Doing Interface Ecology: The Practice of Metadisciplinarity

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Abstract

The interface can be modeled as an ecosystem: connected, dynamic, and characterized by relationships. This model is predicated on a process of working with the interface as a border zone between heterogeneous systems of representation. This paper uses sensation, embodiment, and semiotics to initiate this work process by addressing the range of systems of representation that are involved in its own production. This "presence of the theorist" creates a self-referential metastructure.

As an alternative to the beneficial but ad-hoc assemblages of multi-, inter-, and transdisciplinary approaches, the ecosystems approach proposes that the meshing of systems of representation is an inherent property of interface phenomena. The meshing process causes elements from the involved representational systems to recombine and form hybrids. Recombinant information is a structural formula for creating new knowledge, which can be intentionally invoked for that purpose.

The theorist is part of the environment that s/he theorizes about. The products of theorizing are information artifacts that are also part of the environment; they themselves function as interfaces. The term metadisciplinary is developed here in order to describe the inherent and self-referential nature of this structure. The structure of metadisciplinarity connects theory and practice, which stands in direct contrast with other studies approaches such as performance studies, which separates itself from theater practice.

Border zones where systems of representation meet

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.
-- Interface Ecosystem, The Fundamental Unit of Information Age Ecology [1]

What are the systems of representation that are brought into relationships by interfaces? Let's start with a simple example: a typical personal computer, connected to the Internet. Immediately, we have the "sensation systems" of a human being seeing a computer screen, touching a mouse and a keyboard. The physical is translated into the electronic, and vice versa. The analog representations from the physical, real world are converted to and from the digital representations processed by the computer. We have layers of hardware and software. By referring to a "typical personal computer," I meant to suggest Intel processors and a Microsoft Operating System. Thus, we have the old anti-trust litigation between Apple and Microsoft, and more current jostlings with Linux and those who believe in free software. Somewhere in this scenario, the voices of the hardware and software engineers are echoing. Perhaps they worked very long hours; perhaps they were content with their rewards; perhaps they felt exploited.

The interface of the personal computer puts the user in touch with the assemblers, in a tactile and economical way. The economic relationships leave a sticky trail of money that gets under my fingernails. As I close the case and get back to writing this paper, I worry it might gum up the keyboard.

Those working on the "low level" manufacturing were probably women. [2] Among these, the ones who built the primary circuit board, known as the motherboard, were probably Chinese. [3] Let's open the machine's case and check it out. Perusing the motherboard, integrated circuit labels indicate that they were made in countries such as China (again), Malaysia, the Philippines, El Salvador, and Guatemala. According to the LABORSTA database of the International Labour Organization, the average female electronic equipment assembler in China earned $106 per month during

2000. [4] The interface of the personal computer puts the user in touch with the assemblers, in a tactile and economical way. The economic relationships leave a sticky trail of money that gets under my fingernails. As I close the case and get back to writing this paper, I worry it might gum up the keyboard.

So many relationships already, and we have not yet gotten to the network. There are some open standards here, the TCP/IP protocol stack, and higher level protocols such as HTTP for the Web, SMTP and POP for e-mail. There are standards, too, for declarative languages such as Hypertext Markup Language (HTML) and Cascading Style Sheets (CSS). Of course, no web browser is complete without the potential for search. So Google is here, too.

At the time of this writing, it seems that there is an 85% likelihood that the web browser used by people accessing the Web is Microsoft Internet Explorer. [5] So here we have another of Microsoft's anti-trust litigation scenarios, this one involving Netscape. The U.S. Department of Justice and the Sherman Antitrust law have a presence. So have various states and judges, and the European Union. Operating systems, application systems, legal systems, economic systems, national systems, international systems, and multinational systems are interconnected in complex flows.

Writing this, I am sitting in front of an IBM laptop, so product designers are represented, too. Selker's work on the Trackpoint sits in front of me. [6] So does the brand identity of Big Blue. Paul Rand's logo is present and accounted for. In my memory, a legion of ad campaigns reverberates, from "Solutions for A Small Planet," to "His name is Linux… The future is open." The sound over sound sounds muddy.

Vast infrastructures of research and production are at work; universities, national labs, and corporations carve out highly connected roles. [7] They constitute the social relations of digital production; they selectively filter what gets produced, and what gets omitted.

We have yet to begin browsing, to encounter "content." Yet, already, I feel like I am caught in the sticky web of a horror movie or, at least, a haunted house. I am typing this paper in Microsoft Word, wanting to experience a blank slate for writing but yearnings for a tabula rasa give way to the multilayered reality of a highly structured, complex ecosystem of entities and representations. There are too many windows, too many menus, too many entries, too many buttons. The magical number that defines the capacity of working memory, 7±2, is violated repeatedly. [8] Branded toolbars pervade the digital parchment. I <alt-tab> back and forth from the word processor to web browsers, scanning for supporting materials, and then writing some more. Icons trail my every move.

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In my web browser, I jump from a background article in an industry rag [9] to the <<conference or journal x>> web site to the New York Times for today's news. I drop in on Slashdot, then move on to the ACM Digital Library for more research, then to whatisthematrix.com to find a link to a video, which I connect to an entry about Baudrillard's concept of hyperreality in the site for the metadisciplinary undergraduate class -- "Structures of Interactive Information" -- that I am teaching. [10] The hyperreal refers to the replacement of real world representations, relationships, and values by electronic ones. [11] I keep myself over-stimulated to the point of anxiety, I am saturated with information, out of habit.

This little computer is a meeting point for many codes. Codes of signification. Codes of automata: operators and operands. Codes of expression. Codes of control. A mesh of media renderings, disciplinary structures of methodology, cultural groundings, and epistemological foundations is formed. As I consider all these systems of representation that are in play, all of this signification, I return to the start of this exegesis, to the role of my body-mind. I return to sensation, the core of user experience. I turn to phenomenology (Merleau-Ponty): "The sensor and the sensible do not stand in relation to each other as two mutually external terms… It is my gaze which subtends colour … In this transaction between the subject of sensation and the sensible it cannot be held that one acts while the other suffers the action, or that one confers significance on the other." [12]

According to Merleau-Ponty, sensation is an active process. Sensation situates the individual in her environment. In the field of artificial intelligence and robotics, Brooks' model of embodiment operates similarly:

perception and action are integrated through cognition. [13] Through the process of sensation, through perception and action connected, at the nexus of the interface, I encounter all of these systems of representation, their forms as media, the rules that govern their production and the subversions that attempt to countervail the underlying epistemologies, and their methodologies of practice. As a creative agent, my body is signifier and signified, subject and object. I create information artifacts, which function as interfaces. This paper is one such. I am linked into the complex web of relationships, through my act of writing about this interface ecosystem. Through this act of cognition, the representational forms that I produce are likewise linked. Soon these words will move from the word processor. They will be uploaded as bits by means of a browser, and web protocols. They will be published. They may influence the environment to which they refer. This is our first encounter with the reflexive, recursive, self-referential structure called meta-.

Disciplinary assemblages

Behind each type of representational form that interfaces connect, lie one or more disciplines of methodology. These disciplines enable and govern practice with their codifications of methodological discourse. [14] The composition of disciplines into hybrid assemblages is necessary in order to address the diverse heterogeneous systems of representation that connect through the interface border zone. Examples of these disciplinary assemblages are well known. Gaver [15] and Norman [16] translated Gibson's perceptual model of affordance [17] from cognitive science into human computer interaction. Walczak and Wattenberg brought notions of temporality and self-organizing structure from architecture into interaction design in the web-based artwork *Apartment*. [18] Schiphorst utilized techniques and philosophy from choreography and somatics while creating the Bodymaps installation. [19] Mateas and Stern have developed computational models of theater's "beat" and integrated them with artificial intelligence and computer graphics for their work *Façade*. [20] The author has built a generative space for browsing, authoring, and collecting with principles from music composition and collage, as well as machine learning and computer graphics in *CollageMachine*. [21] In collaboration with creative cognition researcher Smith [22], principles of cognitive science are being integrated with this work in *combinFormation*. [23]

Transdisciplinarity

While these examples constitute instances of practice, they are not sufficient to define an approach. Prior research has begun to address these phenomena of disciplinary assemblage more systematically. Century, among others, describes the advent of the studio-labo-

ratory, "a site … through which artists, scientists, technologists, and theorists commingle" [24] and mentions ZKM, Banff, Ars Electronica, and IRCAM as examples. Gibbons [25], Norman [26], Century [27], and Ascott [28] call these assemblages transdisciplinary -- transdisciplinary research is said to "interpenetrate disciplinary epistemologies" [29]; it is "transgressive." [30]

The value that transdisciplinarity places on the practice of disciplinary assemblage is a good start. The problem is that trans- means, "across, to or on the farther side of, beyond, over." [31] Novak's *transvergence* moves this prescription forward by including an emphasis on connecting, but without theorizing the embodied practice of interface development. [32] While going across, beyond, and over disciplinary boundaries, the denotation of trans- is still lacking not only the structural imperative for assembling disciplines, but also a sense of how processes of disciplinary recombination are a formula for creating new knowledge. Nowotny observes that "Transdisciplinarity ... is more than juxtaposition. ... If joint problem solving is the aim, then the means must provide for an integration of perspectives in the identification, formulation and resolution of what has to become a shared problem." [33] But, what are the structures and processes that catalyze this type of integration?

Recombinant information

In fact, juxtaposition is a starting point for integration. As the collages of Ernst established early in the 20th century, juxtaposition can serve as the first step in a human algorithm for generating new meanings. Juxtapositions and recontextualizations draw the mind to wonder about potential connections between elements. The next steps depend on the sensory and semiotic relationships that can be drawn between elements through cognitive processes. As I suggested in previous writings [34], Dada collage, filmic montage, Debord's detournement, audio sampling and remix, as well as hypertext practices of authoring by reference are all examples of this cognitive and semiotic restructuring. They are types of recombinant information processing: "Recombination is the process of taking existing coded compositions, breaking them down into constituent elements, and recombining those elements to form new codings." [35] Recombinant information forms new meanings through the process of composing elements from the disparate systems. The process works similarly to the shuffling of base pairs in genetics, except here, cognition plays the role of interpreter.

Our cognitive processing of recombinant information is addressed by the geneplore model of creative cognition. [36] According to geneplore, creative experiences can develop when phases of generative processes (e.g., memory retrieval, analogical transfer) alternate with exploratory interpretive operations (e.g., attribute

finding, hypothesis testing). Certain conditions increase the likelihood of creative experience. The generation of pre-inventive structures, which serve as the grist of creative process, makes the development of creative results more likely. Combinations of images and words -- that is, recombinant information -- are a form of pre-inventive structure, as are visual patterns and mental models. The exploration phase consists of articulation, interpretation, and refinement. We play with the pre-inventive structures in search of understanding. We may iteratively cycle back and forth between phases of "generate" and "explore."

Some pre-inventive structures are also characterized by pre-inventive properties. Examples of the latter include ambiguity and incongruity. That is, when information elements are recombined and a combination makes sense immediately, the cognitive process is not likely to go anywhere. However, if there are potential relationships that are not immediately clear, the mind tends to work on making sense of them by finding new connections. Sometimes, configurations of pre-inventive structures do not lead anywhere. There are no guarantees. On other occasions, we have an "Ah-ha!" experience, the emergence of new ideas.

The notion of metadisciplinarity focuses on the recombination of disciplinary systems. Disciplines are referenced and juxtaposed by the sensory, media, and technical intersections of the interface border zone.

A theorem of recombinant information therefore is that the ambiguous and incongruous juxtaposition of heterogeneous elements -- related through the operation of an interface -- is likely to stimulate the emergence of new hybrid forms. The term "element" here may be a nested signifier; that is, whole representational systems of elements can function themselves as the elements that are juxtaposed. In interface ecosystems, systems of representation (such as sensation and text, video and interactivity) are among the elements that are subjected to processes of juxtaposition and recombination.

The notion of metadisciplinarity focuses on the recombination of disciplinary systems. Disciplines are referenced and juxtaposed by the sensory, media, and technical intersections of the interface border zone. The juxtaposition invokes recombinant information principles of collage, detournement, and geneplore.

Disciplines are represented by methodologies, as well as epistemologies; using these together initiates processes of translation. Translations are inherently imperfect, which is where things get interesting: in the context of the interface ecosystem, practitioners have to resolve the ambiguities between disciplines. They / we have to figure out how things fit together. The theorem of recombinant information applies: when juxtaposition is followed by geneplorative processes of conceptual integration, interface ecosystems generate hybrid metadisciplinary forms, as well as new media, and new theory. That is, these processes create new species of meaning and those of us with a need to sell something may be prone to calling this a formula for innovation.

Metadisciplinarity

Hofstadter uses the term "strange loop" to describe a tangled hierarchy in which following a chain of levels of reference returns us to a previous state. [37] These levels of reference are meta-levels. One example would be Gödel's proof of the incompleteness of Whitehead's Principia Mathematica (PM): PM is not complete, because it can't contain all possible statements about itself. (The counterexample is "P.M. is not complete.") These are meta-statements; mathematics and meta-mathematics (and by extension, recursively, metameta…mathematics) are parts of the same system.

The interface described in the section above, which develops and represents theory about interfaces, is another example of a strange loop. We will again find this structure by examining the role of disciplines in the interface ecosystems of the information age.

The notion of metadisciplinarity develops a structurally identical chain of self-reference. In examining and developing phenomena of interface ecosystems, we refer to the underlying knowledge structures of disciplinary inquiry. We refer to the structure of disciplines themselves. Our process of referencing is situated in our bodies, which are connected to technology and information through sensation -- in experiences of reading and writing, seeing and clicking, authoring and designing. Sensation and action mesh in cognition. Action has the potential to express and create. All of this grounds metadisciplinary inquiry in an ecosystem of practice. Theorizing becomes part of our work with interfaces and takes form as a metadisciplinary interface.

Using cognitive principles such as geneplore to describe the process through which we form relationships between disciplines and their constituent languages is another form of self-reference, another strange loop. The practice of metadisciplinarity invokes cognitive science to understand and explain phenome-

na such as its own invocation of cognitive science in combination with other disciplines, such as computer science and cultural theory. And again the theory of metadisciplinarity constitutes its practice.

While the theory of relativity and quantum mechanics have refuted the notion of the unbiased observer, this model still pervades the scientific method. Even though the observer model is refuted and critiqued in discourse, it still governs the structure of disciplines in the humanities and social sciences.

Ethnography and "studies"

Ethnography has been understood as "writing culture." Given the suffix -graphy, we can extend this understanding to include the visual. In his classic work of cultural anthropology, Geertz identified "doing ethnography" as thick description, a piling of layers of signification. [38] Clifford [39] followed by turning ethnography's tools onto its practice. He identified the reflexivity of ethnography, realizing that what gets written down is inevitably as much about the writer as about "the other." The result is an onus on the writer to make her / his presence explicit.

We can apply this reflexive sense of self-reference to the products of writing culture and representing it graphically. The products of ethnography are themselves information artifacts: they function culturally, in the ecosystem of the culture that is being described. By representing observations, in the form of thick descriptions, these information artifacts may exert influence. They are meta-artifacts that integrate theory and practice.

However, ethnography is located in the discipline of anthropology. The making of cultural artifacts involves self-expression and is typically found in disciplines such as art, design, and creative writing. The separation of theory and practice through distinct disciplines interferes with the development of hybrid forms, obscuring the development of the creative role of the individual in "discourse." This is the underlying model of many fields of study, such as performance studies, which observe and write about theater, dance, and ritual, without engaging directly in performance practice. In current academic frameworks, performance studies theses are not performances -- in spite of the fact that a sampling of the NYU Performance Studies Department listserv indicates that many performance studies scholars are accomplished, practicing performers, and that doing performance is important to them.

Conclusion

The structure of metadisciplinarity connects theory and practice. Engaging in interface ecology involves analysis in order to develop an understanding of interface phenomena; it involves synthesis and the development of new interface phenomena. These modes of practice are inseparable. Metadisciplinarity develops an awareness of the structures of situated disciplines that form relationships in interfaces. Through its practice, and intentional cultivation of these relationships, we can create hybrid forms of representation.

Practicing interface ecology means connecting theory and practice through metadisciplinary structures. Separating New Media Studies, or Internet Studies, from practice would avoid the metadisciplinary nature of interface phenomena. Connecting disciplines promotes the creation of hybrid forms. As computational artifacts and their interfaces become tangible and pervasive, as they permeate a wider and wider range of human activities and environments, the need for metadisciplinary practice grows. Future work will explore how the practice of metadisciplinarity can play a new role in pedagogy and research among the fields of computation, information, interaction design, and 'new' media.

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