

The Evolution Of Knowledge Creation Online: Wikipedia and Knowledge Processes

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ABSTRACT

Using the evolutionary theory framework of the variation, retention, selection process, this paper explains the self-organized knowledge production behaviors online, with Wikipedia as an example. Evolution is presented as a trial-and-error process that produces a progressive accumulation of knowledge. The underlying theoretical assumption is that even though online communities feature very different characteristics than traditional organizations, the basic processes of trial-and-error learning in evolutionary theory still apply to the new forms of organizations. Based on the theory of self-organization system and evolution theory, the processes of variation and selection are explained in depth with examples observed on Wikipedia. The study presents a nested hierarchy of vicarious selectors that plays an important role in online knowledge creation.

Categories and Subject Descriptors

K.4.3 [Computers and Society]: Organizational Impacts—*Computer-supported collaborative work*

General Terms

Management, Human Factors, Theory

1. INTRODUCTION

The scholarship on open collaboration system has been interested in studying the organizational process of knowledge creation, sharing and retention in online environments [7, 14, 15]. Evolutionary theory, though often neglected by researchers in the field of open collaboration system, provides a valuable theoretical perspective to analyze self-organized knowledge systems and its organizational processes [2, 3, 12, 13].

An important intellectual inspiration for this paper is a belief that both the organization and "its environment are

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subject to similar development processes and operating principles to those observable in natural evolution" [9]. With this notion, open collaboration systems, such as Wikipedia, are just special cases of natural evolution processes. This study draws upon some general theories about evolutionary epistemology and models of organizational learning [3, 4, 8, 13] to address the practice of knowledge creation in a distributed, self-organized online community setting.

2. EVOLUTIONARY THEORY AND KNOWLEDGE

Campbell [3] made two important theoretical contributions to the field of evolutionary epistemology.

First, he proposed a universal selectionist theorem as 1. A blind-variation-and-selective-retention process is fundamental to all inductive achievements, to all genuine increases in knowledge, to all increases in fit of system to environment. 2. The many processes which shortcut a more full [BVSR] process are in themselves inductive achievements, containing wisdom about the environment achieved originally by [BVSR]. 3. In addition, such shortcut processes contain in their own operation a [BVSR] process at some level, substituting for over locomotor exploration or the life-and-death winnowing of organic evolution. [3]

Second, to further explain the features of socio-cultural evolution, he suggested identifying "knowledge" with "vicarious processes" as in point 2. Vicarious selection "shortcuts selection by the life and death of genetic variants" [4]. Knowledge is more indirectly selected than are biological structures (pp.12). This is crucial for understanding knowledge change, because it reveals the selection at this level to be a highly stochastic process based upon slight probabilistic advantages (pp.12). His idea of viewing human knowledge process as a nested hierarchy of vicarious selection will be further discussed later in this paper.

3. THE EVOLUTION PROCESS ON WIKIPEDIA

The emergence of Wikipedia as a knowledge resource that "anyone can edit" offers a rich research site for the study of knowledge epistemology. On Wikipedia, the geographically dispersed Internet users collectively achieve the goal of encyclopedia writing and knowledge creation.

3.1 Blind Variation and Selective Retention

Campbell's idea of BVSR process is built on the assumption that the acquisition of knowledge is always profoundly

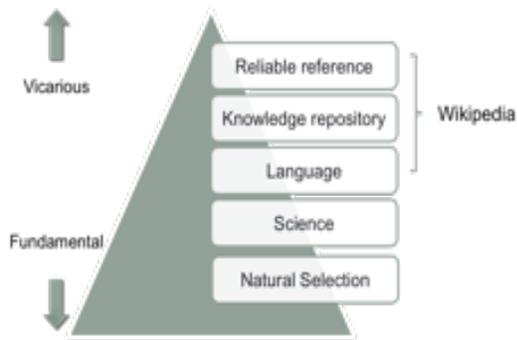


Figure 1: A nested hierarchy of vicarious selectors

indirect and presumptive [6], and this is where the vicariousness in "vicarious selector" comes from. Vicarious selectors are "indirect, or secondary - but not necessarily unreliable - means of probing phenomena that are otherwise difficult to observe (either by expense, time, risk, or availability of means)". They are "shortcuts" in a process of variation and selection, whereby one set of criteria substitutes 'vicariously' for another, more direct form of selection" [1].

This leads our way to viewing knowledge creation as a hierarchy of vicarious selectors, whose levels are ordered according to the amount of the vicariousness or presumptiveness incorporated into the selectors [6]. Within Wikipedia, the variation of and selection on units of knowledge as discussed above are happening, with its own consistent selection criteria; while at the same time, the Wikipedia platform is just part of the larger, encompassing global knowledge process.

Figure 1 summarizes this nested hierarchy system with five different levels of selection.

As an example, the page "Statistics" on Wikipedia has received 126,843 page views in the past 30 days (as of Nov. 25, 2014), which might be larger than any Statistics textbook or journal article in this given period. Over 2,000 editors have edited it more than 4,000 times. New variations are generated, and subsequently tested, selected by others editors for further improvement and refinement. The level of scrutiny increases the selective pressure, and the level of attention received indicates an association between strict selection and retention success. Both characteristics are strengthened in the Internet era, because of the openness to Internet users as knowledge creators/reviewers/users.

4. EXPLORATION AND EXPLOITATION OF KNOWLEDGE

Due to its extremely large scale, Wikipedia articles are certainly not in uniformly good quality, however, the high quality of some articles indicates a possible balance between its openness and reliability. The seemingly contradictory characteristics pose an essential question regarding epistemology and the relation between the exploration of new knowledge possibilities and the exploitation of old certainties. March [10] studies the relation between exploration and exploitation in the context of organizations, and clarifies key concepts around this issue. The explicit decisions in finding a balance between exploration and exploitation are reflected in strategies and investments made by organizations, like re-

	Variation	Selection	Retention
Contributors	+		
Reviewers		+	
Robots	+	+	
Admins		+	
Readers			+

Figure 2: Editing Roles and Evolutionary Functions

finement of an existing routine or invention of a new one [8, 10, 11].

The goal of being a "Wiki" and an encyclopedia at the same time requires the organization to balance the exploitation, which includes the selection and refinement of high quality content, and exploration, which includes the generation of new knowledge variants. From the evolution perspective, exploration improves the blind variation process, and exploitation improves the selective retention process.

Wikipedia demonstrates some organizational structures that implicitly mimic many of these same conditions in evolutionary epistemology, like the design of a Wiki system, a content page/talk page parallel system, and the emergence of different contributor roles. Here, I use the emergence of different roles in the community to demonstrate evolutionary functions.

4.1 Different Roles and Evolutionary Functions

There are three basic evolutionary functions to be accomplished by the Wikipedia editors, in order to meet the key conditions for successful knowledge growth as outlined by Campbell [3], Popper [13]: to increase variation; to increase selection; and to increase retention. By observing the Wikipedian's editing activities and different levels of involvement, I identify five types of roles that each serves the evolutionary functions in a different way, as summarized in Figure 2.

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