Intermediation: The Pursuit of a Vision

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Literature in the twenty-first century is computational. Almost all print books are digital files before they become books; this is the form in which they are composed, edited, composited, and sent to the computerized machines that produce them as books. They should, then, properly be considered as electronic texts for which print is the output form. Although the print tradition of course influences how these texts are conceived and written, digitality also leaves its mark, notably in the increased visuality of such best-selling novels as Mark Danielewski's brilliant hypertext novel *House of Leaves*, Jonathan Safran Foer's *Extremely Loud and Incredibly Close*, and Salvador Plascencia's *The People of Paper*.[1] The computational nature of twenty-first century literature is most evident, however, in electronic literature, literature that is "digital born," created on a computer and meant to be read on it. More than being marked by digitality, such works are actively formed by it. For those of us interested in the present state of literature and where it might be going, electronic literature raises complex, diverse, and compelling issues. In what senses is electronic literature in dynamic interplay with computational media, and what are the effects of these interplays? Do these effects differ systematically from print as a medium, and if so, in what ways? How are the user's embodied interactions brought into play when the textual performance is enacted by an intelligent machine? Addressing these and similar questions requires a theoretical framework responsive both to the print tradition from which electronic literature necessarily draws and the medial specificity of networked and programmable machines. Computation is not peripheral or incidental to electronic literature but central to its performance, play, and interpretation.[2] Consequently, we will begin our interrogation by considering the cognitive capacities of computation for participating in the kind of recursive feedback loops characteristic of literary writing, reading, and interpretation.

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Dynamic Heterarchies and Fluid Analogies

Many scholars in the humanities think of the digital computer as an inflexible brute force machine, useful for calculating but limited by its mechanical nature to the simplest kind of operations. This conception is both true and false—true in that everything computable must be reduced to binary code to be executed, but false in the belief that this inevitably limits the computer to simple mechanical tasks with no possibility for creativity, originality, or anything remotely like cognition. From the field that includes artificial intelligence, artificial life, neural connectionism, simulation science, and related computational research, I will focus on two central concepts to develop the idea of intermediation: dynamic heterarchies and fluid analogies as embodied in multiagent computer programs.

The simple computational devices called cellular automata, as Stephen Wolfram's research demonstrates, can create complex patterns that emerge from local interactions between individual cells (or agents).[3] The problem then becomes how to bootstrap such results into increasingly complex patterns of second-, third-, and n-level emergences. One proposal is intermediation, a term I have adopted from Nicholas Gessler, whereby a first-level emergent pattern is captured in another medium and re-represented with the primitives of the new medium, which leads to an emergent result captured in turn by yet another medium, and so forth.[4] The result is what researchers in artificial life call a dynamic hierarchy, a multitiered system in which feedback and feedforward loops tie the system together through continuing interactions circulating through the hierarchy. Because these interactions go up as well as down, down as well as up, such a system might more appropriately be called a *dynamic heterarchy*. Distinguished by their degree of complexity, different levels continuously in-form and mutually determine each other. Think, for example, of a fetus growing inside a mother's body. The mother's body is forming the fetus, but the fetus is also re-forming the mother's body; both are bound together in a dynamic heterarchy, the culmination of which is the emergent complexity of an infant.

The potential of this idea to explain multilevel complexity is the subject of Harold Morowitz's *The Emergence of Everything: How the World Became Complex*.[5] Its glitzy title notwithstanding, Morowitz's book is essentially a re-visioning of well-established domains of scientific knowledge such as cosmology, the origins of life, and molecular biology into a unified scenario in which, at every level from the beginning of the universe through complex human social systems, complexity emerges through dynamic heterarchies interacting with one another. For example, atoms consist of dynamical systems in which electrons interact with the nucleus comprised

of protons and neutrons (in the simplest account) to form more or less stable units. When atoms combine to form molecules, the nature of the dynamics changes, and the patterns created by the interplay of atomic forces is transformed into a different system in which the emergent results of the first system are re-represented in the different medium of molecular interactions. These are captured and re-represented in turn when molecules combine to form macromolecules such as proteins. At this point the interplay between digital and analogue processes enters in decisively important ways. DNA sequences can be understood as primarily digital systems of base pairs, represented by the discrete letters of the DNA code, *ATCG*. But when the sequences are folded into proteins—the process responsible for determining functionality—the analogue processes of topology become crucial as they continuously interact with the genetic sequences.

As this example suggests, digital and analogue processes together perform in more complex ways than the digital alone, for each has strengths complementary to the other. Digital processes, because they are discrete, give much finer error control than analogue processes. By definition, analogue processes vary continuously along a spectrum; rectifying small errors is difficult because all real points along a number line can theoretically be occupied. This is the main reason why analogue computing, which flourished until the 1950s, lost out to digital computing. Nevertheless, analogue processes have strengths of their own. They excel in transferring information from one medium to another through morphological resemblance, and the complexity of continuous variation allows them to encode information in more diverse ways than digital encoding. In dynamical heterarchies, analogue and digital processes can be expected to perform synergistically with one another, as they typically do in biological processes.

Now let us make a speculative leap and consider the human and the digital computer as partners in a dynamic heterarchy bound together by intermediating dynamics. Do these components satisfy the requirements for a dynamic heterarchy? They are obviously at different levels of complexity, the human being immeasurably more complex than the computer. Just as obviously, they exist as different media, with the human a carbon-based entity with complex electrochemical and neuronal feedback loops, whereas the computer's dynamics are based on relatively simple electro-silicon circuits. Differences in complexity notwithstanding, the human and computer are increasingly bound together in complex physical, psychological, economic, and social formations.

Increasingly, the environments people create for themselves include a diverse array of intelligent machines, especially in developed countries such as the U. S. As computers proliferate, they are endowed with increas-

ingly powerful networking capabilities; they are also moving out of the box into the environment through ubiquitous computing, embedded sensors and actuators, mobile technologies, smart nanodevices embedded in a wide variety of surfactants and surfaces, real-time sensors and data flows, and a host of other developments. As a result, people in developed societies are surrounded by smart technologies of all kinds, from the virtual online world Second Life to intelligent toasters that decide when the bread is brown. In light of these developments, it seems reasonable to assume that citizens in technologically developed societies, and young people in particular, are literally being re-engineered through their interactions with computational devices. A survey by the Kaiser Family Foundation entitled "Generation M: Media in the Lives of 8-18 Year-Olds" reports that young people between the ages of eight to eighteen spend an average of over six hours *per day* (including school days) consuming media.[6] While the lion's share goes to television, significant chunks are also consumed by surfing the Internet, playing video games, sending e-mail, and otherwise interacting with computers.

Anthropologists have long recognized that humans have been biologically, psychologically, and socially shaped by their technologies at least since Paleolithic times.[7] The new wrinkle is the power of computers to perform cognitively sophisticated acts. Compared, say, to a hammer or stone ax, a computer has much more flexibility, interactivity, and cognitive power. In addition, computers are able to handle both natural language and programming code, capabilities that allow them to function in complex human-computer networks. Humans are routinely considered to be distinguished from other species by their intelligence and particularly by their ability to use language, making it possible for them to develop complex social formations. Computers are crucial components of those structures, from international banking protocols to air traffic control at LAX to twelve-year-olds IM-ing their friends. In developed societies, it is not merely a metaphor to say that (some) humans and computers are bound together in dynamic heterarchies characterized by intermediating dynamics. Humans engineer computers and computers re-engineer humans in systems bound together by recursive feedback and feedforward loops, with emergent complexities catalyzed by leaps between different media substrates and levels of complexity.

What evidence is there that computers can function as cognizers, that is, as agents capable of intensionality, the "aboutness" that makes a subject (or an agent) capable of referring to something outside of itself? Recalling John Searle's Chinese room analogy, we may also add the requirement that in some way the computer must *understand* what it is about in order to be considered a cognizer in the strong sense.[8] Here I turn to the research program of Douglas Hofstadter, who in collabora-

tion with several generations of graduate students has devoted himself to investigating this issue.

In *Fluid Concepts and Creative Analogies: Computer Models of the Fundamental Mechanisms of Thought*, Hofstadter details this research.[9] His mantra, "cognition is recognition," posits that cognition is built upon the ability to recognize patterns and extrapolate from them to analogies (pattern A is like pattern B). Once analogies can be formed, the process can theoretically be extended to analogies between analogies (between analogies . . .), a progression capable of leapfrogging between levels in recursive cycles of increasing complexity. The first necessarily modest step is to create a computer program capable of recognizing a pattern. Hofstadter's test case was inspired by the "Jumble" puzzle that appears in newspapers, in which the reader is challenged to unscramble a sequence of letters to form a recognizable word. The idea is to construct the program (dubbed Jumbo) using a wide variety of "codelets," small programs that function as independent agents performing specific tasks. The emergent result from the interactions of all the agents is the successful construction of a word.

The codelets function by randomly putting together pairs of letters or larger strings in a process that includes parameters indicating how strong are the letters' affinities for each other and how "sticky" that string is, that is, how much those particular letters want other letters to join them. Another feature of the program is the "coderack" (an allusion to the coatrack in a checkroom), a sequencer that determines which codelet runs next. As a codelet moves from random assemblage into strings where the bonds between letters are strong, its urgency rating increases so that it will be run more frequently. Hence, the closer it comes to assembling a recognizable word, the greater the likelihood it will have the processor time to finish the task. Although the programs necessarily run sequentially, this mode of sequencing simulates multiagent parallel processing because all programs are given some opportunity to run, albeit in an evolutionary environment where fitness is defined in terms of creating recognizable words. This programming structure creates a milieu in which the program can "understand" the words it assembles—that is, understand not semantically but philologically and linguistically in terms of grapheme and syllable formation.

Another program (Copycat) seeks to complete an analogy by performing a transformation like a given transformation of a sequence of letters (or numbers), for example abc => abd is "like" wxy => ? The answer would be immediately obvious to a human (wxy => wxz), but the point is to use local interactions between diverse agents to arrive at an analogy that reveals the deep structure of the situation. In the example above, the deep structure is the linear sequence of the alphabet. A more chal-

lenging analogy is this comparison: abc => abd is "like" xyz => yz? Faced with this challenge, the program evolved through local interactions three emergent results. The first, xyz => xy, implies that the alphabet is a line segment with nothing beyond its terminus. The second, xyz => xyzz, suggests a deep structure in which the line segment may be extended by repeating elements. The most elegant solution, xyz => xya, implies that the alphabet is circular, with the end cycling back to the beginning.

Despite the apparent simplicity of the challenges, the programs' virtue is that they accomplish their tasks not by applying a rigid set of rules but rather through fluid exchanges between many codelets that progress from random forays in the possibility space to increasingly "informed" guesses about possible answers. Because the dynamics are emergent and interactive, the programs create the computational equivalent of "understanding" the problem, unlike programs that merely encourage the illusion of comprehension while understanding nothing (which Hofstadter calls the Eliza effect, after Joseph Weizenbaum's well-known program that mimics Rogerian psychoanalysis).[10] Hofstadter's inspiration for his research came from introspection about his own techniques for solving similar problems. Following subtle clues and momentary glimpses into his perceptions as they surfaced into consciousness, he became convinced that his cognition emerged not from rigid rules but flexible analogies that could branch in several different directions; hence his name for the method he instantiated in the programs, fluid concepts and creative analogies. As we will see, this work is particularly appropriate for thinking about intermediation between humans and computers as a framework for understanding electronic literature. The programs that perform electronic literature are generally quite different from those created by Hofstadter and his collaborators, but nevertheless Hofstadter's programs nicely capture their spirit. Because literature works through metaphor, evocation, and analogy, it specializes in the qualities that programs like Jumbo and Copycat are designed to perform.

In the context of electronic literature, intermediation has two distinct ways in which it might be understood: as a literal description of the dynamics of human-computer interaction, or as a metaphor for such interactions. Hofstadter's programs add the possibility of recursive loops between these binaries, loops that entangle the literal with the metaphoric, so that the binaries operate as a spectrum of possibilities rather than as polar opposites with an excluded middle. As subcognitive systems, Hofstadter's programs provide the matrix from which higher cognitions can emerge. For example, they have no capacity for semantic recognition but the humans interpreting their results might see interesting patterns in, say, the set of recognizable words generated from a given anagram. The more complex cognitive system, the human who gains insights from

the program's results, might complete the loop by tweaking the program. In this case, the program functions literally as an adaptive system bound together with the human through intermediating dynamics, the results of which are emergent realizations. The program can also operate as a metaphor for other computational systems less intelligent and adaptive that similarly spark insights in the humans who use them. Framed like this, the literal/metaphoric binary becomes a spectrum along which a variety of programs can be placed, depending on their cognitive capacities and the ways in which the patterns they generate and/or recognize are structurally coupled with humans.

In electronic literature, this dynamic is evoked when the text performs actions that appear to bind together author and program, player and computer, into a complex system characterized by intermediating dynamics. Generally, the performance is metaphoric rather than literal because the programs are not nearly as cognitively sophisticated as those Hofstadter created. Nevertheless, the performance is designed to elicit emergent complexity in the player, who possesses much more powerful and flexible cognitive powers than the computer. If this is indeed the result, then the program's *effects* are no longer simply metaphoric, for it has literally changed the human's perceptions and, to the extent that perceptions provide the scaffolding for cognition, cognitive processes as well. The cycle operates as well in the writing phase of electronic literature. When a programmer/writer creates an executable file, the process reengineers the writer's perceptual and cognitive system as she works with the medium's possibilities. Alternating between writing modules and testing them to be sure they run correctly, the programmer experiences creation as an active dynamic in which the computer plays a central role. The result is a meta-analogy: as human cognition is to the creation and consumption of the work, so computer cognition is to its execution and performance. The meta-analogy makes clear that the experience of electronic literature can be understood in terms of intermediating dynamics linking human understanding with computer (sub)cognition.

Crucial to the formation of this analogy is the sense that the human is interacting not exclusively with a rigid rule set (although for most of the programs currently used to create electronic literature, such rule sets exist in abundance), but rather with a fluid mix of different possibilities. For the player, the sense might come from a program designed to encourage this orientation by having parameters vary continuously to produce unexpected results. For the programmer, the fluidity might arise from unexpected effects possible when different functionalities within the software are activated simultaneously. However the effects are achieved, the importance of fluidity to the analogy-forming process

is evident in the richly diverse senses in which flow has become central to narrative thematics, design functionalities, and literary dynamics for contemporary electronic literature.

At this point it may be instructive to compare the processes described above with what happens when a person writes and/or reads a book. The book is like a computer program in that it is a technology designed to change the perceptual and cognitive states of a reader. The difference comes in the degree to which the two technologies can be perceived as cognitive agents. A book functions as a receptacle for the cognitions of the writer that are stored until they are activated by a reader, at which point a complex transmission process takes place between writer and reader, mediated by the specificities of the book as a material medium. Although authors have occasionally attributed agential powers to the book (in Borges's fantastical "The Book of Sand," for example, the letters shift into new positions every time the book is closed),[11] the letters in actual books never shift once ink has been durably impressed upon paper. But in many electronic texts, words and images do shift, for example through randomizing algorithms or programs that tap into real-time data flows to create an infinite number of possible recombinations.[12] Recombinant flux, as the aesthetic of such works is called, gives a much stronger impression of agency than does a book. Displays of the computer's agency are common in electronic literature, including animated Flash poems that play by themselves with little or no intervention by the user, generative art such as Loss Pequeño Glazier's poems that disrupt the narrative poetic line every few seconds, and interactive fictions such as Emily Short's *Galatea*, a sophisticated program that produces different responses from the Galatea character depending on the precise dynamics of the player character's actions.[13] Because the computer's real agency, as well as the illusion of its agency, is much stronger than with the book, the computer can function as a partner in creating intermediating dynamics in ways that a book cannot.

When literature leaps from one medium to another—from orality to writing, from manuscript codex to printed book, from mechanically generated print to electronic textuality—it does not leave behind the accumulated knowledge embedded in genres, poetic conventions, narrative structures, figurative tropes, and so forth. Rather, this knowledge is carried forward into the new medium, typically by trying to replicate the earlier medium's effects within the new medium's specificities. Thus, written manuscripts were first conceived as a visual continuity of connected marks reminiscent of the continuous analogue flow of speech; only gradually were innovations introduced such as spacing between words, indentations for paragraphs, and so forth. A similar pattern of initial replication and subsequent transformation can be seen with electronic

literature. At first it strongly resembled print and only gradually began to develop characteristics specific to the digital medium, emphasizing effects that could not be achieved in print. Nevertheless, the accumulated knowledge of previous literary experiments has not been lost but continues to inform performances in the new medium. For two or three thousand years, literature has explored the nature of consciousness, perception, and emergent complexity, and it would be surprising indeed if it did not have significant insights to contribute to ongoing explorations of dynamic heterarchies.

I propose to put the idea of intermediation in conversation with contemporary works of electronic literature to reveal, in a systematic and disciplined way, how they achieve their effects and how these effects imply the existence of entangled dynamic heterarchies binding together humans and intelligent machines. In *My Mother Was a Computer: Digital Subjects and Literary Texts*, I explored intermediation by taking three different analytical cuts, focusing on the dynamics between print and electronic textuality, code and language, and analogue and digital processes.[14] Such wide-ranging analyses are beyond the scope of this essay, so I will limit my examples to the interplay between print and electronic textuality, with the understanding that the other dynamics, although not foregrounded in this discussion, also participate in these processes.

From Page to Screen: Michael Joyce's *afternoon, a story* and *Twelve Blue*

When electronic literature was in its infancy, the most obvious way to think about screens was to imagine them as pages of a book one turned by clicking, a tendency visually explicit in the short-lived Voyager experiments with electronic books. Nothing comes of nothing, as King Lear observes, and electronic literature was not born ex nihilo. Especially in the first generation of electronic literature the influence of print was everywhere apparent, much in the way the first automobiles were conceived as horseless carriages. In retrospect, early claims for electronic hypertext's novelty seem not only inflated but misguided, for the features that then seemed so new and different—primarily the hyperlink and "interactivity"—existed in a context in which functionality, navigation, and design were still largely determined by print models. As the field began to develop and mature, however, writers, artists, designers, sound artists, and others experimented to find out what the medium was good for and how best to exploit it.

That evolution is richly evident in the contrast between Michael Joyce's seminal first-generation hypertext *afternoon, a story*[15] and his later

Web work, *Twelve Blue*.[16] Both are authored using Storyspace (Eastgate System's proprietary hypertext authoring program), but the ways in which the medium is conceptualized are startlingly different. In the few years separating these two works, we can see a steep learning curve in process, a curve that represents one writer's growing realization of the technology's resources as a literary medium. *afternoon* has received many excellent interpretations, so its effects can be briefly summarized.[17] It works through a branching structure in which the reader is offered alternative plot developments, depending on which sequences of lexias she chooses to follow. In different plot lines, Peter, the protagonist, discovers either that his son died that day or did not die. The ambiguity is not so much resolved as illuminated when the reader comes upon "white afternoon," a crucial lexia surrounded by a "guard field," a program conditional that prevents a reader from accessing it until certain other lexias have been opened. In "white afternoon," the reader discovers that Peter may have been the driver of the car that collided with the vehicle in which his son and ex-wife were riding, with the possible result that he himself caused the fatal injury of his son. This discovery explains the approach-avoidance pattern Peter displays in attempting to find out where his son is; he does not want to face what in some sense he already knows. As Jane Yellowlees Douglas explains in her fine reading of the work, once the reader reaches this lexia she is apt to feel that she has in some sense "completed" the work, even if all the lexias have not been discovered and read. The work is thus driven by a mystery that, once solved, gives the reader the satisfaction normally attained through a conventional Aristotelian plot structure of rising complication, climax, and denouement.

The technique of conflicting plot lines is, of course, not original with Michael Joyce. Some two decades earlier, Robert Coover experimented with similar techniques in short stories such as "The Elevator" and "The Babysitter," print fictions that, like *afternoon*, are broken into brief segments relating mutually contradictory details.[18] These stories are often identified as precursors to electronic hypertexts, for like *afternoon*, they employ branching structures that create irreconcilable ambiguities centering on violent events. In some ways, Coover's stories are more daring than *afternoon* for they contain no kernel that invites the reader to reconcile the contradictions through a psychological interpretation. Comparing the two works reveals how print-centric *afternoon* is, notwithstanding its implementation in an electronic medium. It uses screens of text with minimal graphics, no animation, no sound, no color, and no outside links (a possibility that only came into existence with the World Wide Web). Navigation proceeds by using the Storyspace navigational tool showing what links are available from each lexia, or by clicking on "words

that yield" within each lexia. The linking patterns create short narrative sequences, also identifiable through the navigation tool that allows the reader to follow a given narrative sequence through the similarity of the lexias' titles. The writer's control over these sequences is palpable, for several of them do not allow any exit (short of closing the program) until the reader has clicked through the entire sequence, creating an oppressive sense of being required to jump through the same series of hoops numerous times. Although the reader can choose what lexias to follow, this interaction is so circumscribed that most readers will not have a sense of being able to play the work—hence my repeated use here of the term "reader" rather than "player."[19]

Twelve Blue, by contrast, makes playing into one of its central metaphors. Significantly, it is not conceived as a work driven by the reader's desire to solve a central mystery. There is no mystery here, or more precisely, there are mysteries but not ones that can be solved in any conventional sense, for they open onto unanswerable questions about life and death. ("Why do we think the story is a mystery at heart?" the lexia entitled "Riddle" asks, following that with "Why do we think the heart is a mystery?")[20] Other central images, playing on the etymology of "text" as "weaving," are threads that come together to form patterns and then unravel to come together in different ways to create new patterns. "Twelve Blue isn't anything," Joyce writes in his introduction. "Think of lilacs when they're gone" ("Introduction"). Compared to *afternoon*, *Twelve Blue* is a much more processual work. Its central inspiration is not the page but rather the flow of surfing the Web. The work is designed to encourage the player to experience it as a continuous stream of images, characters, and events that seep or surge into one another, like tides flowing in and out of an estuarial river. In this sense, although it has no external links, *Twelve Blue* is Web-conceived as well as Web-born.

Two seminal intertextual works illuminate the difference between *afternoon* and *Twelve Blue*. The epigraph, taken from William Gass's *On Being Blue*, signals that the strategy will be to follow trails of associations (as Gass says) "the way lint collects. The mind does that."[21] Every screen contains at least one instance of the word "blue," in a range that parallels Gass's own capacious repertoire. The second, less explicit intertext is Vannevar Bush's seminal essay "As We May Think,"[22] in which he argues that the mind thinks not in linear sequences but in associational links, a cognitive mode he sought to instantiate in his mechanical Memex, often regarded as a precursor to electronic hypertext. In *Twelve Blue*, Joyce takes up Bush on his speculation by creating a work that, much more than *afternoon*, instantiates associational thinking and evokes it for the player, who must in a certain sense *yield* to this cognitive mode to understand the work (to say nothing of enjoying it). The player who

comes to *Twelve Blue* with expectations formed by print will inevitably find it frustrating and enigmatic, perhaps so much so that she gives up before fully experiencing the work. It is no accident that compared to *afternoon, Twelve Blue* has received far fewer good interpretations and, if I may say so, less comprehension even among people otherwise familiar with electronic literature. Like sensual lovemaking, the richness of *Twelve Blue* takes time to develop and cannot be rushed.

Let us begin, then, with a leisurely embrace that wants to learn everything it can about this textual body, with an intention to savor rather than attack or master it.[23] The surface that first presents itself already invites us to play, for it consists of twelve colored threads in different hues, predominantly clustered at the blue end of the spectrum, against a deep blue background. The threads, which are interactive and change orientation according to how we play them, are divided into eight "bars," suggesting the measures of a musical score. By playing this score we are also weaving the threads into patterns, a metaphor not so much mixed as synesthetic, for sight is in-mixed with sound, texture with vision. As we open the screens by clicking on the threads or choosing to play one of the bars, the mix we have chosen is imaged on screen left, representing the orientation the threads have in that bar. The URL, shown at screen bottom, indicates the bar and thread respectively of that sequence (for example, 4_10). Repeated exploration could theoretically locate each sequence within a two-dimensional grid indicating its position in time (the bar number) and space (the thread number).

Entering the flow of the screen narratives, one cannot help noticing how difficult it is to identify the characters. Pronouns abound while proper nouns appear sparsely, teasing the player with ambiguities and arousing the desire to probe further into the work, to anchor the actions to terra firma. Gradually, as the player enters the flow and lets it enter her, she comes to recognize patterns and sees them emerge into recognizable shapes. Think of staring at a random dot image; if one strains one only delays the emergence of the pattern, but if one relaxes and lets it take over, the subconscious puts together the information and suddenly the patterns leap out.

So now with *Twelve Blue*. Javier, the cardiovascular surgeon, was married to Aurelie, but they were "unmarried" ("Blue mountain," 2_5) when she chose to "run off" ("Run off," 3_8) with her daughter Beth's swim coach, a woman named Lisa, who "didn't do mother" ("Fierce eyes and a mother's fears," 7_8). Nevertheless, Aurelie cannot help associating Beth and Lisa, these apparent antinomies flowing together in her thoughts. Divorced from Aurelie, Javier has fallen in love with Lisle, a Canadian virologist who also has a teenaged daughter, Samantha. Lisle and Samantha live by Wappinger Creek. When a deaf boy drowns in

the creek while his girlfriend, who cannot sign, sits helplessly by on a creekside log, Samantha is the one to find his body as it floats down to her and Lisle's house.

This is the picture that emerges, but as with a random dot image, the picture itself is unremarkable. The interest is rather on the picture's emergence, the mysterious subconscious and unconscious processes that, out of a chaos of seemingly random information, mysteriously assemble a coherent whole. Central to these processes is the flow of images, like streams coming together, joining, separating. Images caress one another by fleetingly touching, sometimes through the juxtapositions created by links, sometimes by sparking a momentary conflagration in a player's receptive mind. An example or two will illustrate the process (although, since the flows are continuous, one or two has a way of modulating into eight or twelve).

One of Lisle's memories from her childhood is of Delores Peters, whose father on impulse bought a carnival ride in which blue cars, like "stubby little shoes" whirl around ("white moths," 4_10). He sets it up in his farmyard and his wife invites her daughter's girlfriends over to play on it. The mother tries to make the occasion festive by making a cake and bringing out a jug of lemonade, which she sets on a tub of ice. As day fades into evening, the ice melts and white moths settle on the dark liquid, some to struggle and escape, others to die ("white moths," 8_10). The farmyard whirly flows into Lisle's memory of the carnival ride on which she whizzes with her carny boyfriend, after which they have furious sex ("Alpine," 5_9); the blue cars flow into the blue leather Mary Janes that she wore as a child, which she remembers carrying her to the parochial school where she was embarrassed to tell the Sister she had her period ("Long time after one," 2_10). Menstrual blood links this memory to her daughter's poetic image of the damp creekside soil smelling like blood, which she narrates to Lisle in a story that has a boy named "Henry Stone" coming to her ("waters of resurrection," 6_6). This pattern flows into the deaf boy's girlfriend, who refuses to join him in the water on the day he drowns because she is having her period. Samantha sees the moon whitely reflected on the dark creek water and imagines it is like a photograph ("Li Po," 6_12); she is startled when the deaf boy's body surfaces in the middle of this image, in a pattern that recalls the white moths struggling on the dark water. Another lexia entitled "white moths" has Lisle explicitly making the connection to the boy's death, thinking "the world was a drum of dark water where we sometimes caught our wings like moths" ("white moths," 7_10).

Like Hofstadter's codelets that have varying degrees of affinities for different letters, the images are constructed to "stick" preferentially to other image-sequences to form larger patterns such as the one discussed

above. Metapatterns emerge through the process of forming analogies between analogies. For example, the associations comprising the Lisle/Samantha group are linked with another group centering on Eleanore and Ed Stanko, connected to Lisle/Samantha through the overlapping character of Javier. Long ago Javier met a woman named Elli in the Blue Ridge Mountains of Virginia and had an affair with her; the woman is (perhaps) Eleanore, who now lives in a seedy hotel-turned-apartment building owned by Ed Stanko, an unremittingly mean and hard man. Eleanore has a shaky grasp on reality (not to put too fine a point on it, she is nutso) and, having long ago lost a baby girl who may (perhaps) be Javier's illegitimate child, somehow blames Ed Stanko for her loss. Luring him into her apartment with the offer of a quickie, she knifes him in the gut while he is in the bathtub, which she afterwards cleans, along with herself, in a strange ritual involving flowers and skins of blood oranges.

The moon-reflection-as-photograph image from the Lisle/Samantha group connects with the photograph of Javier's great-grandmother, Mary Reilly, that he discovers in the lobby of Ed Stanko's ex-hotel, the only image of her known to exist. Through pure meanness Ed Stanko denies even a copy of the image to Javier, who therefore undertakes a pilgrimage with his daughter, Beth, back to the hotel so she can see it. When they arrive, Eleanore (who on Javier's previous stop at the hotel had hitched a ride with him to Roanoke, perhaps to buy the blood oranges she uses in her cleansing ritual) tells him that Ed Stanko is "indisposed," a pattern that flows into the body of the deaf boy, who like Stanko dies in water. The silence in which the deaf boy had lived in turn flows into Eleanore's silence when she is told (presumably by the police) that she has the right to remain silent.

Such play as this has no necessary end, especially when the player accepts the flow as fulfilling desire rather than insisting on the sharper, more focused, but also briefer satisfaction of a climax, no sooner reached than replaced by the legendary sadness of the denouement. Here the pleasure is more diffuse but also longer-lasting, ending only when the player closes the work, knowing that if she were to linger, still more flows could be discovered, more desires evoked and teasingly satisfied. As Anthony Enns points out in his reading of *Twelve Blue*, this work challenges Frank Kermode's criterion for "the sense of a ending" that helps us make sense of the world by establishing a correlation between the finitude of human life and the progression through a beginning, middle, and end characteristic of many print narratives.[24] Here there is no inevitable progress toward the death of the plot. Does that mean *Twelve Blue* fails in the archetypal narrative purpose of establishing a correlation between its sequentiality and human mortality? I would argue rather that *Twelve*

Blue makes a different kind of sense, one in which life and death exist on a continuum with flowing and indeterminate boundaries.

In a lexia representing in free indirect discourse the thoughts of Ed Stanko, the narrator links him with the deaf boy, a character already dead by drowning while the other is soon to meet his death in a bathtub. "No consciousness in the grub or maggot, none in the fallen bird, the grain of wood, the drowned boy. And yet for all of your life you have wondered, redeeming that word: a wonder. . . . Do we live beyond our breath?" ("Wonders never cease," 5_11). The deaf boy becomes a metaphor for the divine in a linked pair of lexias connecting the "minor character" of his girlfriend (whose name we never learn, she being minor in our story, though undoubtedly major in her own) with another young woman marked for life by the drowning of her mother: "Consider the mind of god a drowning boy" ("naiad," 2_11). Deconstructing the boundary between the mindlessness of inanimate objects, the once-mindfulness of the newly dead, and the infinite mind of God, the analogy-between-analogies that emerges from these flows suggests there are no sharp distinctions between the noncognitive, the subcognitive, and the fully cognitive.

In one of the few perceptive interpretations of *Twelve Blue*, Gregory Ulmer relates it to the shift from a novel-based aesthetic to a poetics akin to the lyric poem.[25] He also relates it to a change from literacy to "electracy," arguing that its logic has more in common with the ways in which image and text come together on the Web than to the linearity of alphabetic language bound in a print book. The graphic qualities of the work indeed play a larger role in *Twelve Blue* than in *afternoon*, from the sensuous deep blue background to the interactive threads with their changing spatial orientations. Undoubtedly Ulmer is correct; the publication of *Twelve Blue*, Joyce's first work available on the Web, occurred during the time the Web was exploding from curiosity to daily necessity. The leap from *afternoon* to *Twelve Blue* demonstrates the ways in which the experience of the Web, joining with the subcognitive ground of intelligent machines, provides the inspiration for the intermediating dynamics through which this literary work creates emergent complexity.

Maria Mencia: Transforming the Relation between Sound and Mark

In Maria Mencia's work, the emphasis shifts from the in-mixing of human and machine cognition to reconfigurations possible with digital technologies of the traditional association of the sound with the mark. It was, of course, this association that inaugurated literacy and, in the modern period, became deeply identified with print technology. In

"Methodology," Mencia comments that she is particularly interested in the "exploration of visuality, orality and the semantic/'non semantic' meaning of language."[26] With graduate work in English philology, she is well positioned to explore what happens when the grapheme and phoneme are detached from their customary locations and begin to circulate through digital media into other configurations, other ways of mobilizing conjunctions of marks and sounds. Digitality assists in the process by providing functionalities that enable new conjunctions and unsettle the established conventions of print. With traditional print literature, long habituation causes visuality (perception of the mark) to flow automatically into subvocalization (inaudible sound production), producing the recognition of words (cognitive decoding) that in turn is converted by the "mind's eye" into the reader's impression that the words on the page give way to a scene she can watch as the characters speak, act, and interact.

"Worthy Mouths" demonstrates how Mencia's reconfigurations trouble this process.[27] The video shows a mouth articulating words, but no sound emerges; rather, text phrases flash at a pace too rapid to allow them to be read completely, although not so fast that portions cannot be deciphered (one such phrase, for example, is "lips pushed outwards closed"). By the time the phrase is decoded, the mouth is already forming other words, no sooner pursued than they too are dislocated from the mouth's movements. The effect is both to mobilize the viewer's desire to connect mark with sound and discombobulate it, forcing a disconnect that unhinges our usual assumptions about the connection between sound and mark. In "Audible Writing Experiments,"[28] video projections covered the gallery's four walls, so that the spectator was surrounded by writing and immersed in a soundscape in which a voice articulated English phonemes. The writing quickly became illegible as it proceeded down the space, transforming into wavy lines that forsook their graphemic vocation and instead began to resemble the threads of a woven fabric. Mencia notes that the illegible writing was "quite textural," a phrase that recalls the etymology of "text" as "knitting" or "weaving." Although the connection between text and vocalization remained intact, the visual perception of the mark registered its gradual divorce from phonetic equivalent into purely visual form.

In Mencia's "Things come and go. . . ,"[29] digital projection showed an animated calligramme composed of pieces of paper inscribed with letters moving through the sky, initially legible as a poem about the ongoingness of things as they come into being, change, and go, a process humans resist as they attempt to hold onto them. As the calligramme shifted and reformed into new shapes, the initially coherent phrases of the poem were broken and reconfigured while a computerized voice

articulated the changing configurations. In her documentation of the work, Mencia comments that "the spectator can either love or hate" this voice, or accept it as it moves "from one state to another."[30] We may wonder if her comment about hating the voice reflects feedback from spectators who found the work frustrating because they yearned for the durably inscribed marks of print that have the decency not to mutate while one is reading them.

In "Birds Singing Other Birds' Songs,"[31] a work shown as a video installation and now available as a Flash version on the Web, birds' sounds were transcribed into morphemes representing human perception of their songs and represented as the corresponding graphemes. These graphemes were then animated to form the bodies of birds flying, with human voices, tweaked by the computer, articulating the sounds denoted by the marks. In the complex processes of translation that the work instantiates, the human is in-mixed with nonhuman life forms to create hybrid entities that represent the conjunction of human and nonhuman ways of knowing.[32] The work can also be understood as a reenactment of the history of literacy through different media as it moves from sounds present in the environment to written marks (orality/writing), written marks to the iconographic shapes of the animated avian bodies (writing/digital images), accompanied by the re-representation of human speech as computerized voice production (digital multimodality).

The ways in which Mencia's works go in search of meaning create analogies between human and nonhuman cognizers on the one hand, and, on the other, analogies between different media transformations. The analogy-between-analogies suggests that media transformations are like the dynamic interchanges between different kinds of cognizers, thus revealing a deep structure of intermediation that encompasses the history of media forms as well as the emergent complexities of interactions between humans, animals, and networked and programmable machines. Although Mencia's works can be classified as electronic literature, they are fundamentally about literacy as such rather than any given literary form. Reenacting media transformations and the conditions that make literacy possible, they are appropriate complements to the comparison between the print-inflected aesthetic of *afternoon* and the "electracy" of *Twelve Blue*.

Rupturing the Page: *The Jew's Daughter*

Judd Morrissey's *The Jew's Daughter*, like the works discussed above, both references the print page and profoundly alters its dynamics.[33] In an interview with Matthew Mirapaul, Morrissey commented that because

The Jew's Daughter "takes the paradigm of the page, you can see that it's not a page."[34] The entire work exists as a single screen of text. Reinforcing the page metaphor is a small box at the upper right corner, which when clicked indicates the current screen's number as well as a box in which the player can type to indicate what screenic text (as indicated by "page" number) should come up next. Within the screen text, a few letters (from part of a word to a sentence or two) appear in blue, seeming to reference the clickable links pervasive on the Web. The blue letters are not links in the conventional sense, however, but rather screen locations of mouseovers. When the player mouses over the blue letters, some part of the text, moving faster than the eye can catch, is replaced. Reading thus necessarily proceeds as rereading and remembering, for to locate the new portion of the page, the reader must recall the screen's previous instantiation while scanning to identify the new portion, the injection of which creates a new context for the remaining text.

For example, the beginning screen narrative is focalized through the young male writer and student whose voice is the predominant, though not the only, narrator for the text.

> I wrote to you that it would not be forgivable, that it would be a violation of our exchange, in fact, a criminal negligence were I to fail to come through. To hand to you the consecrated sum of your gifts, the secret you imparted persistently and without knowledge, these expressions of your will that lured, and, in a cumulative fashion, became a message. In any case, the way things worked. Stops and starts, overburdened nerves, cowardice (Is this what they said?), inadequacy, and as a last resort, an inexplicable refusal. You asked could I build you from a pile of anonymous limbs and parts. I rarely slept and repeatedly during the night, when the moon was in my window, I had a vision of dirt and rocks being poured over my chest by the silver spade of a shovel. And then I would wake up with everything. It was all there like icons contained in a sphere and beginning to fuse together. When I tried to look at it, my eyes burned until I could almost see it in the room like a spectral yellow fire.
>
> A street, a house, a room. (*JD* 1)

Mousing over "criminal," the word in blue, changes the text to this:

> To hand to you the consecrated sum of your gifts, the secret you imparted persistently. June through clouds like sculpted snow demons. My fortune had said, you are about to cross the great waters. But how, now, to begin? After stops and starts, overburdened nerves, cowardice, inadequacy, inexplicable refusal, after everything, she is still here, dreaming just outside the door, her affirmed flesh beached in bed as the windows begin to turn blue. And what can now be said about this sleeping remainder? Her face is a pale round moon. She had a vision of dirt and rocks being poured over my chest by the silver shape of a shovel. (*JD* 2)

While in the first screen the "I" who has a "vision of dirt and rocks" is the male writer, in the new context the pronoun shifts to "she," his lover and girlfriend who is sometimes called Eva. The shifting antecedents are embedded within intertextual allusions that recall Shelley Jackson's *Patchwork Girl*, in which the female creature from Mary Shelley's *Frankenstein* is reassembled to become the principal narrator, as well as the original *Frankenstein*, with its allusions to graveyard robbing to obtain body parts. The play here between the male and female characters sets up an ambiguity similar to that instantiated in *Patchwork Girl*, where the female creature displaces the male scientist as the focalizer. Also resonating through the passage is the "spectral yellow moon," an image that recalls the "dull yellow eye" of the male creature that Victor sees open in *Frankenstein* (in chapter 5), a detail Jackson repeats in *Patchwork Girl*. In the second screen, however, the "pale round moon" of her sleeping face becomes a second source of light competing with the "spectral yellow fire" representing the emergent realization the male writer can almost, but not quite, achieve. This gesture toward some looming synthesis evoked only to be postponed is the work's central dynamic, instantiated both in its thematics and functionalities. As each screen modulates into the next, the pattern of overlapping repetition and innovation propels the text forward through a series of disjunctions and connections, as if it were perpetually in process, driving us toward a synthesis inevitably delayed as the text transforms once again.

In the interview with Mirapaul, Morrissey commented that in conceptualizing *The Jew's Daughter*, "I wanted a fluidity that I haven't seen in hypertext." The fluidity is indeed there, but so are ruptures and discontinuities created by disjunctive syntax and wrenched contexts. The effect is significantly different from the "stream of consciousness" associated with modernist texts, including the work alluded to by Morrissey's title, James Joyce's *Ulysses*.[35] In chapter 17 ("Ithaca") of *Ulysses*, the anti-Semitic ballad "The Jew's Daughter" appears during the course of a conversation Bloom and Stephen have in the kitchen after Bloom has invited Stephen home. Unlike the shifting pronouns and sliding antecedents of Morrissey's work, chapter 17 takes the form, unique in *Ulysses*, of an ultrarational catechism in which an interlocutor asks questions and another voice answers using the "objective" language of the "view from nowhere."[36] To visualize the scene, readers are forced to translate from the style's pretentious objectivism back into the language of everyday perceptions. Whereas *The Jew's Daughter* has an excess of "stickiness" that facilitates ambiguities and multiple syntactic combinations, the *Ulysses* chapter performs the opposite extreme, articulating facts with a pseudoprecision associated with the scientistic goal of eliminating ambiguity altogether.

The "stickiness" of phrases that can ambiguously attach to different sentences and phrases also enacts a difference between modernist "stream

of consciousness" and the kind of awareness represented in *The Jew's Daughter*. As Molly Bloom's final passage illustrates, stream of consciousness narration usually proceeds as a continuous flow of ideas, images, and language. In *The Jew's Daughter*, by contrast, narration is both belated and premature, early and late. Consider the following sequence. "Words are always only words, but these waiting words pause, are cautious, self-aware; know that what is said determines what is has been and will be, what has already not yet happened, what losses are taken and who gets what" (*JD* 7). This morphs to "Words are always only real-time creation, realized under the pressure of days, just as this once should have been realized under the pressure of days. Incipit. Three knocks" (*JD* 8), which morphs to "The fog-breath of the carriage horse on Michigan Avenue would rise impenetrably to obscure the city. Real-time creation, realized under the pressure of days, just as it once should have been realized under the pressure of days. Incipit. Three knocks" (*JD* 9). "Real-time creation" makes sense in the context of the fog-breath rising, but in the earlier context of *words* as "real-time creation" makes less sense, especially when one thinks of words as inscriptions that linger. Similarly, the comparison "just as *this* once should have been realized under the pressure of days" can be taken to refer to the present text's composition, but, when transposed into the next screen's context, results in a puzzling repetition as the relative pronoun mutates to the third-person singular pronoun: "Real-time creation, realized under the pressure of days, just as it once should have been realized under the pressure of days." As the phrase "what has already not yet happened" suggests, temporality has become fractally complex, no longer a uniform progression but a complex formation in which different strata overlap, diverge, and move with different tempos. This temporal complexity is reflected at the narrative level by the disjunctions, sometimes slight and other times more radical, that signal breaks in the text where a passage has inserted itself before its proper context or lingered after its conjoining phrases have mutated into something else. Taken as a representation of consciousness, the kind of awareness performed here is not a continuous coherent stream but rather multilayered shifting strata dynamically in motion relative to one another.

This kind of interaction is very similar to the "Multiple Drafts Model" that Daniel C. Dennett, in *Consciousness Explained*, argues best explains the nature of consciousness.[37] Dennett proposes that consciousness is not the manifestation of a single coherent self synthesizing different inputs (characterized as the Cartesian Theater, the stage upon which representations are played out and viewed by a central self); rather, interacting brain processes, operating with varying temporal dynamics and different neural/perceptional inputs, *are* consciousness. In Dennett's

model, time is represented by and instantiated in distributed brain processes and neural locations; as a result, perceived time is emergent rather than given, constantly modulating according to which processes and locations are dominant at a given instant. To explain the subjective impression of possessing a central self, Dennett argues that the self is not synonymous with consciousness as such. Rather, the illusion of self is created through an internal monologue that does not so much issue from a central self as give the impression a central self exists. Thus narrative, the emergent result from different processes interacting, sutures together discontinuities in time, location, differential inputs, and diverse perceptions to create a single stream of storytelling that tries to make sense and create coherence.

Seen in this perspective, *The Jew's Daughter* recapitulates the temporal and spatial discontinuities constitutive of consciousness through the (inter)mediation of computer software and hardware. The computer, programmed by the writer and designer, reveals to the human player the mechanisms whereby her interior monologue is (mis)taken as the production of a coherent self. The visual interface presenting itself as a print page can then be understood as a simulacrum in multiple senses. Possessing a fluidity and mutability that ink durably impressed on paper can never achieve, it simulates the illusion of a coherent stream-of-consciousness narrative (and by implication, a coherent self producing the narrative) while also making visible the temporal discontinuities, spatial dislocations, and narrative ruptures that subvert the premises underlying traditional ideas about consciousness, thereby pointing toward another model of consciousness altogether. Consciousness in this view is disjunctive, emergent, dynamic, and temporally stratified, created through local interactions between diverse agents/processes that together create the illusion of a continuous coherent self.

That the computer is intimately involved in the performance of this simulation is not coincidental, for similar fragmented, subcognitive processes take place within it, a mechanism that remains innocent of the experience of consciousness. Without knowing anything about *The Jew's Daughter*, Dennett sets up the comparison between human and machine cognition by likening the subcognitive agents from which consciousness emerges, and the even simpler processes that underlie them, to mechanical programs that could theoretically be duplicated in a computer.[38] This move enables us to give an account of *The Jew's Daughter* in terms that combine the computer's operation with the human player's cognitions. In the intermediating cycle as it occurs in *The Jew's Daughter*, mechanical computational processes perform a simulacrum of a narrative traditionally understood as the production of consciousness, thereby stimulating in the player subcognitive processes that dynamically

produce consciousness as the emergent result, which in turn results in the player's mouseovers that, processed by the computer, perform the ruptures and discontinuities gesturing toward the emergent nature of the narrative and the consciousness with which it is associated, both within the diegesis and within the player herself.

"The Error Engine," a collaborative work coauthored by Judd Morrissey, Lori Talley, and computer scientist Lutz Hamel, carries the implications of *The Jew's Daughter* to the next level by functioning as an adaptive narrative engine that initiates a coevolutionary dynamic between writer, machine, and player. In "Automatic Narrative Evolution: A White Paper," Hamel, Morrissey, and Talley explain how the program works.[39] Each narrative node—that is, each textual passage—is assigned a list of keywords that may or may not appear explicitly but in any event reflect the node's thematics. In response to the player's selection of a given word in the screen text, the engine searches for the node whose keyword list most closely matches that choice and presents it as the next screen of text. The algorithm differs from a traditional link coded in html as <href> in that the link is not hardwired but rather chosen from a pool of possible candidates. In the next instantiation of the program, not yet implemented, the authors envision an algorithm whose selection criteria can itself evolve in relation to the player's choices. Such a program would deserve to be called a genetic algorithm, a complex adaptive system in which the user's choices and the algorithm responding to those choices coevolve together. Whether the present implementation is truly evolutionary may be debatable, but clearly the authors envision evolutionary computing as the appropriate context in which to understand their work.[40] In this sense, intermediating dynamics, whereby recursive feedback loops operate through the differently embodied entities of the computer and human, become an explicit part of the work's design, performance, and interpretation. Adaptive coevolution implies that real biological changes take place in the player's neuronal structure that result in emergent complexity, expressed as a growing understanding of the work's dynamics, thematics, and functional capabilities; these in turn change and evolve in interaction with the player's choices.

At this point readers who grew up with print and remain immersed in print aesthetics may object that this is merely a fancy way to say what literary criticism has said for a very long time—that literature functions as a technology designed to change the cognitions of readers. Certainly print literature changes a reader's perceptions, but the loop is not closed because the words on the page do not literally change in response to the user's perceptions. The new component possible with networked and programmable media is the cycle's completion, so that the feedback loops run in both directions, from the computer to the player and from the

player to the computer. A perspective that takes this fully into account requires understanding the computer's processes and procedures, its possibilities, limitations, and functionalities as a subcognitive agent, as well as its operations within networked and programmable media considered as distributed cognitive systems. The danger in applying critical models developed for print is that the new possibilities opened for literary creation and interpretation will simply not be seen. Whatever limitations intermediation as a theory may have, its virtue as a critical framework is that it introduces computation into the picture at a fundamental level, making it not an optional add-on but a foundational premise from which to launch further interrogation.[41]

The implications of intermediation for contemporary literature are not limited to works of electronic literature but extend to contemporary print literature and indeed to literary criticism as a whole. They include the inmixing of human and machine cognition; the reimagining of the literary work as an instrument to be played, where the textual dynamics guide the player to increased interpretive and functional skills; deconstruction of the relation between sound and mark and its rearticulation within environments in which language and code are in active interplay; the rupture of narrative and the consequent reimagining and re-presentation of consciousness not as a continuous stream but as the emergent result of local interactions between various neural processes and subcognitive agents, both biological and mechanical; the deconstruction of temporality and its reconstruction as an emergent phenomena arising from multiagent interactions; and the performance of an adaptive coevolution cycling between humans and intelligent machines envisioned as cognizers embodied in different media at different levels of complexity.

The urgent challenge digital textuality presents for criticism is to reenvision and rearticulate legacy concepts in terms appropriate to the dynamics of networked and programmable media.[42] No less than print literature, literary criticism is affected because digital media are increasingly essential to it, limited not just to the word processing but also the ways in which critics now access legacy works through digital archives, electronic editions, hypermedia reinstantiations, and so forth. Critical production is affected as online journals such as *Vectors* offer publishing venues for the development and dissemination of multimedia criticism—that is, criticism that is not just about multimedia works but itself uses the capabilities and functionalities of multimedia as essential components of interpretation and analysis.[43] The validation and review procedures of print criticism are also under revision, for example in the project sponsored by the Institute for the Future of the Book to reimagine how publication protocols should change for digital media.[44] These developments imply that critics, no less than writers, are increasingly

involved with computation-intensive environments. Given as a truism that the technology one uses affects not only *how* work is produced but *what* is produced, the critical self-reflection that linked, for example, grammatological theory with changed modes of writing and thinking should result in further transformations that link computational theory with new ways of critical thinking, writing, and creating.

Literature, conceptualized not just as print books but as the entire complex system of literary production that includes writers, editors, publishers, critics, designers, programmers, booksellers, readers, players, teachers, copyright laws and other legal formations, Web sites and other electronic dissemination mechanisms, and the technologies that enable and instantiate all of the above, is permeated at every level by computation. The belletristic tradition that has on occasion envisioned computers as the soulless other to the humanistic expressivity of literature could not be more mistaken. Contemporary literature *is* computational.

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NOTES

1 Mark Danielewski, *House of Leaves* (New York: Doubleday, 2000); Jonathan Safran Foer, *Extremely Loud and Incredibly Close* (New York: Houghton Mifflin, 2005); Salvador Plascencia, *The People of Paper* (San Francisco: McSweeney's, 2005).

2 The field of electronic literature has recently been attracting much excellent criticism attentive to the media specificity of computational media. These include David Ciccoricco, *Reading Network Fiction* (Tuscaloosa: University of Alabama Press, forthcoming); Mark B. N. Hansen, *New Philosophy for New Media* (Cambridge, MA: MIT Press, 2004); Matthew Kirschenbaum, *Mechanisms: New Media and Forensic Textuality* (Cambridge, MA: MIT Press, forthcoming); Alan Liu, *The Laws of Cool: Knowledge Work and the Culture of Information* (Chicago: University of Chicago Press, 2004); Adalaide Morris and Thomas Swiss, eds., *New Media Poetics: Contexts, Technotexts, and Theories* (Cambridge, MA: MIT Press, 2006); Jessica Pressman, *Digital Modernism: Making It New in New Media* (PhD diss., University of California—Los Angeles, 2007); and Marie-Laure Ryan, *Avatars of Story* (Minneapolis: University of Minnesota Press, 2006).

3 Stephen Wolfram, *A New Kind of Science* (New York: Wolfram Media, 2002).

4 Nicholas Gessler, "Evolving Artificial Cultural Things-That-Think and Work by Dynamical Hierarchical Synthesis," http://www.sscnet.ucla.edu/geog/gessler/cv-pubs/03naacsos.pdf.

5 Harold J. Morowitz, *The Emergence of Everything: How the World Became Complex* (New York: Oxford University Press, 2002).

6 "Generation M: Media in the Lives of 8–18 Year-Olds," Kaiser Family Foundation, http://www.kff.org/entmedia/entmedia030905pkg.cfm.

7 See, for example, André Leroi-Gourhan, *Gesture and Speech* (Cambridge, MA: MIT Press, 1993).

8 This argument has been published in various forms; see, for example, John R. Searle, "Is the Brain's Mind a Computer Program?" *Scientific American* January 1990, 26–31.

9 Douglas Hofstadter, *Fluid Concepts and Creative Analogies: Computer Models of the Fundamental Mechanisms of Thought* (New York: Basic Books, 1995).

10 For a description of the Eliza program, see Joseph Weizenbaum, *Computer Power and Human Reason: From Judgment to Calculation* (New York: Freeman, 1976).

11 Jorge Luis Borges, "The Book of Sand," in *Collected Fictions*, trans. Andrew Hurley (New York: Penguin Books, 1999), 480–83.

12 It is no accident, then, that several electronic works inspired by "The Book of Sand" have been created; see, for example, Maximus Clarke for an interactive game based on Borges's work, "The Book of Sand: A Hypertext/Puzzle," http://artificeeterrnity.com/bookofsand; and Giselle Beiguelman, "the book after the book/o livro depois do livro," http://www.desvirtual.com/giselle.

13 See, for example, Loss Pequeño Glazier, *White-Faced Bromeliads on 20 Hectares*, http://epc.buffalo.edu/authors/glazier/java/costal1/00.html, and Emily Short, *Galatea*, http://www.mindspring.com/~emshort/galatea.htm. Both works can also be found in the *Electronic Literature Collection*, vol. 1, ed. N. Katherine Hayles, Nick Montfort, Scott Rettberg, and Stephanie Strickland, http://collection.eliterature.org.

14 N. Katherine Hayles, *My Mother Was a Computer: Digital Subjects and Literary Texts* (Chicago: University of Chicago Press, 2005).

15 Michael Joyce, *afternoon, a story* (Watertown, MA: Eastgate Systems, 1990).

16 Joyce, *Twelve Blue* (1991), http://www.eastgate.com/TwelveBlue/. Although *afternoon, a story* has a publication date from Eastgate of 1990, Joyce was circulating copies of it at conferences as early as 1987. It is reasonable to assume, then, that something like four years separates the composition of the two works. Matthew Kirschenbaum in "Save As: Michael Joyce's *afternoons*," in *Mechanisms*, gives a detailed account of the different versions.

17 Particularly influential is Jane Yellowlees Douglas, "'How Do I Stop This Thing?': Closure and Indeterminacy in Interactive Narratives," in *Hyper/Text/Theory*, ed. George P. Landow (Baltimore: Johns Hopkins University Press, 1994), 159–88; Jay David Bolter, *Writing Space: The Computer, Hypertext, and the History of Writing* (Hillsdale, NJ: Erlbaum Associates, 1991), 123–28; and Jill Walker, "Piecing together and tearing apart: finding the story in afternoon," ACM Hypertext Conference (1999), http://jilltxt.net/txt/afternoon.html.

18 Robert Coover, "The Elevator" and "The Babysitter," in *Pricksongs and Descants: Fictions* (1970; New York: Grove Press, 2000), 125–37, 206–39.

19 Noah Wardrip-Fruin, "Playable Media and Textual Instruments," in *dichtung-digital* (2005), http://www.brown.edu/Research/dichtung-digital/2005/1/Wardrip-Fruin, has an eloquent exposition of what it implies to consider a digital work as an instrument that can be played rather than simply a text to read; arguments such as his have bestowed added resonance on "player" as the term of choice for one who interacts with a digital work that has playable characteristics.

20 "Riddle," 8_4. The lexias of *Twelve Blue* are named, but occasionally two different lexias share the same name. Confusion can be avoided by also citing the numbers displayed in the URL, which indicate the thread and bar numbers, in that order, as indicated in the above citation (hereafter cited in text by lexia, thread, and bar number when appropriate).

21 William H. Gass, *On Being Blue: A Philosophical Inquiry* (Boston: David R. Godine, 1991), 7.

22 Vannevar Bush, "As We May Think," *The Atlantic Monthly*, July 1945, 101–8.

23 "Attack" here is an allusion to Marie-Laure Ryan's aggressive reading of *Twelve Blue* in *Narrative as Virtual Reality: Immersion and Interactivity in Literature and Electronic Media* (Baltimore, MD: Johns Hopkins University Press, 2003), where she comments, "The attitude with which I initially attacked the text—and I mean *attack* to be taken in its full force—had much in common with the frame of mind of the player of a computer game or the reader of a mystery novel. I was determined to 'beat the text' by figuring out what the system of links and the multiple ambiguities were designed to hide from me" (238).

Her "quest for coherence" (226) and signature critical strategy of classifying texts through typologies are clearly at odds with the text's aesthetic, so that she finds the text's effect "is that of an amnesiac mind that desperately tries to grasp some chains of association but cannot hold on to them long enough to recapture a coherent picture of the past" (229), which is about as far from my own sense of the text as one could get. Nevertheless, she is too fine (and determined) a reader not to unearth many of the text's connections, and her reading is accurate and nuanced as far as it goes.

24 Anthony Enns, "Don't Believe the Hype: Rereading Michael Joyce's *Afternoon* and *Twelve Blue*," *Currents in Electronic Literacy* (Fall 2001), *http://www.cwrl.utexas.edu/currents/fall01/enns/enns.html*; Frank Kermode, *The Sense of an Ending* (New York: Oxford University Press, 1968).

25 Gregory L. Ulmer, "A Response to *Twelve Blue* by Michael Joyce," *Postmodern Culture* 5, no. 1 (1997), http://muse.jhu.edu/journals/postmodern_culture/toc/pmc8.1.html.

26 Maria Mencia, "Methodology," a brief explanation of the inspiration for her doctoral dissertation, "From Visual Poetry to Digital Art: Image-Sound-Text, convergent media and the development of new media languages" (2003), www.m.mencia.freeuk.com/Methodology.html.

27 Mencia, "Worthy Mouths" (n.d.), http://www.m.mencia.freeuk.com/WorthyMouths.swf.

28 Mencia, "Audible Writing Experiments" (2004), www.m.mencia.freeuk.com/AWE.html.

29 Mencia, "Things come and go . . ." (1999), documentation at http://www.m.mencia.freeuk.com/video2.html.

30 Mencia, "Things come and go . . ." http://www.m.mencia.freeuk.com/video2.html.

31 Mencia, "Birds Singing Other Birds' Songs," Flash version in *Electronic Literature Collection*, vol. 1, ed. Hayles and others; documentation of the video version (2001) at http://www.m.mencia.freeuk.com/birds.html.

32 Lori Emerson, in "Numbered Space and Topographic Writing," *Leonardo Electronic Almanac* 14.5–6 (2006), http://leoalmanac.org/journal/Vol_14/lea_v14_n05-06/Lemerson.asp, engages similar questions to the ones articulated here, asking "at what point . . . does digital poetry cross a threshold and break away from book-bound concerns, thereby also breaking away from the ways in which we normally account for texts?" (2). She rightly cautions that print poetry has also been concerned with movement, urging us not to extrapolate to digital poetry as the simple fulfillment of its teleology. To make the point, she instances Mencia's *Birds Singing Other Birds' Songs*; she finds that it "does not go beyond a transposition of book-bound concerns . . . neither does it demonstrate what the [digital] medium allows." I suggest that this reading, with its emphasis on spatiality, does not fully take into account the sophisticated translation processes discussed above and thus misses the play between different forms of cognition.

33 Judd Morrissey, *The Jew's Daughter*, http://www.thejewsdaughter.com (hereafter cited in text as *JD*). The credits specify that the work was "programmed and crafted by the author," Judd Morrissey, and that the "mechanics of reconfiguration [were] designed in collaboration with Lori Talley."

34 Matthew Mirapaul, "Pushing Hypertext in New Directions," *New York Times*, July 27, 2000, cited in *The New York Times on the Web*, http://partners.nytimes.com/library/tech/00/07/cyber/artsatlarge/27artsatlarge.html.

35 James Joyce, *Ulysses* (New York: Vintage, 1990), 666–722. Pressman analyzes the relation between *Ulysses* and *The Jew's Daughter* in "*The Jew's Daughter*: Remediating, Remembering, and Rereading," in *Digital Modernism*, 205–64. Ciccoricco also has a fine detailed reading of the work, including its relation to *Ulysses*, in "Mythology Proceeding: Morrissey's *The Jew's Daughter*," in *Reading Network Fiction*.

36 Thomas Nagel, in *The View from Nowhere* (New York: Oxford University Press, 1989), popularized the phrase as representative of scientific objectivism, a position that was subsequently heavily criticized in science studies, for example, by Donna Haraway in "Situated Knowledge: The Science Question in Feminism as a Site of Discourse on the Privilege of Partial Perspective," *Feminist Studies* 14, no. 3 (1988): 575–99.

37 Daniel C. Dennett, *Consciousness Explained* (New York: Little, Brown, 1991).

38 Dennett comments that "as long as your *homunculi* [the neural processes that he likens to "hordes of demons"] are more stupid and ignorant than the intelligent agent they compose, the nesting of homunculi within homunculi can be finite, bottoming out, eventually, with agents so unimpressive that they can be replaced by machines." Dennett, "Are We Explaining Consciousness Yet?" *Cognition* 79 (2001): 225.

39 Lutz Hamel, Judd Morrissey, and Lori Talley, "Automatic Narrative Evolution: A White Paper," http://www.errorengine.org/ane-white-paper.pdf.

40 Evolutionary coadaptation is also the point for a fantastic interactive book described in Neal Stephenson's *The Diamond Age: Or, a Young Lady's Illustrated Primer* (New York: Bantam, 1996), 84–86 and passim. The *Primer* has the ability to sense the environment and Nell's reaction, changing its pages and stories to fit her situation. It serves as her tutor, reengineering her neural responses in definitive ways as she matures. For example, in her first encounter with the *Primer*, Nell corrects her name, in response to which "a tiny disturbance propagated through the grid of letters on the facing page" (84), a description that could well be applied to *The Jew's Daughter* during a mouseover.

41 Intermediation is, of course, not the only theoretical framework available. Influential contributions include: from film studies, Lev Manovich's "five principles of New Media" in *The Language of New Media* (Cambridge, MA: MIT Press, 2002); from game studies, Espen Aarseth's functionalist cybertheory as "textology" in *Cybertext: Perspectives on Ergodic Literature* (Baltimore: Johns Hopkins University Press, 1997); from media theory, Friedrich A. Kittler's *Discourse Networks 1800/1900*, trans. Michael Matteer (Stanford, CA: Stanford University Press, 1992) and *Gramophone, Film, Typewriter* (Stanford, CA: Stanford University Press, 1999); and from phenomenology/embodiment theory, Mark B. N. Hansen's *New Philosophy for New Media* (Cambridge, MA: MIT Press, 2006).

42 A strong example is provided by Markku Eskelinen, using Espen Aarseth's cybertext to rethink narratology, "Six Problems in Search of a Solution: The Challenge of Cybertext Theory and Ludology to Literary Theory," in *dichtung-digital* (2004), http://www.dichtung-digital.com/2004.3/Eskelinen/index.htm.

43 *Vectors: Journal of Culture and Technology in a Dynamic Vernacular*, http://vectors.iml.annenberg.edu/.

44 Bob Stein, Institute for the Future of the Book, http://www.annenberg.edu/projects/project.php?id=84.

developed the concept of generative anthropology and has written five other books on the subject, including *Originary Thinking* (1993), *Signs of Paradox* (1997), and the forthcoming *The Scenic Imagination: Originary Thinking from Hobbes to the Present Day.*

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- *Intermediation: The Pursuit of a Vision*
  [Access article in HTML] [Access article in PDF]
  Subject Headings:
  - Literature.

  Abstract:

  Twenty-first century literature is computational, from electronic works to print books created as digital files and printed by digital presses. To create an appropriate theoretical framework, the concept of *intermediation*is proposed, in which recursive feedback loops join human and digital cognizers to create emergent complexity. To illustrate, Michael Joyce's *afternoon*is compared and contrasted with his later Web work, *Twelve Blue*. Whereas *afternoon*has an aesthetic and interface that recall print practices, *Twelve Blue*takes its inspiration from the fluid exchanges of the Web. *Twelve Blue*instantiates intermediation by creating coherence not through linear sequences but by recursively cycling between associated images. Intermediation is further explored through Maria Mencia's digital art work and Judd Morrissey's *The Jew's Daughter*and its successor piece, *The Error Engine*, by Morrissey, Lori Talley, and Lutz Hamel.

Cochran, Terry, 1955-

- *The Knowing of Literature*
  [Access article in HTML] [Access article in PDF]
  Subject Headings:
  - Literature.
  - Knowledge, Theory of.

  Abstract:

  In this essay, I consider the relationship between literature and knowing. In pursuing this reflection, I underscore the way in which historical understanding, as the basis for the organization of knowledge in the human sciences, restricts the epistemological import of the literary. In distinction with this prevailing historical model of literary discourse, I elaborate an understanding of literature – viewed as imaginary projection or idealized discourse – that places in the foreground its necessary role in thinking.

Swearingen, C. Jan.

- *What Is the Text? Who Is the Reader? A Meditation on Meanderings of Meaning*
  [Access article in HTML] [Access article in PDF]
  Subject Headings:
  - Literature.
  - Authors and readers.

  Abstract:

  The displacement of literature by culture and ideology as the primary texts studied in many English departments has brought with it new practices of reading. Alongside and sometimes instead of literary works, "the text" and its

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