

Media Meets Technology:

Thinking Through Media Technology Studies

Panel Series Organized by

Pablo J. Boczkowski (MIT)

and

Frederick Turner (Stanford University)

for the Annual Meetings of the

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and

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Media Meets Technology: Thinking Through Media Technology Studies

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Annual Meeting of the Society for Social Studies of Science, Atlanta (GA), 15-18 October 2003

I. Rationale

Recent developments such as the advent of the personal computer, the proliferation of devices for recording and playing sound and images, the creation of the World Wide Web, and the popularization of wireless communication, have put a premium on understanding the dynamics of change in the area of media technologies. However, while technology scholarship has yielded valuable knowledge about the construction and use of artifacts, there has been comparatively less work on these processes in the case of media artifacts. Conversely, while media scholarship has generated important insights into the production and consumption of information, less attention has been given to the role of technology in these processes.

Each panel identifies a particular nexus of theoretical, methodological and empirical concern. The first opens with an examination of the relationships between science and technology studies and media studies, and then features a series of studies that explore the material and symbolic dimensions of producing media technologies. The second focuses on the practices within which multiple actors take up media technologies in a wide variety of settings. The third addresses experiential and identity-related dimensions of production and uptake, and closes with a paper that re-examines the notion of technological determinism in regard to media technologies. Taken together, these panels hope to spark discussions that span their individual areas of interest as well as the fields of media studies and science and technology studies.

II. Structure

Panel I. *Production.*

Leah Lievrouw (UCLA): *A Prehistory of Media Technology Studies.*

Pablo J. Boczkowski (MIT): *News Worlds: Rethinking the Dynamics of News Production.*

Geoffrey Bowker (UCSD): *Databases as Communicative Devices and Communicable Diseases.*

Gregory J. Downey (Wisconsin-Madison): *Closed-Captioning: History, Geography, and Ethnography of a Technology/Labor System in the New Economy of Digital Convergence.*

Panel II. *Uptake.*

William Dutton (Oxford): *The Social Dynamics of the Internet in Britain.*

Tarleton Gillespie (Cornell): *The Symbolic Shape of Media Technologies.*

Michele Jackson (Colorado-Boulder): *"Location, Location, Location": Considering "Presence" as a Replacement for "Interactivity" in Framing Communication and Media Technologies.*

Susan Leigh Star (UCSD): *Australia's Dingo Fence: Layers of Infrastructure and Meaning.*

Panel III. *Experience.*

Timothy Lenoir (Stanford): *Becoming Digital: How Media Technology Inspires the Posthuman Imagination.*

Trevor Pinch (Cornell): *The Electronic Music Synthesizer: Boundary Shifters and Liminal Entities.*

Frederick Turner (Stanford): *Cyberspace: The Local History of A Ubiquitous Metaphor.*

Susan Douglas (Michigan): *Communications Technologies and Modes of Communication.*

III. Abstracts

Leah Lievrouw (UCLA). *A Prehistory of Media Technology Studies*.

STS has been one of the most fruitful influences on new media research and scholarship. For example, the critique of technological determinism, an emphasis on socio-technical networks, and a focus on the reinvention of new technologies in practice are STS concepts that are taken for granted in new media research, and in fact help distinguish the area from more traditional mass media research. Yet to date, relatively few communication researchers are familiar with the principles and literature of STS, and only a small minority of STS scholars have chosen to study media technologies. This paper presents several concepts from STS that have been particularly influential in new media research, along with a brief historical sketch of the gradual diffusion of STS ideas in media studies. Suggestions are made for a future research agenda that incorporates insights from both fields.

Pablo J. Boczkowski (MIT): *News Worlds: Rethinking the Dynamics of News Production*.

In 1964, at the dawn of social studies of news production, Gieber published his classic article “News is what newspapers men make it.” Gieber’s apt title captured the insight that the news, rather than being a transparent expression of social events, is, at least partially, what results from the work of reporters and editors. For the past four decades, research in this tradition of inquiry has shed light on the interpersonal, institutional, and political factors that shape this work. Despite this valuable contribution, the role of technology has been mostly overlooked by this research. In my forthcoming book about the emergence of online newspapers, I provide an alternative account of newsroom dynamics by focusing on the material culture of news production. This examination of reporters’ and editors’ technical practices and considerations shows that in the online environment a greater variety of groups of actors appear to be involved in, and have a more direct impact on, the production process than what is typically accounted for in studies of print and broadcast newsrooms. The news is created in a relational network composed by editorial, systems, design, marketing, and advertising personnel as well as people outside the formal boundaries of the media organization such as users and sources. Media technologies permeate this relational network: actors use artifacts variously, as communication devices that enable their interactions, as information gathering and processing tools, and as the media embodiments of the news. Inspired by Becker’s seminal study of “art worlds” as the materially grounded and culturally heterogeneous spaces of art work, in this presentation I will outline a research agenda about news making anchored in the notion of “news worlds,” the technology-intensive and socially diverse loci of information creation in old and new media.

Geoffrey Bowker (UCSD): *Databases as Communicative Devices and Communicable Diseases*.

There are many dreams now of a universal database. It is hoped that - unlike the universal library of the encyclopedists or the electron-mechanical universal hypertext library of Paul Otlet in the 1890s or H.G. Wells’ World Brain – this universal, random accessible memory for our species will be sufficiently flexible and ‘smart’ that it will transcend its medium and grow into the dawn of a new form of historical and scientific consciousness. In this presentation, I argue that on the ground in the sciences, the vast impulse to database

presupposes a universal language for communication between disciplines posited on a variety of Comtean positivist hierarchy of the sciences. I argue that looking at databases as communication devices we can get access to some of the political and organizational work that gets done in the process of creating interoperable databases.

Gregory J. Downey (Wisconsin-Madison). *Closed-Captioning: History, Geography, and Ethnography of a Technology/Labor System in the New Economy of Digital Convergence.*

In 2002, on the even of a federally-mandate switchover to digital television, the US Department of Education allocated \$5.75 million for new closed-captioning training programs at some 14 technical schools around the nation – programs to train workers to use stenographic skills and equipment, such as those employed by professional court reporters, to create, on-the-fly, a text version of the audio track of a live TV broadcast, which can then be encoded into a hidden signal sent to home televisions across the country. A recent advertisement from one of these technical schools claimed “there are 200 closed-captioners nationwide today,” that “demand is expected to grow to 2,000 by 2006,” and that graduates of the new program (shown as women in the commercial) stood to make “from \$35,000 to \$100,000” per year while they “work from home.” But why fund training in captioning? And why at these sites? What does captioning matter, anyway? This “work in progress” paper will outline a nascent multidisciplinary (historical, geographical, and ethnographic) study of closed-captioning technology and labor – a socio-technical process of information production which involves both government standard-setting and government subsidy, both non-profit organizations and for-profit businesses, both advanced information technologies and turn-of-the-century keyboard designs, both hearing and hearing-impaired consumers, and both high- and low-wage labor.

William Dutton (Oxford): *The Social Dynamics of the Internet in Britain.*

This paper will discuss the results of a household survey of Internet adoption and use in the United Kingdom. It will draw on a theoretical perspective on the role of the Internet in reshaping access to information, people, services and technologies, one which is anchored in the intersections of communication and technology studies. Cross-national comparisons will be drawn to reflect on the ways in which the cultural context of the UK might be reshaping access to the Internet and, in turn, reconfiguring access to information, people and services in the UK.

Tarleton Gillespie (Cornell): *The Symbolic Shape of Media Technologies.*

The study of media has achieved a complex understanding of communication and its role in society, but is limited by an underdeveloped theory of technology -- imagined either as neutral, or as having some predictable, and unwavering impact on society. Conversely, the scholarship concerning technology offers a rich awareness of the way human choices shape the design and implementation of technologies -- but is hampered by a materialist focus overlooking how technologies are also discursively constructed as symbolic objects. Joining these perspectives allows an investigation into how our interactions with media technologies are themselves mediated by deliberately deployed and culturally available representations of those technologies. I will pursue this line of inquiry by considering the Supreme Court decision to reject the Communications Decency Act; much of the debate

around the statute, and the justification for finding it unconstitutional, hinged on a dispute over what the Internet "is" -- a question answered by imagining its symbolic shape in contrast to other existing media systems.

Michele Jackson (Colorado-Boulder): "*Location, Location, Location*": *Considering "Presence" as a Replacement for "Interactivity" in Framing Communication and Media Technologies.*

"Interactivity," in two senses of the term, has been critical to communication and technology studies over the past two decades. The first sense of interactivity refers to the ability of an individual user to manipulate the technology so as to directly influence the outcome. Interactivity in this sense is a variable property, with a technology being more or less interactive. The second sense of interactivity is a property that allows new media to approximate (or perhaps imitate) face-to-face (FTF) communication. In this second perspective, FTF communication is the *sine qua none*, and interactivity is its central component. Interactivity has proved an enormously rich concept for theory and research. First, it captured our imagination for how technology might create new possibilities for communication. Interactivity decisively separated old media from the new. Yet it is variable, providing room for innovation and creativity in conceptualization and design. By taking FTF as a benchmark, interactivity allowed ICTs to be compared to each other, producing a useful kind of ranking. Second, interactivity is easily accessible as a communication construct. The notion fits well with common understandings of communication that are grounded in sender-receiver encoding-decoding models. The concept calls for us to problematize the medium, rather than communication itself *per se*. Despite this success, there are signs that the concept may soon be stretched thin. We can witness a subtle shift in the nature of very recent communication technologies away from interaction and toward the concept of "presence." In presence technologies, *location* and *embodiment* become as important as interactions. This paper explores the implications of "presence" as a generative concept for theory and research in communication technology studies. The exploration is grounded in two emerging technologies: MMPOGs (massively multiplayer online games) and IVEs (immersive virtual environments). I argue that "presence-based" media technologies require a reconceptualization of communication away from the traditional transmission model to one that sees communication as constitutive and formative of social relationships.

Susan Leigh Star (UCSD): *Australia's Dingo Fence: Layers of Infrastructure and Meaning.*

This is a study of the history of the dingo fence in Australia as a communication media infrastructure. The fence, which is more than 3,000 miles long, has been built across southeastern Australia and maintained for decades. Its purpose is to separate dingoes from sheep (they don't mix well, it seems; a single dingo can destroy a sizeable herd of sheep in one night). So the fence is first a block to communication between these two animal groups. It is also symbolically weighted. That is, the dingo have a special relationship with many Aboriginal communities, both spiritually and culturally. The fence barrier thus carries some messages of racism and reinforces the troubled relationship, at times genocidal, between the white Australian government and Aborigines. Finally, the workers who maintain the fence and troubleshoot have multimedia forms of communication along this narrow corridor: primarily two-way radio, also email, telephone, material messages at the fence itself, shelters along the fence that are also messaging centers, and regular mail

and newsletters. The advantage of this paper would be to broaden the category of media technologies, interweave work and practice with cultural nuances with media technologies that span low-to-high tech. It also speaks to issues of "layering" media technologies, something theoretically quite important, as new media are interwoven into old, low-tech structures, and all forms of the technology continue to be used and reconfigured over time.

Timothy Lenoir (Stanford): *Becoming Digital: How Media Technology Inspires the Posthuman Imagination*.

This paper offers a case study of current developments related to radio frequency identification (RFID) tagging of physical objects, the embedding of these tags in nano devices, such as MOTES, and their potential for being embedded in the environment (human and natural). These technologies will enable hand-held devices, cell phones, and other communications devices to read web links attached to physical objects, a development which will create the possibility to surf reality. I intend this case study material to provide an occasion for exploring how media technologies are reshaping our environment as well as our perceptions of both physical nature and ourselves. Specifically I will explore the convergence of market forces, agreements on standards, technological development and the cultural imaginary in shaping the acceptance of the world and ourselves as digital.

Trevor Pinch (Cornell): *The Electronic Music Synthesizer: Boundary Shifters and Liminal Entities*.

In this paper I draw general lessons from my on-going study of the evolution of the electronic music synthesizer (see, for instance, Trevor Pinch and Frank Trocco, *Analog Days: The Invention and Impact of the Moog Synthesizer*, Harvard U. Press, 2002.). The development of the first commercial synthesizers in the 1960s heralded a new dawn in the production of electronic music and sound effects. New machines were introduced, new sorts of sound were made, and users had new sorts of listening experiences. I will review the general themes from technology studies that have informed my work and argue that we need some new ideas to explore how identities of machines and people are transformed in the course of developing and using these new instruments.

Frederick Turner (Stanford): *Cyberspace: The Local History of A Ubiquitous Metaphor*.

In 1984, novelist William Gibson coined the word "cyberspace" to describe an array of data ringing a world dominated by highly centralized and brutal corporations. Less than ten years later, the metaphor of "cyberspace" emerged as an emblem of a decentralized, personally and collectively liberating marketplace. Cyberspace, to this new way of thinking, was in itself already such a market, and it was about to transform those material markets around the globe with which it intersected. Drawing on archival research and interviews with John Perry Barlow, Stewart Brand and others, this talk will trace the evolution of the concept of cyberspace in the San Francisco Bay Area from its early deployment in the Virtual Reality industry, through its use on the Whole Earth 'Lectronic Link (the WELL), to its reconfiguration as a libertarian "electronic frontier" in the Foundation of the same name. The talk will pay particular attention to how Barlow and others linked their interactions with digital media to countercultural practices and political

ideals. It will then show how these locally developed meanings were exported nationally and internationally. In the process, it will offer a model for thinking about the power of geographically localized networks and their local experiences of media technologies in the shaping of what otherwise might appear to be global discourses of socio-technical change.

Susan J. Douglas (Michigan). *Communications Technologies and Modes of Communication*.

Communications technologies have especially evoked deterministic predictions and assessments about their ability to alter individual behaviors and institutional structures. At the same time, historians and sociologists of technology eschew technological determinism, at least the “hard” version that simplistically asserts that machines make history on their own. Debates have thus ensued about how much television, say, on its own, has forever altered American politics or email has altered the workplace and created virtual relationships that sometimes supplant familial or other face-to-face relationships. In my own work on radio, I have argued for, I guess, a somewhat “soft” determinism when it comes to changing radio technologies and the extent to which they evoked and cultivated different modes of listening among the audience. In this panel, I propose to summarize my own thoughts on the relationships between evolving radio technology and cognition, and to use that framework as a jumping off point for collective discussion and brainstorming about how communications and technology studies scholars can most fruitfully theorize about the dynamic relationships between different communications technologies and changing modes of interpersonal communication, reception of mass communication, and the construction of imagined communities that these different technologies make possible. In particular, I’d like to provoke comparisons between radio and the Internet. I am especially interested in exploring where scholars see themselves now in the ongoing debate about communications technologies and determinism.

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Panels Organized by Pablo J. Boczkowski (MIT) and Frederick Turner (Stanford)

Communication and Technology Division, Annual Meeting of the International Communication Association, New Orleans (LA), 27 - 31 May 2004

I. Rationale

Recent developments such as the advent of the personal computer, the proliferation of devices for recording and playing sound and images, the creation of the World Wide Web, and the popularization of wireless communication, have put a premium on understanding the dynamics of change in the area of media technologies. However, while technology scholarship has yielded valuable knowledge about the construction and use of artifacts, there has been comparatively less work on these processes in the case of media artifacts. Conversely, while media scholarship has generated important insights into the production and consumption of information, less attention has been given to the role of technology in these processes. This two-panel sequence aims to build bridges between these two domains of inquiry by fostering conversations about the distinctive dynamics of developing and appropriating media technologies. To accomplish this goal, these panels bring together a mix of senior and junior scholars who draw from several traditions of inquiry and utilize an array of methodologies to address multiple dimensions of media technologies in work and leisure situations, and in historical and contemporary settings.

Each one of these two panels focuses on a particular nexus of theoretical, methodological and empirical concern. The first panel explores issues at the intersection of work processes, the role of boundaries, and the media practices that deviate from a technology's anticipated uses. Boczkowski and Ferris' paper examines the organizational innovations undertaken in the adoption of online technologies by a traditional media firm, and pays special attention to the making and crossing of boundaries across multiple organizational units and media outlets. Bowker's paper looks at the work processes that subtend the development of database technologies in scientific contexts, and the role played by disciplinary boundaries in these processes. Livingstone's paper addresses young people's transformative uses of the Internet, in relation to the more anticipated uses, and reflects on the design and regulatory implications of these various uses, and the evolving boundary between them. Sterne's paper centers on the history of the attempts to domesticate missile technology as a means of communication, thus illuminating cultural tensions at the boundaries between military and civic life, and between modes of transportation and communication.

The second panel explores the co-evolution of communication, artifacts, and users' practices, identities and ideologies. Bar's paper takes up the previously neglected social history of WiFi, revealing the multiplicity of actors and settings that have influenced this increasingly ubiquitous technology. Nakamura's paper examines new genres of visual communication on the World Wide Web with an eye to showing how users appropriate and alter them in the course of doing their own identity work. Turner's paper shows how members of an early and prominent "virtual community" re-imagined computer networks in terms of countercultural ideals, substantially reshaping both their own identities and popular understandings of computer networking. Yates and Orlikowski's paper examines the practices of combining multiple media technologies undertaken by the employees of a geographically distributed firm to sustain their enterprise across space and time. Together, these papers emphasize the need to make sense of

interdependent material and symbolic dynamics of media technologies in the context of the actors who use them – and the value of bringing multiple theoretical and methodological resources to this endeavor.

II. Structure

Panel I. *Work, Boundaries, and Transformative Practices.*

Pablo J. Boczkowski and José A. Ferris (MIT): *Multiple Media, Convergent Processes, and Divergent Products: Organizational Innovation in the Adoption of Online Publishing by a European Media Firm.*

Geoffrey C. Bowker (UCSD): *Databases as Communicative Devices and Communicable Diseases.*¹

Sonia Livingstone (LSE): *Pushing at the Limits: Reflections on Young People's Use of the Internet.*

Jonathan Sterne (Pittsburgh): *The Strange Case of Missile Mail.*

Panel II. *The Co-Evolution of Communication, Artifacts, and Users.*

François Bar (USC): *Movie Stars, Composers, Kingdoms and Pringles Chips: The Social History of Wi-Fi.*

Lisa Nakamura (Wisconsin-Madison): *The Visual Culture of AIM Buddies and Race on the Internet.*

Frederick Turner (Stanford): *Virtual Community as Network Ideology: Revisiting The WELL.*

JoAnne Yates and Wanda Orlikowski (MIT): *Combining Multiple Media in a Geographically Distributed Firm.*

III. Abstracts

Pablo J. Boczkowski and José A. Ferris (MIT): *Multiple Media, Convergent Processes, and Divergent Products: Organizational Innovation in the Adoption of Online Publishing by a European Media Firm*

This paper addresses two related under-explored themes in media and technology scholarship: the role of technology in news production and the processes that shape media convergence, respectively. It explores them by studying the organizational innovations pursued by a European firm in its adoption of online publishing. This firm operates print and broadcast outlets in several specialized news markets. Between 1994 and 2003, it went from online experimentation undertaken by teams located within each existing newsroom, to creating a separate unit handling the online content of print and broadcast newsrooms, to integrating news production into single newsrooms per specialized market generating different products per outlet. This analysis challenges dominant ideas in media and technology scholarship by showing that the adoption of online technologies has involved shifting the equation one newsroom-one medium to one newsroom-multiple media, in an evolution towards increasing convergence in production processes but persistent divergence of the resulting products.

¹ For personal reasons, Geoffrey C. Bowker could not present his paper at the panels organized for the 2003 annual meeting of the Society for Social Studies of Science, where it was originally scheduled. He was invited to include the same paper in the panel submission for the 2004 annual meeting of the International Communication Association.

Geoffrey C. Bowker (UCSD): *Databases as Communicative Devices and Communicable Diseases*

There are many dreams now of a universal database. It is hoped that - unlike the universal library of the encyclopedists or the electron-mechanical universal hypertext library of Paul Otlet in the 1890s or H.G. Wells' World Brain – this universal, random accessible memory for our species will be sufficiently flexible and 'smart' that it will transcend its medium and grow into the dawn of a new form of historical and scientific consciousness. In this presentation, I argue that on the ground in the sciences, the vast impulse to database presupposes a universal language for communication between disciplines posited on a variety of Comtean positivist hierarchy of the sciences. I argue that looking at databases as communication devices we can get access to some of the political and organizational work that gets done in the process of creating interoperable databases.

Sonia Livingstone (LSE): *Pushing at the Limits: Reflections on Young People's Use of the Internet*

The relation between design and use of new media interfaces is vital to conversations between media and technology scholars. This relationship is analysed within two linked traditions – one relating media texts and reception, the other relating producers and users of consumer goods. The challenge for designers, content producers and policy makers is illustrated by findings from an ongoing project on children and young people's internet use, 'UK Children Go Online'. It is argued that, in ways not always recognised or valued by adults, children and young people (a) underestimate the potential of the internet, using it in normatively and uncritically, but in other ways they (b) push at the limits of the internet, using it in creative and subversive ways. For young people to gain from online opportunities but avoid online risks, those designing and regulating the internet should learn from the activities of these 'pioneering' young users.

Jonathan Sterne (Pittsburgh): *The Strange Case of Missile Mail*

On June 8, 1959, the U.S. postal service collaborated with the U.S. navy on an experimental mail missile launch from a navy submarine. While the concept of mail delivery by cruise missile seems strange today, it made perfect sense in the cold-war world of technological innovation. Following Bruno Latour's injunction in *Aramis* to consider failed and other "unloved" technologies, this speculative history of missile mail argues that it was a logical extension of both mobile privatization and the domestication of military technologies in civilian, utilitarian forms. Missile mail represents a connection between war and civic life that has been a hallmark of media technologies from telegraphy to satellites and computers.

François Bar (USC): *Movie Stars, Composers, Kingdoms and Pringles Chips: The Social History of Wi-Fi.*

Wireless data networks, in particular those based on Wi-Fi technology (Wireless Fidelity), are spreading fast. This largely results from the freedom that surrounds them: since Wi-Fi uses unlicensed radio spectrum, anyone can deploy Wi-Fi networks and experiment with them. Thus, Wi-Fi provides a fertile ground to explore how technology co-evolves with its uses: who invents and deploys it shapes the technology's applications. Conversely, how it

is used leads to further changes in the technology itself. This paper explores this interaction in the case of Wi-Fi. It studies the social history of this technology, from the early patent on spread-spectrum filed by actress Hedy Lammarr and composer George Antheil in 1941, to Dewayne Hendricks' wireless deployment in the South Pacific island Kingdom of Tonga and Rob Flickenger's more recent discovery that the length of Pringles cans matches Wi-Fi's wavelength, making them perfect cheap antennas to boost the reach of Wi-Fi signals.

Lisa Nakamura (Wisconsin-Madison): *The Visual Culture of AIM Buddies and Race on the Internet.*

AIM (AOL Instant Messenger) buddies run the gamut from cartoon characters, television and movie stars, and figures from fantasy and mythology. It appears that anything from a scanned photograph of Jennifer Aniston to an image of the user's cat can be an AIM buddy. These tiny graphical images function as remediations of both older televisual media and "sigs," or the automated identifiers appended to the end of email messages. I argue that AIM buddies occupy a liminal role between the more traditional graphical avatar and the textual "sig" familiar to pre-1995 Internet users. Their use as graphical proxies of identity warrants some theorization of its own, as it is such a widespread and little understood practice. The visual culture of AIM buddies has yet to be written; this presentation will start that work by discussing the topic in light of racial signification and identity in this area of avatar construction.

Frederick Turner (Stanford): *Virtual Community as Network Ideology: Revisiting The WELL.*

Since journalist Howard Rheingold promulgated the term in 1993, "virtual community" has served as a central – if ahistorical -- lens through which to examine online interaction. This presentation will trace the origins of the term to one of the most influential pre-Web computer networks, the Sausalito, California-based Whole Earth 'Lectronic Link (the WELL). It will show how both the communities who used the early WELL and the system itself embodied networking habits of mind first developed in the American counterculture. Finally, it will show how WELL users and managers transformed those countercultural ideals into ideological resources for integrating computer networking technologies into networked patterns of employment then emerging in the San Francisco Bay area. In this way, the presentation develops a historically sensitive model for thinking through the ways in which cultural, economic and technological forces have shaped one another online.

JoAnne Yates and Wanda Orlikowsk (MIT): *Combining Multiple Media in a Geographically Distributed Firm.*

Many studies have looked at how users make choices among various communication media or how teams, organizations, and communities actually use a single communication medium such as email. Yet most groups depend on more than one medium to interact. This presentation examines communication among the geographically dispersed members of a small (three full-time and two part-time partners) start-up firm founded to develop a complex system software product. The three full-time and two part-time members were located in four different cities and three different time zones. Communication among the five members occurred primarily through email and telephone (both either group or dyadic), with occasional dyadic face-to-face meetings. This study, drawing on email,

transcribed notes from weekly telephone conferences, and phone bills from the first four years of the firm's existence, supplemented by interviews, examines how firm members combined these various media to produce a web of communication that sustained the enterprise.