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Interface Ecosystem, The Fundamental Unit of Information Age Ecology

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A (biological) ecosystem involves:

- The circulation, transformation, and accumulation of energy... through the medium of living things and their activities...
- The processes responsible for the transport and storage of materials and energy, and the interactions of the organisms engaged in these activities...
- The kinds of organisms that are present and the roles that they occupy in its structure and organization.

Francis Evans, "Ecosystem as the Fundamental Unit of Ecology" [Evans 1956]

ABSTRACT

The Information Age is the period of history in which products and services based on information and knowledge have principal economic value. Information artifacts are implements of use and aesthetic expressions that both reflect and create the ways in which people individually and collectively think and act. Interactive artifacts are designed to engage people in access to and development of knowledge and information. Their human computer interfaces are instances of a broader set of phenomena. Cultural, creative, technological, and everyday frames of reference, spoken languages, economic positions, programming languages, and runtime platforms converge through the lens of the interface nexus. It is necessary to abstract and extend our notion of interface and to contextualize the operation of interfaces amidst dynamic meshworks, in order to address these phenomena.

With regard to life on earth, ecology investigates the web of relations between interdependent organisms and their surroundings. In the Information Age, people, activities, codes, components, and systems form the same kinds of interrelationships. Interfaces are the multi-dimensional border zones through which these relationships are constituted. Interface ecology investigates the dynamic interactions of media, cultures, and disciplines that flow through interfaces. The semiotic encodings of these wide-reaching systems of representation are their interactions' building blocks. Interfaces recombine semiotic codes, forming hybrids.

The ecosystems approach brings the perspectives of diverse disciplines to bear on what interfaces are, how they work, and how they can work. Disciplines, and the media, cultural, and epistemological forms to which they apply, are free to relate in meshworks, opening inquiry. No system of representation dominates; none are considered subordinate. Rather, they are interdependent elements, connected by referential flows of interaction.

INTRODUCTION

With "the medium is the message," [McLuhan 1964] McLuhan began to identify the role of media as languages that structure expression. But media and their associated epistemologies are not the only critical systems of representation. Cultures, local and global, are the semiotic ground in which our identities are situated. Likewise, disciplines are "schools of thought" that structure discourse and practice. These systems dynamically interact, effecting the representation of individuals, communities, and institutions. *Understanding Media* gets caught in the too-normal implicit glorification of the role of science and engineering, losing the critical perspectives of fields such as ethnography, cultural

theory, and political economy. For example, while "new" media have transformational effects, they have not, in themselves, created "patterns of decentralization and diversity" (p. 359), nor has the information age, in itself, made "the entire business of man become learning and knowing" (p. 58). Such techno-utopianism maps the history and culture of media technology as the monotonic, increasing function of modernist progress.

Manovich [Manovich 2001] creates a rich analysis of new media in terms of cinema language, and the history of film. By positing that "cinema can be thought of as an interface to events taking place in 3D space" (pp. 326-327), he suggests the notion of interface as an abstract operand. Focus on the operational characteristics of interfaces, with further abstraction and expanded scope, and on languages as carriers of energy flows—through which complex multidimensional relationships are constituted—are fundamental in the ecosystems approach to Information Age development.

1. THE CONTEXT OF THE INFORMATION AGE

We live in the Information Age. By information, I mean representations of what is going on.² Information's more rarefied counterpart, knowledge,³ adds a component of cognition. While information and knowledge date back to the beginning of history, the Information Age is the period of history in which products and services based on information and knowledge take principal economic value. As the Information Age has established itself, digital forms of information, which can be processed by computers, are of prime importance. The Information Age follows the Industrial Age, wherein manufacturing⁴ was the primary source of economic value. During the Industrial Age, imperial powers extracted raw materials from colonies outside of the economic center, that is, outside of Europe, America, and Japan. This contact was effected through the operation of transportation and communication infrastructures. Previously separated cultures were brought into contact, albeit in a one-sided manner. European and American commercial centers extended their control of the margins. Cultural anthropology came into existence to investigate the cultural exchange occurring in these by and large economically driven border zones.

This historical description of the flow of cultures contains an anachronism. Not only did cultural anthropology form as part of "international economic development," but our very notion of culture as plural, rather than as the single "objective" standard of high culture, coevolved with this same process [Norman 1988]. It would be more accurate to say that previously separated ways of life came into contact. While removed ways of life had come into contact in earlier historical contexts, such as the Roman empire, the extent of such contact, both in terms of breadth and depth, crossed a threshold during the 19th century. The contemporary, plural conception of culture⁵—as the tangible manifestations of a way of life, and the associated values, aesthetic sensibilities, and states of consciousness—originated not before, but during the same period. This definition implies knowledge of the existence of distinct ways of life, and thus of a great heterogeneous world of cultures. However, ironically, the contact through which imperialism made⁶ "civilization" aware of remote cultures, and the concomitant flows of cultural information, concurrently effected the more or less gradual reduction of essential heterogeneity. Through multinational capitalism, cultural mixing has accompanied the rise of the omnipresent hegemony of international financial markets and transnational corporations, from the British East India Company to CNN.⁷ Culture typically flows with



economies from the center to the margins. Though it has roots from the dawn of the Industrial Age, culture, itself, is an Information Age concept. It finds fruition, as well as dilution, in the global village of electronic media networks.

As De Landa observes, [De Landa 1997] the form of history is not a linear, monotonic progression. The Information Age did not replace the industrial mode of production; it only eclipsed its significance. Historical ages overlap. We can identify their passage in terms of the formations that are required to begin an essential transition, the reactants that catalyze this transition, and the threshold phenomena that mark the transition as an essential shift. Thus, while we might correspond the onset of Information Age to various events, such as the proliferation of the Internet during the 1990s or of the personal computer during the 1980s, the antecedent formation and flows of culture, though it overlaps with the Industrial Age, nonetheless marks the Information Age's origin.

In the Information Age, information and knowledge, themselves, form the basis of essential artifacts.⁸ Information and knowledge may be stored in forms that humans are unable to access directly, like the electronic charges on a magnetic disk spinning 7200 revolutions per minute. Even the first layer of decoding those charges—the long strings of ones and zeroes—are not interesting to humans. What we deal with are media representations of information, and the tools (meta media artifacts) which deliver them and enable their production. Media are sensory renderings into perceivable and usable forms. Information and knowledge cannot function as artifacts without being rendered through media. In concrete analog form, this means paintings, books, films, and television, as constructed with paint brushes, paper, printing presses, film stocks, cameras, and editing bays. In the digital realm, the media of information artifacts include images, documents, programs, multimedia, and hypertext, as developed with editors and processors. Means of delivery, such as galleries, museums, warehouses, trucks, stores, theaters, transmission towers, networks, browsers, and players are also essential components. In both the analog and digital domains, each medium is associated with particular technologies. Media effect whole epistemologies of theory and practice. For example, in film, the montage of Eisenstein, the oblique camera angles of Welles, and the fast action/fast cut aesthetic of Lucas' *Star Wars*⁹ are operational units of vocabulary. Like cultures, media constitute systems of representation. Through media, information and knowledge artifacts take form.

While the primary economic and semiotic result of knowledge artifacts is an Information Age phenomenon, the crystallization of knowledge into artifact forms has occurred throughout history. Michelangelo's frescoes in the Sistine Chapel, Homer's *Odyssey*, a song sung to bring rain, a dance performed to prepare for battle, and a codified plan for when to plant seeds and tend them in certain ways in relation to climatic signs; these knowledge artifacts are material representations of culture through media, embodiments of understanding.

2. INTERFACE

Interactive artifacts are designed to engage people in access to and development of knowledge and information. An examination of what happens in human-computer interfaces makes it clear that they are more than a simple meeting of person and machine. There is more to the interface than meets the eye—lurking in the shadows, behind the curtain. Interactive artifacts are instances of a broader set of phenomena. Flows of many levels converge here. The relationship between developer and user is that of ethnography's "the other"—the epitome of cultural separation as connected by process. Myriad abstract

layers are embedded in the multiple material layers of hardware and software that make up typical interactive artifacts. Cultures, frames of reference, spoken languages, economic positions, programming languages, and runtime platforms converge through the lens of the interface nexus. The ecosystem approach shifts these many aspects and levels from the margins to the center.

An interface is a border zone where systems of representation come into contact. It is a membrane, regulating the exchange of vital messages from one side to the other. The more open the membrane, the more flow, the more new combinations that an interface supports. Particular membrane structures can act as filters, tuning feedback loops.

Crossing borders results in an exchange of cultures; the border, through its very existence, asserts that constituents on each side are somehow different. An interface may act as a conduit or as a barrier. One side may be privileged and white; the other, a barrio. An interface may encourage mixing or enforce separation. Interfaces both permit and deny. The crossing may be facilitated in some dimensions, and opposed in others. Exclusion, when it occurs, may be deliberate, endemic, or accidental. It may be brought about by indifference or ignorance of implicit operatives. Inclusion is harder to achieve; it requires intentional inclusion of people's diversity.

Interfaces are the medium of interaction. They constitute the situations in which representations are presented to and by the user and the developer, the subject and the object, the ethnographer and the other. In an immediate frame, our experience of interfaces is sensory. They consist of media. They employ affordances.¹⁰ A well designed affordance provides clues which show how to use it. Again, these clues are messages, and the semiotic codes which form the basis of the messages characterize interfaces.

3. INTERFACE ECOSYSTEMS

Ecosystems are heterogeneous, dynamic, self-organizing, and self-sustaining aggregates. Organic and artifact elements are interconnected in Information Age ecosystems. These meshworks produce, manipulate, and transform signs.¹¹ Interfaces constitute strategic, connecting edges, both within, and in the case of nesting, between cyborg meshworks. They are pathways that support energetic flows in feedback loops. Even though interfaces seem not to be sites, but connections between sites, the study of Information Age ecosystems needs to focus on them. An interface ecosystem investigates Information Age phenomena from a frame of reference that is centered on the relationships and flows between a multiplicity of systems of representation rather than from a predominant discipline or medium. The overlapping border zones become the primary focus, rather than the entity itself. This referential frame emphasizes flows, edges rather than nodes, processes rather than products, dynamic structures instead of particular transient states. Inasmuch as edges support exchange between heterogeneous nodes, they form regions of contact, activating collage principles. [Kerne 2001] Found objects of varying levels of abstraction form assemblages. The proximity of disparate representations activates the human desire to understand connections. In this way, interface ecosystems effect cutting and pasting, semiotic flows, and the concomitant processes of recontextualization, translation, and interpretation. As with the energy of biological systems (see Evans above), signs circulate through and are transformed by ecosystem pathways. This exchange catalyzes the emergence of new hybrid formations on all levels. Interface ecosystems generate fundamental innovations of form, experience, knowledge, and technology. Through this essential, catalytic, evolutionary function, interface ecosystems operate as the fundamental unit of Information Age ecology.

Depending on the location from and role in which an entity is positioned relative to the border zone an interface delineates, that interface looks different. From the point of view of an ecologically oriented developer, an interface is an interpretive translation—created with media and representing cultures—that draws from disciplines in its construction. It carries meanings across a border. From the point of view of those who receive it, the interface is the border zone; it is a media manifestation that represents culture from other perspectives around and amidst the border, offering and/or denying translation and traversal in various aspects.

For the biologist, Evans, the “medium through which energy is circulated, transformed, and accumulated,” consists of “living things and their activities.” For the semiotician, Baudrillard, “the sign... (is) a total medium, a system of communication administering all social exchange.” [Baudrillard 1981] As the conjunction of these operations, interfaces are the strategic multidimensional loci which circulate and transform signs. Evans’ definition of biological ecosystem serves as a template, a mapping from biological to informational dynamics. Thus, an interface ecosystem involves:

- The dynamic interactions of media, cultures, and disciplines, the border zones through which these interactions occur, the voices represented, and the hybrid forms that emerge.
- The roles of human beings and cyborg components—such as corporations, markets, information artifacts, semiotic codes, telecommunications networks, computers, and presentation media—and the flows which connect them.
- The technological, socio-cultural, political, and economic processes which define, circulate, transform and accumulate sign values, and the concomitant significant behaviors through which people manipulate and are manipulated by signs.

4. INTERFACES: IMPLICIT AND EXPLICIT

interface + dynamic interactions of interrelationships
between media, cultures, and disciplines = ecosystem

Equation 1

What does it mean to broaden the scope of interface? Aren’t the interactions of disciplines, culture, and media something else? Consider the case of artifacts which we have already been calling interfaces. Human-computer interfaces are an example of these explicit interfaces. When cyber, organic, and hybrid entities interact, they exchange messages. The messages are represented by media; they are based on and contain cultural perspective; cultures form the ground of meanings, that is, the context, in which they occur. A process of translation between cultures, and their semiotic codes, is required. An interface translates messages from one system of representation, to another. The interactive artifact, which, itself, is already an integrated product of previous interfacing activities, mediates exchange through the interface, across a border. Most immediately, the computer is on one side of the border, the user is on the other. Behind the curtain of the computer dwell the interface designer and the designers of the layers of the underlying platform. Each of these actors may work in a different cultural context. These add dimension to the ecosystem, which can be mapped as nodes and flow pathways. The study of such an interface is the matter of disciplines, which is to say that as soon as one considers its range of implications and effects, a multiplicity of disciplines is invoked. Yet, the range of cultures and disciplines which are dynamically involved in such explicit interfaces are often not considered. The factors are often not specified in statements of work and requirements documents, nor in prevailing expectations. Equation 1 makes explicit these implicit factors, which always operate in the context of interfaces.

Consider, as well, the case of identified intercultural, intermedia, and interdisciplinary situations. In these implicit interfaces, such as the recent saturation of Afghanistan by news networks like CNN, the systems of representation or factors of interaction are explicit. The need for translation, and the separation between the ethnographer and the other are obvious. The notion of interface is unstated. Yet, in all such cases, Information Age technologies play a key role in effecting semiotic flows. Despite its lack of roots in history or community there, CNN nonetheless becomes my interface to life in Afghanistan.

Units of meaning are represented, stored, transmitted, recombined. Borders are crossed. Representations are recontextualized. Meanings shift. A different, multivocal example is the performances of Dzikunu’s London-based Adzido ensemble. Adzido effects a cross-cultural synthesis of African music and dance forms. African artists conduct ethnographic research in communities removed from their origins and exchange detailed knowledge of diverse local traditions. Video plays an important “notebook” role. The result is both the recontextualized construction of traditions and the synthesis of new hybrid choreographies.

Jeremijenko [Jeremijenko 1995] frames her works by bringing implicit, unstated factors to light through unexpected interventions. Suicide Box uses video capture and analysis to record and count suicides on the Golden Gate Bridge. Through its unofficial, yet functional role, the work provokes us to question our assumptions about the contexts interactive artifacts operate in and about the roles of these artifacts themselves. It creates an interface to a prevailing multidimensional ecosystem of malaise. This is not McLuhan’s misplaced utopia of “learning and knowing.” People are dying out there. Technology is not the knight in shining armor. The ecosystem approach can generate authentic developments that challenge our expectations precisely by focusing on intersections of representational borders.

The information age elevates the value of meanings. Artifacts and the environments in which we use them operate semiotically. Media, disciplines and cultures, technologies, economies, and human activities press into contact, transforming context. They engage in vigorous multi-branching flows of representation. They form rich ecosystems, with complex interdependent roles and essential processes of circulation. The interface is the catalytic border zone that effects the dynamic interplay of these reactants. New meanings emerge. By multivocally opening frameworks of discourse to address these phenomena, interface ecology supports the analysis and creation of essential new Information Age formations.

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NOTES

1. An aggregate is an association of diverse elements, all of which are on the same level [De Landa 1997]. Some structure, process, or mechanism sustains their association. The relationships between the elements are multifarious. Even though they are part of a common aggregate structure, the components retain their distinct identities. Processes within aggregates develop bottom up. They are heterogeneous structures that foster diversity. A meshwork is a self-organizing aggregate in which there is significant exchange of energy among the constituents. The binding association is a strong one, based on ongoing, active feedback loops. Dynamic circulation in meshworks pushes them toward boundary conditions, and the emergence of new forms. Meshworks contrast with hierarchies, in which structurally uniform elements dominate one another recursively in static formations.
 2. Information, or data, refers to signals gathered from sensors, and to results collected from devices. Information can be transmitted and stored. This document is information, as are temperature readings inside and outside my house during my last 12 hours of writing.
 3. Knowledge includes models and mechanisms for utilizing information. Knowledge is information digested. Knowledge is based on understanding. It includes decision-making frameworks.
 4. I refer principally to the form of assembly line production, characterized by interchangeable parts and labor.
 5. My personal take on this definition is influenced by many, including Kroeber and Kluckhohn [Kroeber and Kluckhohn 1952], Williams [Williams 1983], and Geertz [Geertz 1973].
 6. This process is ongoing.
 7. Aka Cable News Network LP, LLLP, an AOL Time Warner Company.
 8. An artifact is, literally, a thing made through the knowledge and practice of human art and workmanship. [Oxford 1995] As culture is a primary form for representing, storing, transmitting, and producing knowledge of human practices, so artifacts are material forms of culture. They are material representations of a way of life. Artifacts are implements of use and aesthetic expressions that both reflect and create the ways in which people individually and collectively think and act. Artifacts are situated in particular locations and practices.
 9. This aesthetic has proliferated since the advent of MTV.
 10. An affordance is a sensory attribute of an artifact which, through a user's perceiving it, enables interaction [Norman 1988].
 11. The sign is the atomic particle of meaning, of which languages are composed. Particular sets of signs that are used together constitute languages, semiotic codes, and systems of representation. Saussure [Saussure 1966] broke the sign down into signifier (the name, label, picture, phonemes) and signified (the concept referred to) Barthes [Barthes 1972] and Baudrillard [Baudrillard 1981] observed that this construction applies recursively to build up complex levels of contextualized meaning. Thus, what is sign in one level becomes signifier or signified in another. Political economy is one such second-order sign-forming context.
- Sign value [Baudrillard 1981] refers to flows of prestige and power, with economic and cultural components. Brands play a pronounced role. The meaning of technology, as experienced through interface ecosystems, is tightly wrapped in sign values. The rise and fall of the dot-com bubble is an example. Branding plays as significant a role in defining the Internet as art and science do. And step out onto the SIGGRAPH 2002 exhibition floor: experience the marketing of technology and creativity as the operation of sign-value composites. The SIGGRAPH 2002 art and technical programs are connected elements. The representation of value systems other than economic ones is generally marginalized. Signs are packed—multivalent, multilinked—units of meaning.