

# *Beyond Individual Knowing: How Learning Extends into the World*

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A lot of people at this and the previous year's Complexity and Education Conference have noted that it is tough to break free from "common sense", Cartesian assumptions about the nature of learning and knowledge. In particular, it is difficult to express in concrete terms the idea that knowledge can be embodied or enacted within and among living systems, collectives or networks. Our day-to-day ways of thinking and talking seem always to pull us back to the notion that knowledge is something "contained" somehow in individuals' heads.

In this paper, I briefly offer up some of the ideas and authors that have helped me to make sense of complexivist ideas of knowledge, especially the idea that learning and knowing always extend—both in micro and macro directions—beyond the level of the individual person's head. In order to provide a concrete context, I have tried to frame my discussion around an actual event: The collective creation of the online *Complexity and Education Glossary* (at <http://www.complexityandeducation.ca>, under the 'Resources' button).

This online glossary was created by the Complexity and Education Seminar Group in the Department of Secondary Education at the University of Alberta during the Spring Term of 2004. This group collectively identified key terms in the study of complexity in education and each member,

working individually or in pairs, contributed a number of definitions. Each definition was then critiqued by other members of the group and further changes were made. As the project progressed, new terms were added and others were changed or discarded. An overall design for the glossary, that of a “tree” with “click-able” terms, emerged part way through.

Although I had final responsibility for compiling, proof-reading, editing and ensuring consistency within the glossary, and although I learned a great deal from the experience, the knowledge enacted in the glossary greatly exceeded my own knowledge. It was not as if each definition “went into my head” and then found its way onto the final document. Rather, I had the impression that I was nurturing and trimming a plant that had a life of its own. Indeed, I regularly return to the glossary to learn new things.

Furthermore, the collective knowledge enacted through the glossary seemed also to exceed the knowledge of *all* the individual people who contributed to it. Each definition had been read and critiqued over time by multiple people and had gradually taken shape in relation to the other terms and the organization of the glossary “tree” as a whole. I have no doubt that the glossary “knew” things that none of the individuals involved did.

This collective glossary project, I believe, illustrates a number of complexivist ideas about learning and knowing and how they extend beyond individual brains. In the first place, it shows how knowledge can emerge at the level of the collective that transcends the knowledge of all the individual parts—considered separately—that compose that collective. Several authors have observed this phenomenon in biological and social communities. In *Emergence* (2001), for example, Steven Johnson describes how colonies or hives of social insects “learn” to avoid recurrent dangers and find long-term food sources, even though the individual members generally live very short lives and follow extremely rudimentary rules (such as simply following a certain kind of pheromone trail): “They think locally *and* act locally, but their collective action produces global behavior” (p. 74). Although not themselves complexivists, Lave and Wenger, in their studies of human communities of practice, observe that “mastery resides not in the master, but in the organization of the community of practice of which the master is a part” (1991, p. 94).

It is important to note that complexivists are not simply claiming that knowledge can reside *either* in individuals *or* in collectives. Their position is much more radical and sophisticated than that: They assert that knowing can be enacted at many different levels of living systems—from the microscopic to the personal to the planetary—and that each level can be seen as *both* as a unity *and* as a collective. In effect, the distinction between individuals or unities on the one hand, and collectives or systems on the other, is relativized: Whether one treats a phenomenon as a unity or as a collective depends on your position and purpose.

For instance, as we have seen, a social collective such as the Complexity and Education Seminar Group can be treated as kind of emergent learning unity, its knowledge enacted in the glossary project. Similarly, an individual person can be seen as a collective of smaller scale unities. As Davis (2004) points out, “recent complexity-oriented medical research has underscored that the body’s organs are relatively autonomous and cognitive unities” (p. 165). Johnson compares individual human beings to social insect colonies:

... social insects ... collectively engage in nuanced and improvisational problem-solving... They think locally and act locally, but their collective action produces global behavior ... turns out we’re not all that different from social insects like ants termites, or bees. ... The relationship between the body cells is indeed very much like that between bees in a hive. The human body is made up of several hundred types of cells—muscle, blood, nervous, and so on ... you are the sum of their actions... (2001, pp. 74, 82, 83)

Matura and Varela write that “[o]rganisms and societies belong to one class of metasystems; these consist of aggregates of autonomous unities that can be cellular or metacellular” (1987, p. 198).

The upshot of these insights is that every complex, or living, system can (and *must*) be seen, simultaneously, as a collective of smaller scale unities, a unity in its own right, and a component of larger scale systems.

The creation of the *Complexity and Education Glossary* can also be used to highlight how learning processes and knowledge can never be isolated at one particular level of living system. As we have seen, complex learning systems both form part of larger complex wholes and are themselves composed of other, smaller scale systems (it is for this reason that complex systems are often described as *nested* forms). Although each level’s self-organizing dynamics prevent it from being entirely determined by, or reduced to, what happens at other levels, there is always interlevel affect or “leakage”. As Alicia Juarrero writes, to understand any particular complex system, one must attend to multiple levels:

...at least three levels are simultaneously involved: the focal level, the environmental level immediately above, and the component level immediately below. (1999, p. 114)

For instance, if one wants to study the Complexity and Education Seminar Group (as well as the knowledge it created in the glossary) one must attend not only to this collective unity, but also to the individuals who composed it and the larger social and cultural systems in which the collective was embedded.

From a complexivist standpoint, any robust understanding of the cognitive processes of either individual persons or collectives like our seminar group demands an acknowledgement of biological, social, cultural and technological contexts. Indeed, because we are so thoroughly enmeshed with

such contexts, and because they both enable and constrain our acting/knowing as human beings, the word “context” does not seem to do them justice. We might, for example, follow Juarrero in referring to them as our “external structure” (Juarrero, 1999, p. 114).

Several recent authors have provided fascinating explorations of just how deeply human knowing is embedded in its biological, social, cultural and technological contexts. In relation to the biological embodiedness of knowing, for example, Thompson and Varela, in their forthcoming book *Why the Mind is Not in the Head*, write about the fundamental interdependency of action and perception; for instance, a subject’s actual perception varies depending on whether a visual flow is actively generated by the subject’s own head movements or is simply passively observed (p. 13). Emotion also underlies and supports all cognition:

Every cognitive state (whether conscious or unconscious) needs to be grounded on the homeodynamic processes of emotion, otherwise the organism would have no individual perspective from which to know, perceive, and act. (Thompson and Varela, forthcoming, p. 11)

Merlin Donald, a respected and influential cognitive neuroscientist, provides an excellent analysis of the role of culture in human cognition in his book *A Mind So Rare* (2001). He argues that human beings are “hybrid creatures”, our minds combining a biologically-based capacity for fuzzy, experiential analogizing with sharper, culturally-received symbolizing.

Modern human awareness is shot through with cultural influences, and regardless of its physical boundaries, it is in the firm grip of the cultural web. It is woven as seamlessly into those collective networks as it is into the submolecular depths of the physical universe. (p. 151)

Several authors have also observed how technological artefacts are seamlessly incorporated into our cognitive routines. Roy Pea, for example, writes that

...the environments in which humans live are thick with invented artifacts that are in constant use for structuring activity, for saving mental work, or for avoiding error, and they are adopted creatively almost without notice. (1993, p. 48)

Finally, my narrative about the creation of the *Complexity and Education Glossary* can be used to elucidate a conceptually difficult issue related to complex living systems—that is, the manner in which different levels of nested systems influence one another. All complex systems are characterized by *upward* (or “bottom up”) causation, the process by which local interactions among the parts of a complex system give rise to it as an emergent whole. Such processes were, of course, evident in the manner in which interactions between individual members of our seminar group gave rise, one level up, to the collective entity whose knowledge was enacted in the online glossary.

Less well-understood is the process of *downward* causation. It is a “top-down” process by which an emergent whole constrains the activities of its parts, one level down, in order to serve its purposes. Examples include the way our body as a whole constrains the functioning of organs and cells in order to preserve its existence, how the conscious mind directs one’s mental processes towards solving certain problems, and the manner in which society constrains the actions of its members through laws.

In the context of the Complexity and Education Seminar Group, such downward causation can be seen in the way that the collective whole influenced the individuals that composed it. For instance, the group constrained the activities of individuals (they were assigned certain terms to define and not others), and the collective knowledge that emerged in the glossary shaped the on-going learning of the individuals who were creating it.

Juarrero encapsulates this simultaneous process of upward and downward causation within complex systems in the following way:

...complex dynamical systems self-organize out of the interrelationships among parts—and then loop back to constrain those parts...In other words, self-organizing systems exhibit...interlevel causality...both bottom-up and top-down. (1999, p. 128)

As she observes in *Dynamics In Action* (1999), this new idea of causation represents a major break from traditional scientific conceptions, which accept only “efficient”, billiard-ball style explanations of causation, in which causes are separate from, or external to, effects.

In summary, the creation of the online *Complexity and Education Glossary* has been instructive in a number of ways. In addition to the individual and collective learning that took place among participants during its creation, it offers a concrete illustration of many difficult concepts associated with complexity science and its account of learning and knowing, including:

- 1) how knowledge can emerge at the level of the collective that transcends the knowledge of all the individual parts;
- 2) how every complex, or living, system can be seen, simultaneously, as a collective of smaller scale unities, a unity in its own right, and a component of larger scale systems;
- 3) how learning processes and knowledge can never be isolated at one particular level of living system, and always affect multiple levels;
- 4) just how deeply human knowing is embedded in its biological, social, cultural and technological contexts; and
- 5) how complex systems are shaped through the on-going processes of upward and downward causation.

It is my hope that this paper will be helpful to those seeking to learn more about this fascinating field.

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