Chapter XLVI
Evolving Learning Ecologies

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ABSTRACT

This chapter describes the application of self-organising principles to the field of e-learning. It argues that traditional managed approaches to e-learning suffer from deficiencies both in cost and adaptativity that are addressed through the application of nature-inspired processes such as stigmergy and evolution. Such systems, primarily those employing social navigation, are built to generate structure through the dialogue-like interactions of individual learners within them. The result is emergent control of the learning process, adapting dynamically to learner needs, with limited teacher involvement. The chapter describes some example applications and explores some of the remaining challenges in the field, most notably in encouraging pedagogically useful structures to evolve.

INTRODUCTION: THE PROMISE OF E-LEARNING

The capacity to learn is a central and defining characteristic of most organisations, both large and small (Seely Brown & Duguid, 2000; Vaill, 1996; Wenger, 1998). Many formal and informal approaches have been developed to assist the process of learning within an organisation. Until recently, the predominant formal approach has been face-to-face training, be it through classroom or apprenticeships. However, this is changing. Driven largely by cost considerations, the benefits of anytime, any place delivery and a just-in-time approach, computer-based training (CBT), computer-aided learning (CAL), and more recently, Internet-based or e-learning, have become vital tools to help provide skills and disseminate knowledge within organisations. The financial arithmetic is compelling: for example, Kelly and Nanjiani (2005) report that in 2003, for every dollar spent at Cisco on e-learning, there was a $16 return on investment. Such success stories rely on a range of factors, most notably organisational commitment, but it is central to virtually all forms of e-learning that there is some involvement of a teacher or mentor, be it in the production of learning materials or the ongoing support and evaluation of learners. Carefully designed CBT or CAL learning materials suffer from two main disadvantages, inasmuch as their production is:

1. labour intensive, and
2. time consuming.

Apart from the cost, the net result of this is that, in a dynamic and fast-changing environment, such learning resources may not be perfectly adapted to the current state of the business ecosystem nor to the needs of the learners. For these and other reasons, it is therefore common to supplement or replace these carefully designed resources with some form of learning community, whether face-to-face, asynchronous (typically using discussion forums), or synchronous (e.g., through video/audio/text conferencing or through Web meeting software). Again, this can be relatively costly to manage and requires highly skilled and dedicated personnel to operate successfully.

This chapter explores an alternative approach. It describes a range of nature-inspired technologies and processes that enable groups of individuals in learning communities to help each other and help themselves. In particular, it describes how evolutionary and stigmergic mechanisms can generate an emergent structure that is adapted to the needs of specific groups of learners and is, potentially, relatively inexpensive. Teachers, mentors, and subject experts are not excluded from the process. On the contrary, such systems are predicated on the assumption that information networks and the Internet in particular are rich and deep pools of resources for learning. However, such resources are often freely available or very cheap due to economies of scale.

FINDING STUFF

Perhaps the most obvious characteristic of the Internet is that it is huge. In December 2004, Google™ had indexed over 8 billion Web pages (http://www.Google.co.uk/corporate/timeline.html), a number that continues to grow. This vast number only hints at the far greater quantity of information available on the Invisible Web (Lackie, 2003), stored in databases, hidden behind intranets, in protected content management systems, or simply not yet indexed. Beyond the Web, e-mail, file-sharing, Usenet newsgroups, and other forms of electronic communication and information perhaps exceed the amount of data available on the Web. Within this wealth of stored and communicated knowledge, it is hard to imagine that for any conceivable learning need, there is not something that might be of value. For example, I teach networking, one tiny aspect of which is Ethernet. A search on Google (June 2005) for "Ethernet tutorial" reveals around 701,000 potentially valuable pages, illustrating that the Internet is not so much an information superhighway but a 'stuff swamp' (Crawford, 1999). The problem is to identify what might be of greatest value and, equally, of identifying the useless or positively harmful. Google is a form of implicit collaborative filter or recommender system. Its PageRank™ algorithm (Brin & Page, 2000) and others of its ilk go part of the way, making use of latent human annotation (Kleinberg, 1998) to provide some hint that others have found these pages valuable. However, as a teacher I am able to recognise potentially valuable tutorials right down to the final page of Google's results (about 790 pages into the search, as it happens), but equally I can find tutorials that might be far from relevant, timely, or effective for my teaching needs on the first page.

Identifying the quality of information returned by a search is essential. Google uses implicit recommendations provided by hyperlinks in Web pages, making decisions based on this single dimension of value. When seeking high-quality information, there are many other relevant criteria we might use. For example,