Self-Organization in Social Software for Learning

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INTRODUCTION

The Internet has long been touted as an answer to the needs of adult learners, providing a wealth of resources and the means to communicate in many ways with many people. This promise has been rarely fulfilled and, when it is, often by mimicking traditional instructor-led processes of education.

As a large network, the Internet has characteristics that differentiate it from other learning environments, most notably due to its size: the sum of the value of a network increases as the square of the number of members (Kelly, 1998), even before aggregate effects are considered. Churchill (1943) said, "We shape our dwellings and afterwards our dwellings shape us." If this is true of buildings then it is even more so of the fluid and ever-changing virtual environments made possible by the Internet. Our dwellings are no longer fixed but may be molded by the people that inhabit them. This article discusses a range of approaches that make use of this affordance to provide environments that support groups of adult learners in their learning needs.

BACKGROUND

Darby (2003) identifies three generations of networked learning environments used in adult education. First-generation systems are direct analogues of traditional courses, simply translating existing structures and course materials. Like their traditionally delivered forebears, they are dependent on individual authors. Second-generation systems tend to be team-built and designed for the medium from pedagogical first principles, but still within a traditional course-based format. Third-generation systems break away from such course-led conventions and provide such things as just-in-time learning, guided paths through knowledge management systems, and personalized curricula. This article is concerned primarily with such third-generation environments.

Saba's interpretation of Moore's theory of transactional distance predicts that in an educational transaction, as structure increases, dialogue decreases and vice versa (Moore & Kearsley, 1996; Saba & Shearer, 1994). What is significant in differentiating learning experiences is not the *physical* distance between learners and teachers, but the *transactional* distance, measured by the degree of interaction between them. Highly structured educational activities have a high transactional distance, while those involving much discussion have a lower transactional distance.

In a traditional learning environment, the structure of the experience is provided by the teacher or the instructional designer. However, learners will not benefit equally from any given structure, as different learners learn differently. It would be better if learners could select appropriate approaches for their needs—to choose whether or not to choose, to control or to be controlled (Dron, 2007a). Without a teacher, help with this might be provided by the opinions of other learners. However, eliciting those opinions, assessing their reliability/relevance, actually finding the resources in the first place, and once found, fitting them into a structured learning experience is difficult. Several approaches to these problems are available, but first it is necessary to introduce a few concepts of self-organization.

SELF-ORGANIZING PROCESSES

Self-organization processes are emergent: the interactions of many autonomous agents lead to structure, not due to central control, but to the nature of the system itself. Such processes are very common in nature and in human social systems. Two in particular are of interest here, *evolution* and *stigmergy.*

Based primarily on work following that of Darwin (1872), evolution is one of the most powerful self-organizing principles, whereby a process of replication with variation combined with natural selection (survival of the fittest) leads to a finely balanced self-adjusting system. It is important to note that "fittest" does not mean "best" by any other measure than the ability to survive in a given environment.

Stigmergy, a form of indirect communication through signs left in the environment (Grassé, 1959), leads to self-organized behavior—examples range from ant trails and termite mounds to forest footpaths, money markets, and bank-runs. For example, ants wander randomly until they find food, after which they return to the nest, leaving a trail of pheromones. Other ants are more likely to wander where such pheromone trails mark the route. When they too find food, they too leave a trail. The stronger the trail, the more other ants are drawn to it. This positive feedback loop continues until the food runs out, after which the trail evaporates.

A full discussion of the many factors that result in a successful self-organizing system is beyond the scope of this article. However, the following brief discussion should give a flavor of what is involved.

Self-organizing processes occur through local interactions. For systems to develop any sort of complexity, it is necessary for these interactions to occur at a number of scales. For instance, the interactions of bacteria in an ant's gut affect the ant, groups of ants can affect tree growth, tree growth can affect climate. Local interactions should form small clusters, which in turn interact with each other, leading to ever-increasing scales of self-organization. However, in general, the large and slow-moving affect the small and fast far more than vice versa, which is a common feature of self-organizing systems, from forests to cities (Brand, 1997). Parcellation is also an important feature of such systems (Calvin, 1997). As Darwin found in the Galapagos Islands, isolated populations tend to develop differently and more rapidly than their mainland counterparts. Any self-organizing system relies on interactions between more or less autonomous agents. The precise level of interactivity varies, but it is interesting to note that, for a system which teeters at the edge of chaos, neither too stable to change nor too changeable to develop, the average number of connections between interacting agents tends to stabilize around just over two (Kauffman, 1995). Systems must be capable of change, being in a more or less permanently unfinished state. Already perfect systems cannot evolve (Shirky, 1996). Equally, systems in perpetual flux can never achieve the stability to achieve self-organization.

SOCIAL SOFTWARE AND THE IMPORTANCE OF THE GROUP

Social software has been defined by Clay Shirky as that in which the group is a first-class object within the system (Allen, 2004). Early social systems such as discussion forums and mailing lists tended to provide a means of supporting individual interactions, with little consideration of the combinatorial effects of the behavior of the many. Typically, they scaled badly, suffering equally from too many as from too few users. In newer social software that underpins the hype-laden term 'Web 2.0', emergent patterns are capitalized upon and reified. For example, tag clouds provide a snapshot of aggregates of classifications by many individuals, social networking software provides structured webs that are generated from individual links between users, wikis gain their structure from individual decisions to link pages, and clusters of linked blogs give texture to the blogosphere. In all cases, the primary determinant of structure is the bottom-up, local behavior of the many. This means that (in general) social software gets better as more people use it.

Interactions within an e-learning environment have previously only considered agents such as the individual learner, the teacher, and the software with each other and with others of the same kind (Anderson, 2003). If the group is a distinct entity from the individuals of which it is composed, then there are more potential interactions to consider. In particular, the group may be seen as, in some ways, a potential teacher within the system (Dron, 2006a).

SOME EXAMPLES OF SELF-ORGANIZED LEARNING IN PRACTICE

For many knowledge-seekers, the starting point is often Google (*http://www.google.com*), perhaps the largest and most pre-eminent example of social software available today. Google's PageRank™ algorithm (Brin & Page, 2000) is based on the assumption that most Web pages provide links to other sites when those sites are considered in some way valuable. Implicitly, the more links that point to a given site, the higher its approval rating. Combined with a content-based search for keywords, documents returned therefore should have a high degree of relevance and reliability. This approach is self-organized, incorporating evolution as unlinked sites "die" and stigmergy as more-visited sites get more links pointing to them (Gregorio, 2003). It is social, not relying on a central controlling authority to provide decisions on resources' usefulness or give a structure to the content that is returned. However, limited parcellation, problems with term ambiguity, and the lack of a support for identifying relevant resources for specific learner needs beyond content-based searching make Google a relatively poor learning tool.

Social navigation, which explicitly capitalizes on stigmergy to enable the navigation or classification behavior of previous users to influence those who follow, is becoming almost ubiquitous on social sites. Tag clouds of the sort found on del.icio.us (*http://del.icio.us*), Flickr (*http://www.flickr.com*), or MySpace (*http://www.myspace.com*) emphasize popular tags by increasing the font size relative to those that are less popular and limiting the display to popular tags, providing a constantly changing map of a community's interests. Applied in an educational setting, such systems offer many benefits, but at the cost of many distractions, inappropriate content, and a breadth of focus that is as likely to discourage as to enthuse learners.

Wikis allow anyone, or sometimes a more closed community, to edit any page. The potential for chaos is enormous, and yet Wikipedia (*http://www.wikipedia.org*), an encyclopedia generated by thousands of volunteers with