual cognitive. My colleague, Brian Hazlehurst, and I took a different tack, building communities of connectionist networks. We used an understanding of interaction to create simulations in which language-like patterns (lexicon or grammar) could emerge from interactions among simple units. In each interaction a pair of individuals jointly produce an emergent public structure and simultaneously each individual tunes its internal processes to maintain coordination with the emerging shared public structures. In these systems new patterns emerge on the group level, while processes (shaped by connection strengths) inside the individual agents continually adapt to the changing cultural world. For the purposes of this talk I want to highlight the simultaneous production of, and adaptation to, emergent structure.

As cognitive science shifts from a core concept of cognition as a logical mechanism to cognition as a biological process, the role of the body in cognition has become increasingly apparent. This development, coupled with a renewed appreciation for the role of culturally constructed activity systems, provides a foundation for a new vision of collective intelligence.

The cognitive ecosystem of any interacting social group is constituted by inventories of cultural activity systems such as those listed above. These cultural activities take place in arenas, physical spaces that are created or appropriated for the conduct of cultural activities (supermarket, ship bridge, science lab, garden plot, film studio, concert hall, courtroom, ball court, and nursery, for example). The arenas accommodate the artifacts that are involved in the conduct of the activity.

Activities are brought into being through the performance of cultural practices. Practices are the things people do, they are ways of orchestrating action. Some practices, such as conversation and collaborative work, are ubiquitous in human experience. Other practices, such as reading and writing or plotting a position on a chart, are special purpose practices that require special tools to perform and training to master. There are usually many ways to put practices together to engage in any particular activity. Some activities have multiple roles, and different roles often imply different practices. Consider the speaker and the audience in the lecture activity we are jointly engaged in now.

Are practices located in the heads of the people who perform the practices? Yes, of course partly, but they are also in the organization of the arena and the structure of the tools. For example, neither reading nor writing is entirely inside the reader or writer. Both are dynamic interactions between a person and a culturally organized world that includes special purpose material artifacts. We could say more generally that practices reside in the interactions of biological processes with extra-biologically inherited, culturally constructed cognitive niches.

Cultural practices recruit resources in individuals and orchestrate the cognitive resources of individuals into functional skills. Language probably, and music certainly, recruits native resources that were evolved for other purposes. Furthermore, particular languages seem to recruit particular skills. If you acquire a language in

which spatial relations are obligatorily described in terms of cardinal directions, resources within you will necessarily be recruited and re-organized to support judgments of cardinal direction. Reading and writing recruit native perceptual and motor resources, which must be domesticated in order to subserve these practices. The cultural practice of counting orchestrates the relationship between two component practices that are usually acquired previously and separately: the controlled movement of a partition through a set and the transitions through the sequence of number names. In counting, the partition separates items already counted from the not-yet-counted, and each shift of the partition must be coordinated with the production on the next number name in the conventional sequence. Cognitive scientists now know quite a lot about the resources recruited by these practices, although the recruited resources are not usually conceived in this way. In his 2001 book, *Mindware*, Andy Clark argued that the mind is leaky in the sense that mind leaks out to appropriate resources in the environment of thought. Given the perspective presented here it is probably more useful to reverse the imagined direction of flow and say that culture leaks into the minds of people.

The permanent immersion of a community in the soup of cultural activities and cultural practices produces a distribution of functional skills across the members of a population. Those functional skills may then be available for recruitment by more complex cultural practices as we saw in the case of counting. In our society, the resources that are recruited and organized to subserve reading and writing are subsequently recruited by many other more complex practices. The continual two-way traffic of organizational constraint from cultural practices to functional skills and back to cultural practices produces a bootstrapping process.

How does this change our vision of cognition and collective intelligence?

As just one example, consider the distribution of functional skills in a population that is induced by the cultural practices of the community. It would be nice to have a way to measure the properties of that distribution. A narrow and limited version of such a method already exists, although it is mostly not recognized for what it is. It is called the IQ test. From the perspective presented here the widespread use of IQ tests is a way to coerce the crowd-sourcing of answers to questions about the distribution of a restricted set of functional skills. Aggregate IQ scores have been steadily rising in the developed world since the beginning of the 20th century. This puzzling fact goes by the name Flynn effect, after the scientist who first highlighted it. IQ scores are a complicated and contentious issue. However, I believe that the best explanation of the Flynn effect is one that fits the framework laid out here. Aggregate scores on IQ tests are rising because they are as much a measure of the distribution of functional skills in a population

(which is in turn a consequence of a historically changing set of cultural practices) as they are a measure of intellectual ability. The everyday cognitive ecosystems of the Western democracies have changed over the years in ways that more reliably recruit and orchestrate exactly the functional skills that are measured by IQ tests.

The co-adaptive dance of cultural practices with cognitive resources is the source of both individual and collective human intelligence. Human intelligence IS collective intelligence. That is what is characteristically human about it.