

MARC DAVIS

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info@marcdavis.me

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Marc Davis

**School of Information Management and Systems, University of California at
Berkeley
Berkeley, CA USA**

Michael Travers

**Afferent Systems, Inc.
San Francisco, CA USA**

Introduction

In the fall of 1990 at the MIT Media Laboratory, we started a weekly, student-run reading group to explore topics at the intersection of artificial intelligence and literary theory. The group, which we named Narrative Intelligence (NI), quickly took on a life of its own and became a forum in which ideas from philosophy, media theory, and psychology could combine with current research in computational theories of mind and media. Meeting in the basement of the MIT Media Laboratory (so we were both literally and figuratively underground), the group grew to include a local membership of students and faculty from the Media Lab, other MIT departments, Harvard University, and Brown University. The group's mailing list included a large cadre of remote members including luminaries in the fields of human computer interaction, artificial intelligence, and film analysis. Narrative Intelligence became a vital hotbed of interdisciplinary thinking and exploration for its members. It brought together humanists and engineers in the creation of a new cross-disciplinary activity connecting insights from artificial intelligence, media studies, and human computer interaction design. What started out as an attempt to create common ground between two Media Lab students eventually influenced the culture and curriculum of the Media Lab and MIT through the students and faculty that participated in this unofficial, multi-year, interdisciplinary seminar. In this article we describe the formation of the Narrative Intelligence Reading Group, its goals, the core texts and issues it engaged with, reflect on lessons learned, and talk about the future of narrative intelligence.

Formation of the NI Reading Group

In 1990, two graduate students at the MIT Media Lab were trying to talk with each other about topics that seemed of common interest. One, a humanist new to computing (Marc), wanted to build programs that could automatically assemble short movies from archives of video data. The other, a computer scientist with an interest in literary theory (Mike), wanted to program software agents that could understand a simulated world, each other, and themselves. What they found was that while their areas of interest seemed to have common issues (narrative theory and comprehension, knowledge representation, story understanding and generation, and user interface design), the discourse each used to talk about these areas was largely unintelligible to the other. Even such core ideas as "representation," "language," and "communication" meant different things to each of them. Rather than throw up their hands, they wagered that if they could get each other to read the core texts in their respective disciplines, they might be able to construct a common language and a useful discourse. Together with a group of Media Lab students they formed the Narrative Intelligence Reading Group (NI) that met weekly in the basement of the Media Lab building for six years. From 1990 – 1993, Marc Davis, Mike Travers, and Amy Bruckman actively led and facilitated the group, from 1994 – 1996, Amy Bruckman and Warren Sack continued the group for another three years. From 1997 to the present, the Narrative Intelligence Reading Group has functioned as a mailing list and resource for its members and others interested in its topics (ni@media.mit.edu).

Motivations for a New Interdisciplinary Discourse

As early graduate students in the Media Lab, we were faced with trying to synthesize an intellectual framework in which we could situate our work. The desire of the founders and early members of NI to create a common discourse and practice connecting artificial intelligence and literary theory also stemmed from a growing frustration with the limits of our respective disciplines in their ability to inform the analysis, design, and construction of computational media.

In artificial intelligence (AI) we encountered a discipline founded on logicist, formalist, and objectivist conceptions of language, cognition, and computation. Alternative approaches to AI included connectionism and situated action, but

both of these schools lacked a coherent theory of representation. Furthermore, existing theories of representation in AI reflected a bias toward understanding representation as based only on textual, logical, or mathematical constructs, and as such, did not offer useful models for thinking about non-textual media. Within the scope of AI and cognitive science, important steps toward a theory of cognition and representation informed by narrative theory had been made by Roger Schank and his students, by George Lakoff and Mark Johnson, and by Phil Agre's work on writing and representation. The analysis and extension of these texts was a key part of our mutual education in NI.

In literary theory, including post-structuralist, semiotic, and reader-response approaches, we found a discipline that had undergone radical transformation and creative growth since the 1960s, but which had been largely oblivious to, and uninfluenced by, both the theoretical roots of computation in the early part of the century and the theoretical implications of the massive changes in communications occurring as a result of the exponential growth of computational technology in the last 20 years. The challenge of literary theory was also that while it provided us with a powerful set of analytical tools (e.g., Saussurean linguistics, semiotics, reception aesthetics, deconstructionism), it offered no guidelines as to how to use them to synthesize and construct computational media informed by that analysis. Beginning with such theorists as Wolfgang Iser and Roland Barthes, we found frameworks we would appropriate for rethinking AI's traditional conceptions of meaning, agency, comprehension, and language.

Crossing Disciplinary Boundaries: Learning How To Talk With Each Other

Some of the greatest challenges we faced were in making explicit our implicit disciplinary assumptions and practices. This had far reaching and recurring implications for our attempt to read and discuss texts together. On the most basic level there were a host of terms and concepts that were unfamiliar to different members of the group. By reading the core and crossover texts in our disciplines we set out to understand each other's language. But the disciplinary differences were not only terminological: the standards and practices for what constituted acceptable talking, reading, writing, analysis, presentation, and production (texts and artifacts) were all quite different. Here is a somewhat caricatured, but useful breakdown of the differences:

TASK	LITERARY THEORIST	COMPUTER SCIENTIST
Read Natural Language Texts	Close analysis of style, rhetorical structure, and implicit meanings to generate an interpretation.	Quick extraction of core concepts and utility of text to generate an instrumentalizable understanding. Style and other explicit rhetorical structures are devalued.
Read Programming Language Texts	No existing practice (this is an enormous oversight of the humanities)	Develop detailed understanding of how the text works so its parts can be appropriated for new text production
Write Natural Language Texts	This is the primary form of text production. Texts are most often analyses of other texts. This writing employs deliberate use of rhetorical devices to persuade the reader. Stylistic innovation is rewarded.	This is a secondary form of text production. Texts are most often analyses and documentation of programs. This writing employs unconscious use of rhetorical devices to persuade the reader. Stylistic innovation is discouraged.
Write Programming Language Texts	No existing practice (programs are texts which can generate texts – they are the realization of post-structuralism's dream of the autonomous self-replicating text, yet literary theorists do not study or write programs)	This is the primary form of text production. This form of writing creates machines, and, in some cases, machines which can make machines.
Discussing and Presenting Work	Speech as a rhetorical art form (the speech is itself an artifact). Innovation, complexity, elegance, and cleverness are valued. Complex texts are read from paper.	Speech as an instrumental means to facilitate the creation of artifacts. Simplicity, lack of ornament, and perspicacity are valued. Present simple slides and a demonstration of the work. Talk is improvised based on slides.

Table 1: Differences in practice between literary theorists and computer scientists

We encountered these differences time and again, and learned to recognize, understand, and even engage in each other's different practices. The structure of the group helped in this process. The Narrative Intelligence Reading Group was student-initiated and student-run, so it had no curricular or departmental guidelines to adhere to. Each semester its members would meet to establish the schedule. Within the loose framework of the group's goals, members would suggest texts to read that they would be willing to lead sessions on, then the group would collectively decide on the semester's syllabus and schedule. The group met once a week in the evening, for two hours or longer. Meetings usually had about 15 participants made up of a core group of roughly 12 people who went to most all meetings and a few people drawn from a pool of about 20 other members. Presenters would usually summarize the text, offer questions and frame issues, facilitate the discussion, and then close the discussion with a summary and look ahead to the next week. The schedule and syllabus were flexible and responsive to the needs of the group and the topics it covered. Based on the outcome of a session, we could elect to reorder the schedule, add new texts, or stay with a text for another session. The discussions were lively, multilevel, challenging, and compassionate. No question was too dumb (since most of us were novices outside our core fields), no answer too sacrosanct not to be challenged, questioned, analyzed, and rebuilt by the group. We made it up as we went along; we taught each other our fields and methods, and in the process fashioned a new discourse and practice of our own. It was both challenging and thrilling, and for many of us who participated in NI, it remains a kind of "golden age" of intellectual inquiry, colloquy, and invention.

In addition to the years of weekly meetings, we also went as a group to several events that helped strengthen the social and intellectual fabric of NI: Umberto Eco's talk "On the Quest for a Perfect Language" at Boston University hosted by Marvin Minsky in 1991; the Second International Conference on Cyberspace in Santa Cruz, CA, at which two of our members presented in 1992; talks at MIT by Evelyn Fox Keller, Camille Paglia, and Henry Jenkins; and the Tenth International Conference on Technology in Education in Cambridge, MA, at which some of our local and remote members appeared on a panel together in 1993. We also had some "guest stars" visit NI over the years, including Samuel Delaney (noted science fiction author and literary critic) and Tim Oren (software architect of Apple's Guides project).

As we developed a common discourse based on having read, critiqued, taken apart, and put back together our core texts and theories, we also were able to offer critique and support for our own NI-influenced work. We read each other's papers and offered feedback to each other's conference presentation rehearsals.

After several years of overcoming our disciplinary prejudices and habits, what did eventually emerge was a new type of interdisciplinary methodology for Narrative Intelligence. The primary breakthrough occurred in our developing ways to interleave and cross-pollinate theory (analysis of texts, people, and computational systems) with practice (creating new forms of computational media). By having read, discussed, and critiqued each other's core texts, we were able to develop a common discourse that supported a dialectic between the theoretical frameworks we inherited from artificial intelligence and literary theory and our practical experience of analyzing and building computational media systems.

Core Texts and Issues

In this partial bibliography, we list the core works that formed the center of our discourse, as well as a few other selections to indicate the diversity of interests in the group. We have divided them somewhat arbitrarily into categories, but in fact almost all of our readings crossed disciplinary boundaries.

Artificial Intelligence and Cognitive Science

At the time we founded NI, mainstream artificial intelligence seemed bogged down in a view of mind based on mathematical logic and objective representation. Cognitive science developed theories of mind with similar assumptions and faced many of the same problems. Dissatisfied with this, we read some critiques from within the field, and identified for ourselves what we thought was useful. From traditional AI, the respective work of Marvin Minsky and Roger Schank was geared to less formal forms of knowledge, including narrative. Schank's group had a longstanding interest in story understanding and generation, and Minsky's Society of Mind theory had integrated some of these ideas into a computational framework.

The situated-action critique of AI (Phil Agre, David Chapman, Rodney Brooks, Gary Drescher, and others) was also influential. Drescher's work drew on constructivist roots that many of us shared. Agre's work was most informed by exposure to literary and social theory, and his paper "Writing & Representation" was one of the "founding documents" of the group. George Lakoff's work on metaphor and critique of objective representation was also influential in our thinking.

- Agre, Philip (2001). Writing & representation. In M. Mateas and P. Sengers (Eds.), *Narrative Intelligence*. Amsterdam & Philadelphia: John Benjamins. Originally circulated in 1989 as an unpublished MIT AI Lab report.
- Dennett, Daniel & Marcel Kinsbourne (1992). Time and the observer: The where and when of consciousness in the brain *Behavioral and brain sciences*, 15(2), 183-200.
- Drescher, Gary (1991). *Made up minds: A constructivist approach to artificial intelligence*. Cambridge, Massachusetts: MIT Press.
- Lakoff, George & Mark Johnson (1980). *Metaphors we live by*. Chicago: University of Chicago Press.
- Meehan, James (1981). TALE-SPIN. In R. C. Schank and C. K. Riesbeck, (Eds.), *Inside computer understanding: Five programs plus miniatures* (197-226). Hillsdale, New Jersey: Erlbaum.
- Minsky, Marvin (1987). *The society of mind*. New York: Simon and Schuster.
- Newell, Allen (1990). *Unified theories of cognition*. Cambridge, Massachusetts: Harvard University Press.
- Ortony, Andrew, Gerald L. Clore, & Allan Collins (1998). *The cognitive structure of emotions*. Cambridge: Cambridge University Press.
- Schank, Roger C. (1973). Conceptualizations underlying natural language. In R. C. Schank & K. M. Colby, (Eds.), *Computer models of thought and language* (187-247). San Francisco: W.H. Freeman.

Literary Theory

Literary theory provided an important framework for understanding language, communication, and cognition in ways critical of the conceptions underlying artificial intelligence. Roland Barthes' work on semiotics and the "death of the author," Wolfgang Iser's work on reception aesthetics, and Michael Reddy's "toolmakers paradigm" enabled us to go beyond the sender-receiver model of communication underlying most thinking in computer science to one in which meaning is an active and constructive process. Aristotle's rhetorical theory provided an important common toolset for analyzing the structure and style of the texts, artifacts, and theories. Frances Yates' work on memory palaces offered us ancient but highly relevant ways of organizing discourse and memory, and provided fertile metaphors for envisioning new types of computational media systems and interfaces.

- Aristotle (1977). *The rhetoric and the poetics of Aristotle*. New York: Random House Modern Library.
- Barthes, Roland. (1977). The death of the author. In *Image, music, text* (142-148). New York: Hill and Wang.
- Barthes, Roland. (1977). From work to text. In *Image, music, text* (155-164). New York: Hill and Wang.
- Iser, Wolfgang. (1974). The reading process: A phenomenological approach. In *The implied reader: Patterns of communication in prose fiction from Bunyan to Beckett* (274-294). Baltimore: The Johns Hopkins University Press.
- Iser, Wolfgang. (1989). The play of the text. In *Prospecting: From reader response to literary anthropology* (249-261). Baltimore: The Johns Hopkins University Press.
- Reddy, Michael J. (1993). The conduit metaphor: a case of frame conflict in our language about language. In A. Ortony (Ed.), *Metaphor and thought. Second edition* (164-251). Cambridge: Cambridge University Press.
- Yates, Frances A. (1966). *The art of memory*. Chicago: University of Chicago Press.

Media Studies

From literary theory we broadened our focus to examine scholarly studies of other media technologies, such as film and television. Walter Ong's work deals with the oldest communication technology, writing, and the sharp distinction it generates between oral and literate cultures, and was quite important for us in understanding new hybrid media like MUDs that combine elements of the oral and the written. David Bordwell's book introduces the narrative language developed in the relatively short history of film. Scott McCloud's work is a masterful comic book about comic art that uses techniques of sequential visual representation to explain sequential visual representation. Jenkins debunks the commonly-held image of the passive television viewer, while McLuhan's sweeping and prophetic work practically invented the information age now coming to pass.

- Bordwell, David (1985). *Narration in the fiction film*. Madison: University of Wisconsin Press.
- Jenkins, Henry (1992). *Textual poachers: Television fans & participatory culture*. New York: Routledge.
- McLuhan, Marshall (1964). *Understanding media: The extensions of man*. New York: McGraw-Hill.
- McCloud, Scott (1993). *Understanding comics: The invisible art*. Northampton, Massachusetts: Tundra.
- Ong, Walter J. (1982). *Orality and literacy: The technologizing of the word*. London: Methuen.

Narrative in Psychology and Sociology

There have been threads of work in psychology and sociology that center around narrative. Bartlett's view of memory as imaginative reconstruction of events was helpful to us in trying to break away from more static views of mental representation. Nelson's work on children's monologues showed how this reconstruction could take the form of oral self-narratives. These and other works helped sharpen for us the central role of narrative in the construction of the individual and of society.

Applebee, Arthur (1989). *The child's concept of story*. Chicago: University of Chicago Press.

Bartlett, Frederic (1932). *Remembering: A study in experimental and social psychology*. Cambridge: Cambridge University Press.

Freud, Sigmund (1933/1965). Lecture XXXI: The dissection of the psychical personality. In Strachey, James (Trans., Ed.), *New introductory lectures on psychoanalysis* (51-71). New York: Norton.

Nelson, Katherine (Ed) (1989). *Narratives from the crib*. Cambridge, Massachusetts: Harvard University Press.

Sacks, Harvey (1972). On the analyzability of stories by children. In J.J. Gumperz, & D. Hymes (Eds.), *Directions in sociolinguistics: The ethnography of communication* (325-345). New York: Rinehart & Winston.

User Interface Theory

All of the participants from the Media Lab (and many of the outsiders) were actively engaged in the research and design of new media and user interfaces, and were applying what we learned in NI to our work. Naturally we were interested in other efforts to apply literary theory or related disciplines to UI design. Brenda Laurel, Abbe Don, and Tim Oren, who were also participants in the group, were the most notable authors in this area. The issue of agents and character-based metaphors was and still is a prominent issue in the UI community. Our focus was on the intimate relationship between character and narrative.

Don, Abbe (1990). Narrative and the interface. In B. Laurel (Ed.), *The art of human computer interface design* (383-391). Reading, Massachusetts: Addison-Wesley.

Laurel, Brenda (1990). Interface agents: metaphors with character. In B. Laurel (Ed.), *The art of human computer interface design* (355-365). Reading, Massachusetts: Addison-Wesley.

Laurel, Brenda (1991). *Computers as theatre*. Reading, Massachusetts: Addison-Wesley.

Oren, Tim, Gitta Salomon, Kristee Kreitman, & Abbe Don (1990). Guides: Characterizing the interface. In B. Laurel (Ed.), *The art of human computer interface design* (367-381). Reading, Massachusetts: Addison-Wesley.

Software

We spent some sessions examining software, looking at how narrative was handled, or simply trying to apply some of the intellectual tools we had to criticism and analysis. We tried to apply reception theory and other tools to the analysis of new media forms, including hypertext, *The Visual Almanac*, an early work from Apple, programs for children, and the then-new genre of screen-savers. In addition, we presented and critiqued some systems developed by our participants. IDIC applied some of our knowledge about narratives to the task of assembling video sequences. The *Programming with Characters* project depicted the workings of a program using characters and narrative in order to make it more understandable to a user.

Apple Computer Multimedia Lab (1988). *The Visual Almanac*. San Francisco: Apple Computer.

Hickam, Craig (1991). *Kid Pix 1.0*. Novato, California: Broderbund Software.

Nelson, Theodor Holm (1982). *Literary Machines*. Sausalito, California: Mindful Press.

Rundgren, Todd (1990). *Flowfazer* ® Music For The Eye. Utopia Grokware.

Sack, Warren & Marc Davis (1994). IDIC: Assembling video sequences from story plans and content annotations. In *IEEE International Conference on Multimedia Computing and Systems* (30-36). Boston, Massachusetts: IEEE Computer Society Press.

Travers, Michael & Marc Davis (1993). *Programming with characters*. In *1993 International Workshop on Intelligent User Interfaces* (269-272). Orlando, Florida: ACM Press.

Social Computing

One thread of our discourse led from narrative to character to the real-life presentation of self as modified through computational media. In such media, identities become fluid, the usually implicit rules of social interaction become explicit or otherwise changed, and narrative play takes on new forms.

- Borning, Alan & Michael Travers (1991). Two approaches to informal interaction over computer and video networks. In *Proceedings of CHI '91* (13-19). New Orleans: ACM Press.
- Bruckman, Amy (1992). Identity workshop: Emergent social and psychological phenomena in text-based Virtual Reality. Unpublished paper. Online at: <http://www.cc.gatech.edu/~asb/old/papers-index-deco1.html#IW>.
- Grudin, Jonathan (1990). Groupware and cooperative work: Problems and prospects. In B. Laurel (Ed.), *The art of human-computer interface design* (171-185). Reading, Massachusetts: Addison-Wesley.
- Stone, Allucquère Roseanne (1991). Will the real body please stand up? Boundary stories about virtual cultures. In M. Benedikt (Ed.), *Cyberspace: First steps* (81-118). Cambridge, Massachusetts: MIT Press.

Constructionism in Science and Learning

The NI group was steeped in the culture of Piagetian constructionism, mostly through the influence of Seymour Papert. Our ideas about narrative were all implicitly of a constructionist bent. Since we were already familiar with this viewpoint in the areas of education and cognition, we decided to broaden our horizon by looking at the constructionist theories of science, which were not so readily accepted at MIT.

- Haraway, Donna J. (1991). A cyborg manifesto: Science, technology, and socialist-feminism in the late twentieth century. In *Simians, cyborgs, and women: The reinvention of nature* (149-181). London: Free Association Books.
- Keller, Evelyn Fox (1992). Secrets of God, nature, and life. In *Secrets of life, secrets of death: Essays on language, gender and science* (56-72). New York: Routledge.
- Keller, Evelyn Fox (1990). Physics and the emergence of molecular biology: A history of cognitive and political synergy. *Journal of historical biology*, 23 (3), 389-409.
- Papert, Seymour (1980). *Mindstorms: Children, computers, and powerful ideas*. New York: Basic Books.

Lessons Learned and Impact

For the members of the Narrative Intelligence Reading Group a new type of intellectual activity became possible: a mutually reinforcing theory and practice of analyzing, designing, and building computational media consciously informed by the humanistic disciplines of literary theory, media studies, psychology, sociology, and philosophy. We also learned that true interdisciplinary work takes perseverance and patience. After 4 years of running a weekly unofficial seminar in the basement of the Media Lab, we found we had begun to have an impact on the institution's curriculum. In 1994, about a third of the doctoral proseminar syllabus for incoming Ph.D. students included "NI" materials. This was largely due to recent MS graduates who were members of NI entering the Ph.D. program. We also found that a number of courses being offered at the Media Lab and around MIT started to reflect the interdisciplinary approach of NI. Over the years of the seminar we had two faculty members who were very active participants (Henry Jenkins and Edith Ackermann) and who advocated NI approaches at MIT. As we became established and well known, we had frequent visits from other faculty. The most telling sign that we had blazed an important intellectual and curricular trail was the appearance in our later years of students who already hybridized literary theory, media studies, and computer science. These were students who were trained both in semiotics and programming languages as undergraduates and expected media technology research to combine them.

The Future

While we accomplished much in the 6 years of the Narrative Intelligence Reading Group at the MIT Media Lab, there is so much more to be done. Most humanities departments still look at computation as a mere instrumentality and not as a serious and relevant area of intellectual inquiry. Most computer science programs, and even media technology programs, do not offer courses in which literary and media theory are taught and applied. The challenges facing the humanities and computer science demand not merely an interdisciplinary dialogue, but a redrawing of disciplinary boundaries. Training students and practitioners at this historical moment—as our means of communication are being radically transformed—requires that we develop a theoretically informed praxis that combines the best of our humanistic and computational sciences. The work of the Narrative Intelligence Reading Group was an early step in the

important process of redefining what it means to practice (and to teach) a hybridized discipline of computational media studies.

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