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A Learning Ecology Perspective for the Internet

Chee-Kit Looi

The Internet is a powerful phenomenon that is radically transforming much of our economy, politics, culture, education, business and social processes, and almost everything else. In order to make sense of such a phenomenon, researchers have applied the ecology metaphor to information production and consumption on the Internet. In the education and training arena, some authors and researchers have also applied the ecology metaphor to viewing learning on the Internet (Brown, 1999). The Internet is seen as a powerful medium for creating and supporting a learning ecology. In this article, we explore the notion of a learning ecology on the Internet by looking at the dimensions of diverse participation, information production and consumption, representations, and experiences. We hope that such a discussion will be useful in framing some of the educational technology problems and solutions on the Internet as well as deriving implications for designing tools and learning activity structures for online learning.

Introduction

Metaphors serve as a kind of mirror that brings out illuminating aspects of the phenomenon we are trying to understand. Lakoff and Johnson (1980) say that metaphors are pervasive because they reflect how we think, and when we change the metaphor, we change the way we think about things. Stefk (1997) writes that the policies that shape the design and use of the Internet are often influenced by the metaphors that we ascribe to it. The most common metaphor for the Internet is the “information superhighway.” A metaphor for the digital library on the Internet is that of a publishing and community memory; the metaphor for the electronic marketplace is that of a place for buying and selling goods and services; and the metaphor for the digital world is that of a gateway to experience (Stefik, 1997).

In this article, we examine the phenomenon of learning on the Internet in terms of a digital ecology. What does such a learning ecology metaphor buy us? How does it help us to recast or reframe some of the classical problems of education and distance learning in quite new terms (Brown, 1999)? We would expect a learning ecology metaphor to allow us to see things from a systemic perspective, and to understand the components of the system and how they interplay with each other to enable and to support the processes of learning.

We posit that an ecological perspective is consistent with the perspective of distributed cognition. By viewing cognition as fundamentally distributed rather than residing “in the head,” the tools, the rules, values, and actors in a classroom form a highly complex, interacting system (Hewitt & Scardamalia, 1997). Knowledge is distributed among different people and mediated by tools and artifacts in the environment. An ecological perspective emphasizes the relationships and dynamics among the various participants in the classroom or in any learning situation.

Ecology of Diverse Participation

The Internet has properties that make for an open ecology. It is diverse, dynamic, self-organizing, self-regulating, interdependent, and boundary-free. Brown (1999) states: “An ecology is basically an open, adaptive system comprising elements that are dynamic and interdependent. One of the things that makes an ecology so powerful and adaptable to new contexts is its diversity.” Mæs (1999) describes a digital ecology as a collection of people and machines that perform activities in a distributed way. It is adaptive in that none of the components is critical: Even if some people and machines are removed, the system will still perform.

The Internet as a digital ecology provides new solution paths to problems. Brown (1999) describes it as small efforts by many people and machines to solve problems, rather than large efforts by the few. In his aggregate analyses of participation in discussion forums and newsgroups, Guzdial (1997) observes that few students contribute many notes to the conversations, and many students contribute few notes to the conversation.

Diversity of participation provides efficient, adaptive, and robust ways of doing things. Within the walls of a classroom, the student is limited in his or her interactions with the other participants and the teacher. When the students are connected online through the Web, they have access to diverse sources of information and expertise. The learning tasks for the students become those of knowing how to look for relevant information and knowledge; how to evaluate, assimilate, synthesize, and apply this material; and how

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to work with others to achieve their goals. When we view learning from a systemic perspective, we consider all the diverse participants—students, teachers, parents, the principal, education officers, colleges, universities, libraries, organizations, etc.

In recent years, many researchers and practitioners have viewed learning as a process in which learners construct knowledge and negotiate meanings together. Learning is seen from the perspective of participating in a “knowledge-building community” (Scardamalia & Bereiter, 1994), a “community of practice” (Lave & Wenger, 1991), or “community of learners” (Brown, 1992). In such communities, learning is an “intermental process” (Edwards & Mercer, 1989; Morrison & Collins, 1995; Vygotsky, 1978) that takes place in the context of real-time discourse. Knowledge internalization occurs when this interpersonal process at the social level is transformed into an intrapersonal process at the individual level. The Internet provides the technological infrastructure for enabling many interpersonal and social processes that were not possible or even imagined before.

Online communities are those which have a current common area of interest. Myriads of communities thrive on the Web. There are collections of communities with overlapping interests cross-pollinating each other (Brown, 1999). Communities evolve and self-organize on the Web. Designers of educational technologies need to think of mechanisms to help such cross-pollination and to sustain and grow good communities for learning.

In biological evolution, there is a major pattern of speciation. In speciation, the original species splits into more than one descendant species, each adapted to a different niche (Van House & Sutton, 1996). Niche is a term in ecology which means the place occupied by a species in its ecosystem, or the potential place or role within a given ecosystem into which a species may or may not have evolved. The notion of niches maps to the communities of interest on the Internet. If the community is too narrowly defined, it may risk extinction as its niche disappears. The larger, more varied (resulting in diversity of contributions), and more flexible a population, the greater its ability to spread to new niches. Here is the notion of communities of interest splitting and specializing into different niches.

The survival of a population is defined as the continuation of its genetic code. The analogy for a learning community is for its knowledge base, tools, approaches, practices, and values to continue in some form. Online communities are a means to help preserve and continue the interests, knowledge, and culture of a group bound by common interests.

Ecology of Information Production, Access, and Consumption

Aggregate behavior within an information space such as the Web is seen as an “information ecology” (Card, Robertson, & York, 1996). The participants in such an information ecology are the producers, gatherers, and consumers of information. We study the rules of behavior and the relationships between variables in the information ecology to learn how to maximize the ecology, for example, by gathering more information at lower cost (Guzdial, 1997). Ecological models of the Web are being developed, for example, that describe when pages are created or deleted, and when they are accessed (Pitkow & Pirolli, 1997). When information is accessed or consumed by participants for the purpose of learning or knowledge advancement or performing or acting upon, the information ecology becomes a learning ecology.

Ecological theory focuses on populations, not individuals, and on the dynamics of the relationship between populations and environment. An ecological system has variables \(x, y, z, \ldots\), relationships \(a(x + z), \ldots,\) and dynamics such as attractors and manifolds. If we look at the Internet as an ecology, then in terms of variables, we understand that anyone can become an author, and contribute content to the Web. This may take the form of sending e-mails, creating and uploading Web pages, contributing to discussion groups or chat forums, participating in communities of interest, and others. Relationships comprise the links, relevance evaluation, aggregation, and search, which relate the contents created by authors. Authors of content can create linkages from their content to other content; for example, Web pages can be linked to other Web pages, and messages may contain URLs of varied sites. Such Web content may be rated with relevance ratings, and catalogs of Web content can be created, such as at Yahoo.com. Once the content is on the Web, search engines will be able to index such content and include them in future searches.

The dynamics comprise content design and delivery mechanisms. Good content or designs are copied instantaneously, or, at the upper end, at the speed of light. The Internet as a medium makes this possible. Contrast this with the print medium, in which information transfer is several orders of magnitude slower. Once content is posted or uploaded to the Web, the gatherers and consumers of the content can access it immediately. And, of course, on the Internet, digital content feeds many, unlike in physical ecological systems.

The exponential growth of the Web is expedited by the increasing availability of delivery mechanisms, which makes it easy for anyone to be a producer of content. Delivery mechanisms include free hosting.
services for Websites, e-mail accounts, personal organizers, groups, etc.

If we view learning as knowledge advancement, learning is a form of intellectual foraging. Learners forage for “food” on the Internet. This metaphorical food suggests good information, data, and knowledge, which can promote learning. Some consume good knowledge and produce better knowledge. Others consume bad knowledge and suffer. Can we extend the analogy further? How do foragers learn what is good or bad food? How do foragers pass this knowledge on to other members of their clan? Herein lie opportunities for designing and using technologies and tools to provide such mechanisms to support this process and improve the ecological balance. For example, while paper publishing is a one-way medium, the Web is different. A consumer of Web content can invariably tell the author of the contents what he or she thinks of it—immediately.

Ecological systems exhibit the herd principle: When searching for sustenance, follow the track of others. Recent work has looked into the capture of the interaction history and the notion that the work done by past users can be important to helping current users solve problems, such as navigation in a complex information space. For example, map and trail mechanisms are created on top of hypertext systems or the Web by designers for guidance or pedagogical purposes. They include:

- Scripted Documents, which are top-down created artifacts to assist in navigation (Zellweger, 1989);
- WebWatcher, a tour-guide agent for the Web (Joachims et al., 1997); and
- Walden’s Paths, a K-12 educational application of scripted paths (Furuia et al., 1997).

Metadocuments are higher-level structures that link information related by topic or interest. Tools based on this concept include IBM’s Aqui (http://www.aqui.ibm.org), Web rings (http://www.webring.org), and Footprints (Wexelblat & Maes, 1999). Recent developments have now enabled any user, not just the designer, to script and create these map and trail mechanisms (see, for example, Third Voice at http://www.thirdvoice.com).

A personification of a natural law is “Nature abhors a vacuum.” Is it the same on the Internet? The author of any published content on the Web would like to draw a ready audience, but this is not always possible, unless the content is linked from existing Web resources and there are easy and effective ways of accessing the content. A discussion forum or a chat tool open to the public can draw some form of participation, but the organizer of such forums would like to draw productive participation instead of nominal or frivolous participation. “Build it and they will come” is a philosophy that will not work for attracting traffic to your contents or portal or learning community unless there are strategies for attracting traffic and bringing people back again (Hagel & Armstrong, 1997).

Ecology of Representations

An ecology has diversity through its participants. This provides resilience and feedback on the contributions made by any participant. We now discuss the notion of diversity not just from participants but by the representational forms of knowledge. Many representational forms can be used for learning on the Internet, thus creating a kind of ecology of representations.

Looking at the Internet as a learning ecology in terms of representations, the variables are the representations freely available to all users. Relationships comprise the various design patterns for content creation. The dynamics involve leveraging on the combinations of representations to deliver the messages.

The Internet, as a new medium for learning, is the first medium that respects multiple forms of intelligence: textual, visual, abstract, musical, social, and kinesthetic (Brown, 1999). There is now a plethora of media available on the Internet: streamed video, images, and text that provide multiple ways of expressing ourselves. There are effective ways in which these different media augment each other. A representational learning ecology, populated by many different representational kinds, including visual and verbal ones, respects multiple forms of intelligence. For example, there is a place for text-verbal representation, as witness the success of many text-based MUDs and MOOs in supporting communities of learning.

The medium plays an important role in terms of affordances for visual and verbal representation. An audio stream provides for a linear exposition, while a text stream allows for more introspective reading where you can go back to previous portions of the text. Video by itself is a visual medium, but it does not provide for active engagement and interactivity. The development of Internet technologies has shifted heavy use of verbal representations on the Internet (initially with text, and later graphics and voice) to more visual representations (videos, etc.). Visual and verbal representations augment each other. We can use text-verbal tools to annotate not just Web pages, but visual streamed media. In this way, visual tools provide the richness of context, while textual tools allow the formulation of discourse, which focuses on particular aspects of the context. Conversely, visual tools are often used to animate or depict what the participant wants to communicate (as researchers, we would grab the nearest napkin to illustrate our ideas quickly). Augmenting representations through annotations add more context to the main representation or message.

One of the effective ways of fostering learning is by encouraging conversation. A learning conversation is more likely to revolve about a co-production of an
insight around a joint activity (Brown, 1998). On the Internet, we can use or design tools to support these joint activities. Conversation is not just language but also multimodal and multimedia in form. Visual tools for representation expand the range of representations beyond linear speech and writing, and support the creation of knowledge in situ. On the Web as a learning platform, verbal tools leverage on our capacity for conversation while visual tools provide a focus for conversation.

A diversity of different representation forms is now possible in the new learning ecology. The coupling of different representations in innovative ways allows the creation, capture, and sharing of knowledge that supports effective learning, and respects multiple ways of knowing and multiple intelligences. We can now present multiple perspectives of a phenomenon, and we can build and provide rich representations of situations, simulations, and phenomena.

Consequently, we propose the law of foraging for optimal representations: The forager is attracted to the representation that provides the highest information yield at the lowest access cost. The advent and pervasiveness of portable devices make possible information access at any time. With the right bandwidth and at the right cost, you can have rich representations, such as video and other complex media. With lower bandwidths and at lower cost, you can get a digest or summary or surrogate version of richer representations. Herein lie opportunities for adapting presentations to suit the bandwidth, the display device, the cost, and the type of consumer. Content sites are offering their own products, such as quick updates beamed to small handheld computers and cell phone screens and subscriptions to longer versions of articles and other features.

Ecology of Experiences

A more recent model of the Internet is Pine and Gilmore’s notion that we have moved beyond a service economy to an “experience” economy (Pine & Gilmore, 1999). In the business sector, all businesses must orchestrate memorable events for their customers. Pine and Gilmore explain the difference between service and experience: “When a person buys a service, he purchases a set of intangible activities carried out on his behalf. But when he buys an experience, he pays to spend time enjoying a series of memorable events that a company stages—as in theatrical play—to engage him in a personal way.” Pine and Gilmore argue that for any compelling experience, there should be elements of entertainment, educational, aesthetic, and escapist, the design of which would invite participants to enter and to return again and again. As McLellan (1999) observes, Pine and Gilmore’s model of the experience economy provides an excellent starting place for educational institutions to plan how to capitalize upon their valuable experience assets in cyberspace.

We look at a learning ecology in terms of the providers of education experiences, the space and the props, and the consumers of the experiences. If we think about providing educational experiences on the Internet, we need to think about the design of the entertainment, educational, aesthetic, and escapist elements (McLellan, 1999). McLellan notes that organizations like PlanetAll (http://www.planetall.com) seek to capitalize on the lasting experience value of higher education in cyberspace by helping alumni network with each other and share continued experiences such as travel and enrichment opportunities.

Digital stories are another compelling metaphor for the experience economy (Atchley, 1999). It involves the gathering, creation, sharing, and acting out of stories. The learning ecology involves the provision of tools for authors to create the space, props and stories, and the provision of the space for participants to actively participate and immerse into the digital stories.

Conclusion

The ecology metaphor helps us understand the phenomenal growth of the Web as well as its dynamics. Applying the ecology metaphor to learning on the Internet is a complex endeavor. It is more than an information ecology, as the chain does not stop when the user accesses and receives relevant information. We also need to consider whether learning occurs, what is being learned, and how information and knowledge are processed, used, applied, and internalized in the user.

In this article, we articulate the dimensions of diverse participation, information production and consumption, representations, and experiences that pertain to a learning ecology on the Internet. An ecology perspective to studying Internet learning enables analysis at a high level of abstraction by studying aggregate relationships and behaviors. Such an understanding can suggest successful learning designs, and to inform designs of technologies and tools for online learning.

As the Web expands, and Internet technologies and services develop and proliferate, new theories of information and learning ecologies can be expected to develop. As we further understand the learning ecologies of the Internet, we can better design and use these facilities in order to facilitate learning, and to help design activities and tools that foster learning communities as learning ecologies.

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References and Suggested Readings


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