User-Centered Technology in Participatory Culture: Two Decades "Beyond a Narrow Conception of Usability Testing"

—ROBERT R. JOHNSON, MICHAEL J. SALVO, AND MEREDITH W. ZOETEWEY

Abstract*—*Twenty years after the publication of Patricia Sullivan's "Beyond a narrow conception of usability testing" in the* IEEE TRANSACTIONS ON PROFESSIONAL COMMUNICATION, *three scholars—all Sullivan's students—reflect on the history and development of usability testing and research. Following Sullivan, this article argues that usability bridges the divide between science and rhetoric and asserts that usability is most effective when it respects the knowledge-making practices of a variety of disciplines. By interrogating trends in usability method, the authors argue for a definition of usability that relies on multiple epistemologies to triangulate knowledge-making. The article opens with a brief history of the development of usability methods and argues that usability requires a balance between empirical observation and rhetoric. Usability interprets human action and is enriched by articulating context and accepting contingency. Usability relies on effective collaboration and cooperation among stakeholders in the design of technology. Ultimately, professional and technical communication scholars are best prepared to coin new knowledge with a long and wide view of usability.

Index Terms*—*Empirical research, history, methodology, participatory design, rhetoric, science, usability, user-centered design.

The "problem" of usability has been a source of great scholarly and practical interest for many years in technical communication, even before 1957 when the IEEE TRANSACTIONS ON PROFESSIONAL COMMUNICATION (T-PC) first appeared. **Usability** was not a term commonly used 50 years ago, but the spirit of making things more usable and more useful was already a strong concern of the budding profession we now know as technical and professional communication. But despite our historical attachment to users and the various artifacts they use, there has been one consistent difficulty in usability development for technical and professional communication. Practitioners and scholars alike have been continually frustrated by the fact that, at least in the worlds of engineering and commerce, usability is often seen as an end-of-the-production-cycle affair. That is, we claim that we know better; we are well aware of the strong impact that early, middle, and late usability can have on product usefulness, marketability, and integrity.

In 1989, the T-PC special issue on usability testing (Volume 32, Number 4) confronted this "end-of-the-line" problem head-on. This landmark collection is particularly worthy of recognition for its innovative focus then and longstanding relevance now. In this special issue, the end-of-the-line-problem is addressed implicitly and explicitly by Grice and Ridgeway [1], Rosenbaum [2], and others. Most particularly, the article by Patricia Sullivan, "Beyond a Narrow Conception of Usability Testing," provides what still remains an important argument for helping to solve part of the end-of-the-line problem [3]. Sullivan was among the first to acknowledge that usability testing is weakened when confined to validating all-but-finished documentation, and she points out that end-of-development usability fails to capture important user input that can be of great value earlier in the design cycle. Technical communicators, she argues, are well poised to help make users more central to the entire development process. Sullivan examines "the groups, the methods, and the research questions associated with usability research to begin to depict [a] landscape of usability research from the viewpoint of technical communication" [3, p. 256].

As Sullivan said in a 2006 interview:

Zoetewey: *Do you think the narrow conception of usability you describe in your 1989 article has become broader? Or is this problem still out here?*

Sullivan: *I don't know. I think I would have to research that to answer it properly. I mean I could sit and wonder about it, but I would have to go and go to the conferences for a couple years.*

Zoetewey: *Which conferences would you go to?*

Manuscript received July 11, 2006; revised January 29, 2007.
R. R. Johnson is with the Walker Arts and Humanities Center, Michigan Technological University, Houghton, MI 49931-1295 USA (email: rrjohnso@mtu.edu).
M. J. Salvo is with the Department of English, Purdue University, West Lafayette, IN 47907-2038 USA (email: salvo@purdue.edu).
M. W. Zoetewey is with the Department of English, University of South Florida, Tampa, FL 33620 USA (email: mwzoetewey@gmail.com).
IEEE 10.1109/TPC.2007.908730

Sullivan: *I'd go to SIGDOC. I might go to the Applied Psychology Conference...*

Zoetewey: *Which journals would you look at?*

Sullivan: *Much of the usability work is not in journals; it's in the files of the corporations that do it. However, methods will be talked about in journals. So I'd look at the* IEEE-PCS *and the* International Journal of Man and Machine Studies. *What I would be looking for would cross with psychology, and I would probably look at interface development labs. That work tends to be talked about in SIGCHI. Now I'm not sure where I'd go to think about emerging media. My guess is not much of this is being tested. So there we have to get beyond a narrow view of usability in a new set of media.*

This article helps us determine some of our own goals in relation to other groups studying usability, and maps out future directions we might take. And though Sullivan's essay is too infrequently referenced, recent work in user-centered technology [4] and usable culture [5] shares its commitment to social and political change rooted in the reorientation of technological development around people rather than artifacts [6]–[8].

The 50th Anniversary issue of T-PC affords us two important opportunities: (1) the opportunity to grapple with the attendant issues of power and authority that are so often raised in conjunction with usability (especially as they manifest in the complex relationship between rhetoric and science); and (2) the opportunity to reassert Sullivan's work as central to the lineage of the usability of documentation. In our article, we build on Sullivan's work as a starting point to produce a historical sketch of usability—a sketch that reflects the view both before and after her article in that T-PC issue. This historical rendering is beneficial for articulating difficulties that accompany the development of user-centered methodologies but may not specifically be seen as usability issues themselves. We bring the voice of Patricia Sullivan to the table—offered here as excerpts—through a recent interview we conducted with her about her sense of usability during the periods before and after her article appeared. We feel it is especially important to reassert Sullivan's voice as recent critiques of usability and user-centered design are bypassing Sullivan's early work, failing to cite her 1989 article, and making similar assertions without realizing that professional and technical communicators have struggled with end-of-the-cycle usability since the beginning [9].

THE HISTORICAL "ROOTS" OF USABILITY: A BRIEF SKETCH

Problems associated with the human use of technology can be found in the literature, philosophy, and history of virtually every Eastern and Western civilization since ancient times [10]. Whether the source of these problems came from agriculture, architecture, warfare, navigation, industrialization, and any myriad of contexts, technological use has been central to human action and thought for millennia [11], [12]. Bernadette Longo traces the history of techno-cultural communication and confusion back to Agricola, although the discussion continues back at least as far as Plato's fear of the emerging technology of print in the fourth century B.C. [13].

Twentieth-century use of technology added efficiency as a criterion for measuring effective technical communication. To this end, engineers, managers, economists, and industrialists delved deeply into the problem of making technology more efficient in terms of time and cost. In the early twentieth-century, Taylorism and Fordism are most immediately recognizable as placing efficiency at the center of definitions of effectiveness. Essentially, Frederick Taylor and Henry Ford led the way in making technological systems, artifacts, and attendant processes more efficient through what was labeled "scientific management" by Taylor, and quickly adopted as the key concept for efficient control of humans working with technology, broadly construed [14].

During the decades following the influence of Ford and Taylor, the problems associated with technology use took on a wider scope, and with this widening another criterion was added to the lexicon: accuracy. More complex technologies were emerging in nearly all aspects of human endeavor, and the accurate use of technology to meet the ends of human actions drew scientists and engineers into considering complications when analyzing, and allowing for, human use. That is, efficiency coupled with accuracy begged for even more fully developed methods of measurement of human behavior and actions, hence the fields of human factors and ergonomics. These fields, from their inception, were interested in accurately measuring many different dimensions of human interactions with technologies of all kinds through what were usually referred to as scientific methods [15].

With World War II on the horizon, however, something of an "accident" occurred in the realm of human factors studies. Up to this point, most

human factors work dealt with physical—or what we might now call nondiscursive—technologies such as farm equipment, industrial tools, automobiles, navigation instrumentation, and so on. The overall goal of most of these investigations was to take already-in-place technologies and study how people used them; and then, in turn, either (a) adapt small parts of the machines (such as knobs and dials) to make them more efficient and accurate in their use, or, more commonly, (b) determine what needed **to be taught** to the users of the technologies to improve efficiency and accuracy of use [16].

Now to the "accident." In 1940, for the first time in the history of the US, the Selective Service was implemented in peacetime. One of the results of this move was that many soldiers were drafted into the military and were immediately being trained to work dangerous and complicated machinery, such as artillery and other types of weapons and explosives. Soldiers were taught by instructors in very traditional, classroom-type environments where they studied textbooks and then went out into the training fields to apply their newly acquired knowledge. The outcome was often disastrous; many recruits suffered horrible injuries or died misusing technologies.

Textual knowledge resulted in dire consequences. These consequences gave birth to the first concerted efforts to understand how people read and then apply knowledge to technologies. A window was unconsciously opened for technical communicators to influence technology use and the transfer of knowledge about these technologies. Since this time, of course, much has happened in technical and professional communication regarding the usability of communication in a variety of media. We delve into these expansions of usability within our profession throughout this article, but for now we focus on the main points of our analysis—namely the roles of science and rhetoric within usability theories and practices in technical and professional communication. While culture and rhetoric are not synonymous, Charles Percy Snow's articulation holds for the culture of technical and professional communication.

Twenty years after Sullivan's article, usability remains at the impasse most famously described by Snow in *The Two Cultures and the Scientific Revolution* (see Fig. 1) [17].

As Snow describes them, culture and science are two wholly separate, self-contained constructs. Recently, the split between culture and science was

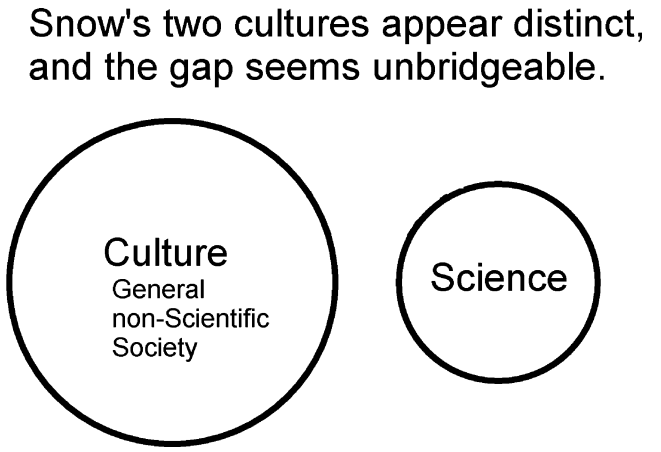

Fig. 1. Snow's two cultures: separate, unconnected.

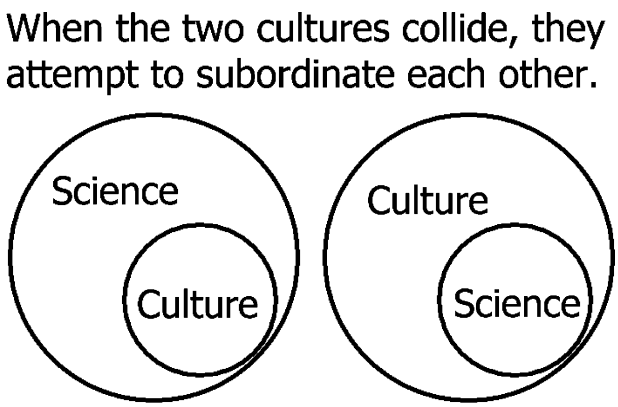

Fig. 2. Culture subsumes science, science subsumes culture.

exacerbated by the culture wars. This split is most strikingly represented by the misunderstanding that filled the pages of *Social Text* when that journal unwittingly published an essay written by NYU mathematical physicist Sokal that was purposefully written in impenetrable, nonsensical jargon [18]. Sokal claimed the point of the subterfuge was to expose the lack of rigor in science studies. This exchange led to publication of *The One Culture?: A Conversation About Science* which tried to heal the rift caused by Sokal [19]. Unfortunately, like so many other attempts, science and culture end up eliminating or subsuming each other, leaving the underlying problems unresolved (see Fig. 2).

In other words, the process is all a hermeneutic, circular logic leading back to where we started. Recently Latour has lamented this circularity in "Why Has Critique Run Out of Steam?" [20]. Indeed, the field of critical studies of science does not have a good track record of getting along with its stated subject of inquiry, neither with science nor with scientists. Latour traces this history, and here

that history complicates any attempt for technical writers to effectively collaborate with engineers, hence crossing the two cultures' divide.

USABILITY AS SCIENCE, USABILITY AS RHETORIC: SHALL THE TWAIN MEET?

As we have described above, usability has been historically regarded as a scientific activity—an activity guided by strategic methods and often quantitative measurement systems—that attempts to create verifiable and replicable results. With the incursion of technical communication into usability, however, there has been something of a disruption of the dominance of usability as science. Instead, usability has also been recognized as a rhetorical art. Although we do not wish to make this a hard binary between science and rhetoric, usability resides at this nexus of epistemologies, as the following two examples demonstrate.

Usability as science is clearly described by Gillan and Bias [21]. Although their article is promised to be the first installment in a series, only the first piece, "Foundations," has appeared at the time of publication of this article. Their self-conscious attempt to build a science of usability offers an interesting development. In trying to build the practice of usability inquiry into an academic field, Gillan and Bias construct an inside and an outside—naming fields invited to stay on as part of a usability science while omitting others. Gillan and Bias include a narrow range of inquiry in their usability science: "We believe that usability science covers the conceptual area between the basic cognitive and behavioral sciences (primarily cognitive and perceptual psychology) and usability engineering" [21, p. 351]. They conclude by calling usability a field of "applied science." Omitted (among others) are technical communicators as practitioners of the art of usability. It is unclear whether Gillan and Bias seek to sever communication between the art and their proposed science of usability. Technical communication practitioners have challenged calls for scientizing the field.

In a recent issue of *Interactions*, Arnowitz and Dykstra-Erickson challenge the above assertions of the science of usability and instead question usability as science:

> Presenting usability testing as science ignores that a typical human–computer interaction is crafted from multiple perspectives: business, design, human factors, individual emotions. "Science" sounds like a rather lofty term for the quick-hit studies in vogue. [22, p. 7]

Arnowitz and Dykstra-Erickson strike an inclusive tone, and are aware of both the multiple stakeholders in usability testing as well as the needs for both practical and contextually meaningful results that can be applied. They go on to recognize the incredibly brief moment in the development cycle in which usability results can have some sway in the design process:

> With some development cycles as short as two weeks, and as few as five users per test advocated by increasing numbers of usability specialists, we find it both awkward and difficult to promote our usability services as scientific. The basis of usability testing has never been 100 percent coverage of the entire potential design space; we're simply trying to weed out the worst from the lot. [22, p. 8]

At the heart of this analysis of usability is the recognition that tests have to be designed and carried out; additionally, information has to be compiled and results communicated in a startlingly short timeframe. Practitioners have responded by streamlining the process by testing fewer users and maintaining rather modest goals.

Facing the reality of the changing economy at the turn of the millennium, practitioners appropriately scaled expectations back to meet the stringent requirements of a harsher economic environment. But in so doing, gains made in usability as a research method were lost in an understandable effort to retain employment. Coupled with the economic downturn was the reintroduction of limits on usability testing. On its way to fuller integration into the design process in a number of ways—such as iterative [23], recursive [24], user-centered [4], [25], and even user-participatory design [26]—usability again found itself as an end-of-process design approval step rather than an integral element of design.

To defend their gains, some practitioners turned to science. There may be opportunities for a number of scientifically-driven disciplines to contribute scientific observations, perhaps informing best practices and offering some applicable results, but usability testing should not be re-articulated on the whole as a scientific discipline. In our recent conversation with Sullivan, she explores the limits of science:

> Zoetewey: *Bob* [Johnson] *recalls you commenting, "I've changed a lot. I'm no longer*

the same empiricist that I was." Have you rethought any of your methods?

Sullivan: *Since this article?*

Zoetewey: *Sure.*

Sullivan: *This is a tough question. I think that there are some positivist assumptions behind some of the methods I talk about in this article that I don't agree with anymore as assumptions. But I also think that in usability, these assumptions often prove helpful. So, if we took for example, the example of survey methodology, if somebody was going to do surveys in a setting for usability, I would think that it's helpful for them to come up with a sampling plan and to think about random sampling versus quota sampling. That these are useful concepts. Now, you don't have to believe that when you take that sample that you have represented the population that you're dealing with in order to find that useful. And so I would say that what I've come to find out is that while I don't actually accept many of the assumptions behind these methods, the practices of the methods are often very sound.*

Zoetewey: *Do most of those methods still hold sway in the field?*

Sullivan: *I'd say yes.*

Zoetewey: *In which industry?*

Sullivan: *Well, it's even becoming more so in education. Look at the fact that after, you know, twenty years of qualitative methods getting a foothold in education, then we have "No Child Left Behind" and evidence-based research and there's no funding for any qualitative work. I mean they've gone back to the most rigid statements of Truth.*

Sullivan's acknowledgement that methods which might be termed "positivistic" are alive and well struck a deep chord, reflecting the conversation we have sketched with reference to Gillan and Bias and the *Interactions* editorial. Sullivan goes on to talk about the value and importance of contextual research, which we read as a reference to the rhetorical methodology she developed with Porter as described in their book *Opening Spaces* [27]. Critically and rhetorically, that book does so much to talk about, deal with, and explain the problems of observing, analyzing, and articulating human behavior. Sullivan's work specifically addresses the problem and limit of interface testing, which by its very nature is a "one off" activity. In other words, evaluating an interface is something that will only happen once, its problems will be rather unique, and while we may have some guidance from previous usability studies, for the most part, the analysis is going to be nonreplicable and decidedly unscientific.

Whitehouse illustrates the limits of scientific perspective when narrating his interaction with Lighthouse International—an advocacy and educational organization based in New York—to develop tactile signage that can be read with the eyes **and** hands [28]. Whitehouse lists many limits to reliability and repeatability related to the way individuals with sight impairments and blindness interpret the world. It is difficult to imagine scientific results that can be widely applicable. Whitehouse's work is exemplary usability research that, if usability is redefined as science, might be silenced and forgotten.

The "Uniqueness of Individual Perception," (to reference Whitehouse's title), becomes a metaphor and a driving principle for understanding how other groups of human beings, other users, interpret information displays. Whitehouse defamiliarizes expectations of shared sensory input: blind users do not see, and therefore have different interpretations of usability and different needs to make interfaces usable. The implication is that each user and the unique individual perception that the user brings with her makes generalizability and repeatability impossible. And in large part, this uniqueness is what Sullivan's article is about. She encourages technical and professional communicators early on in the development of usability to think not about creating the perfect test, but of improving technology. Following Sullivan, we believe usability has a place beyond the narrow challenge of improving technologies during testing. The challenge exists as a profound interest in creating a user-centered culture in which human beings and their attendant physiological and cognitive needs and limitations are the center of technology design, rather than centering design on efficiency and the demands of technological systems.

As a rhetorical (language-mediated) practice, an expanded sense of usability communicates with and is an equal partner to scientific research. Usability is not contrary to science. Rather, it recognizes limits to scientific and positivistic inquiry, seeking dialogue. Nonscientific or design-based usability would continue to concentrate on the unique and singular design challenges represented by Whitehouse's narrative. The growing interest

in scientific usability might allow usability practitioners to seize those occasional opportunities when rigorous, sustained science would reveal more generalizable results that can be compiled into best practices. Sometimes, as with usability testing, we may have to relinquish any hope of creating a kind of scientific regime (an unattainable rational utopia), and rather develop a partnership between science and rhetoric—between observation, representation, and statistical analysis—so that we can ultimately offer our best advice applicable to the situation at hand rather than, as science is want to do, definitively settle questions.

In short form, Sullivan suggests that anyone undertaking usability study (1) build "an interpretation of the context that the study grows out of," and (2) analyze "the structure of a usability study" [3, p. 257].

Neither of these steps is particularly groundbreaking now, and many articles, chapters, and books have been published since 1989 asserting similar conclusions. But consider them in tandem with Hertzum and Jacobsen's much more recent usability evaluation methods (UEMs) to enhance the human factors of computer artifacts [29]. On one level, Hertzum and Jacobsen's list of "Consequences for Practitioners" is not substantially different from Sullivan's original recommendation:

(1) Be explicit on goal analysis and task selection.
(2) Involve an extra evaluator, at least in critical evaluations.
(3) Reflect on your evaluation procedures and problem criteria.

One main difference between Sullivan's list and the conclusions reached by Hertzum and Jacobsen is a concrete suggestion to add an extra evaluator. Indeed, the statistical work of the later article quite clearly indicates that more usability testing evaluators increase the number of problems found. After 20 years of usability testing, however, this seems a limited addition to testing procedures given the amount of mystifying mathematical baggage Hertzum and Jacobsen add to usability evaluation. After reading Sullivan's two-step advice for situating a study, we suspect most students will shrug and ask why they were required to slog through 20 pages of Hertzum and Jacobsen's mathematical formulas and statistical charts to reach the same warning message that many usability texts suggest: articulate the context and limits of testing and be critical of any findings. Both these warnings are part of usability's status as an interdisciplinary method that relies on context to make sense to readers. Ultimately, usability results are only as valuable insofar as they directly relate to changes to the design tested. Usability's value, after all, is measured by its effects in the agora—the marketplace.

Human Interface Designers, Usability Engineers, Information Architects, and professionals with a dozen more titles (and yes, "Technical Communicator" is among them) vie for control of usability. At the core of this discussion is whether usability is an academic discipline, a professional activity, an interdisciplinary field of inquiry, or an amalgam of some or all of these elements. The question can remain one of control—of who gets to define the parameters of usability—and of an authoritative definition. Or the discussion can shift not to definition, but to continuing the description of the challenges. This is the powerful discursive move we assert Sullivan made in 1989: articulating the challenge of a broad and culturally-aware field of inquiry, built around the challenges of understanding and improving the relationship between humans and our technologies. Sullivan addresses this question and clarifies it for today:

> Zoetewey: *How would you characterize* [usability]?
>
> Sullivan: *I think it's an activity that takes place in two different disciplines. One being applied psychology and ergonomics. The second being technical communication. And I think that when it has a place in an organization, it thrives. And that place usually comes from engineers who have a vision because most companies are run by engineers. At least most good companies.*

Sullivan's assertion, in distinction to Gillan and Bias, is that there are at least **two** elements to usability, one scientific and the other rhetorical, to which Sullivan (in good Aristotelian form) adds a third element: the engineer as practitioner at the site of technology transfer. For Sullivan, sustainable practice exists in organizations where engineers, as representatives of the situated practitioner, balance the competing discourses of singular design and replicable data. And she returns technical and professional communicators to the core challenge of the discipline: working effectively with the engineers, who (in well-run companies) are setting design agendas. We might say, then, that usability is at its best when it offers actionable information, based (as it must be) on contingent and contextual data in a timely way. And it is that timeliness that distinguishes usability testing from an interest in creating an independent field of usability science. Usability is effective when informing ongoing

processes of design and development in a timely way. And that recognition of opportunity or kairos is part of the contribution rhetoric continues to make to the preparation of technical writers—and to usability practitioners. Sullivan connects usability to rhetoric and audience.

> Zoetewey: *How do you see usability as being related to rhetoric?*
>
> Sullivan: *That's a good question.*
>
> Zoetewey: *Well, I suppose it's a leading question...*[laughs].
>
> Sullivan: *I would think that at [the time the article was published], all of my friends were convinced that they were integrally related...I don't think that that was the climate. If you had said "rhetoric," people would have run for cover. So, typically, I would talk to people, when I wanted to talk about rhetoric I would talk about audience...and the relationship of the target audience to the wider conceptual audience that you might be reaching. And so one of the things that I would constantly [be] talking with the people...about when I did usability work was how the people we were studying, because we didn't have the money to study everyone or all of the cohorts that they might be trying to reach, how the ones that we actually ended up studying matched up with their ideal audiences. And by talking about it in that kind of practical framework, I learned a great deal about the philosophies that developers had in relation to their products. I think that we often underestimate the depth at which engineers think about the work that they do.*

Key to establishing a dialogue between writers and engineers is creating mutual respect, through which dialogue can be established. Is usability informing the depth of engineers' thinking? Are usability testing regimes created in support of these engineering goals? While it remains a challenge to get institutional recognition for expertise in writing and communication, Sullivan's response reminds technical and professional writers of the importance of understanding and respecting the work of our partners and collaborators. That is, writers can demonstrate respect for expertise by recognizing the commitment our colleagues in engineering bring to the design process beyond their technical skills. At the same time, writers can ask for respect from engineers as they value the insights users can provide through effective and timely testing and evaluation. One way to demonstrate respect for both of these stakeholder populations is to present useful information to engineers, helping these designers build knowledge of their users with comprehension of the constraints users face when they use the objects being designed. Writers also demonstrate respect for our engineering colleagues when they recognize and value the economic constraints under which organizations function. For a contextualized example of this relationship between technical communication and economic concerns, see "A Case of Exhaustive Documentation" [30].

The argument presented here resonates with Zuboff's concept of "informating" the design process [31]. During design and development, experts in communication can inform decisions and present information as needed. Such development of critical, participatory design does challenge accustomed models of technological invention and dissemination; these differences are more radical and pervasive than reforming the current modes of designer-centered technological development towards something else—a more context aware—post-industrial model of technological invention, style, and delivery that uses observation to deliver contextualized design.

Technical communicators and human–computer interaction (HCI) researchers have gestured towards this emerging technology mode of technology invention, design, and dissemination [32]. But choosing the moniker "user-friendly" indicates a continuing problem with the limits of these forecasts, these problems with power and control rhetoricians have been grappling with. Technologically, space for acknowledgment of the user, and for developing exchange with the user, is evident in the study of writing and literacy as early as 1987. Kemp, shortly before the appearance of Sullivan's article, offered rhetoricians a critique of the dumbing-down of interfaces represented by misguided attempts to be user-friendly [33]. These efforts, exemplified by Microsoft's failed Bob interface of the mid-1990s, inevitably decreased the potential of personal computing for most users. Instead, by listening to users, and then (as Kemp asserts and the Web later testifies to) recognizing the computer as a communication tool rather than a computation device, computer interfaces can be designed with user participation.

Sullivan's article forecasted the interest in human-centered design. Called, in different contexts, Scandinavian design [34], participatory design [26], and cooperative design [35], the key

distinction between these boundary-blurring strategies and usability testing is the maintenance of boundaries between producers and consumers. These modes of user- and contextually-aware design align well to usability testing rather than to the more radical calls to open the door to users. Learning from and alongside users will continue to impact the conversations designers, engineers, and technical writers have within organizations, and will by extension impact the processes and values with which technologies are constructed.

Coming after Kemp and five years after LeFevre's *Invention as a Social Act*, Sullivan's 20-year-old article reflects the growing interest among rhetoricians in moving beyond romantic notions of authorship—of isolated humanistic knowledge emanating through a creative genius [36]. This body of research asks us to consider widening the scope of usability concern beyond testing, and opens a new world of design possibilities. But we must recognize that science and applied scientific disciplines had long ago left the idea of knowledge created solely by its author. Yet science has not yet left behind its notion of knowledge produced by a privileged class, a notion Haraway traces to science's very beginnings and the practice of "modest witnessing" [37, p. 24]. And as hard as Feenberg has worked to articulate that technologies, when disseminated into culture, are changed as they are integrated into users' lives, his Marxist analysis keeps his ideas from reaching a wider audience [38].

Latour, again, is instructive here. Latour opens *Pandora's Hope* with an explanation of the challenge presented to science when one acknowledges the role of the user in technology [39]. Science, emerging and gaining legitimacy through Cartesian separation of the mind from the body, fears including untrained representatives of culture, of "the mob"—those people unwashed, unprepared, and assumed unable to help in the lofty pursuit of science. Science, privileged in its certainty of discovery, is nevertheless unable to inform the specific, contextual, and time-bound needs of design:

> How could it be so important to maintain this awkward position, in spite of all the cramps it gave philosophers, instead of doing the obvious: retracing our steps, pruning back the brambles hiding the lost fork in the road, and firmly walking on the other, forgotten path? And why burden this solitary mind with the impossible task of finding absolute certainty instead of plugging it into the connections that would provide it with all the relative certainties it needed to know and act? [39, p. 12]

Latour has been commenting on the sites, practices, and beliefs of science and scientists for 30 years, offering insight and rearticulating both knowledge and the process of making knowledge; he is a rhetorician among scientists. And his olive branch between science and **not** science, hinges on a single word that has been rhetoric's basis since Aristotle articulated it: rhetoric is concerned not with certainties but with **relative** certainties. Rhetoric is about contingency. And our engineering colleagues, interested in making practical things in the real world rather than discovering truth in the laboratory, have also been—while scientifically based—nevertheless equally driven by **probability**.

Rhetoric as the articulation of the probable and as contingent is as old as rhetoric itself. Aristotle asserts that the domain of rhetoric is the probable and the contingent, rather than the certain:

> A probability is a thing that usually happens; not, however, as some definitions would suggest, anything whatever that usually happens, but only if it belongs to the class of the 'contingent' or 'variable'. [40, 1357b]

So in defining parts of usability as rhetorical, or contingent on context, we seek to return this discussion of usability to the application and use of scientific findings rather than displacing science or emplacing science in application. Rhetoric is most applicable not in deciding general principles but in articulating the contingent and the particular. Aristotle again is instructive: "For it is about our actions that we deliberate and inquire, and all our actions have a contingent character; hardly any of them are determined by necessity" [40, 1357b]. We must embrace the contingency of the situated design rather than move toward a science of usability that would ignore context. Once we leave the realm of probability—of contingency—we leave rhetoric and, according to Aristotle,

> The nearer one comes, unconsciously, to setting up a science that is distinct from dialectic and rhetoric. One may succeed in stating the required principles, but one's science will be no longer dialectic or rhetoric, but the science to which the principles thus discovered belong. [40, 1358b]

Not only would usability science exclude rhetoric, it would also cease being usability.

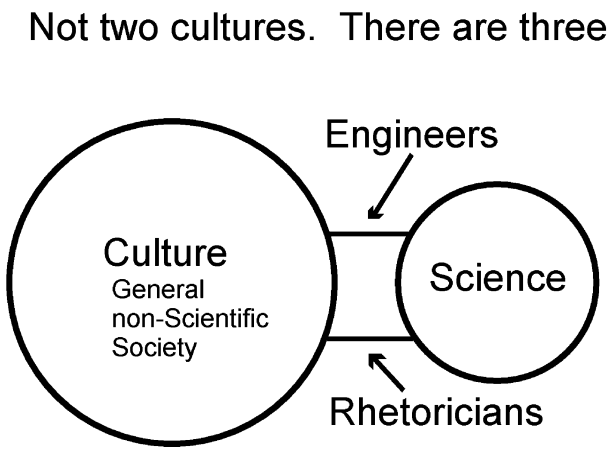

Fig. 3. Expanding Snow's conception to three cultures, where engineers and rhetoricians share the challenge of design and application in a contingent realm.

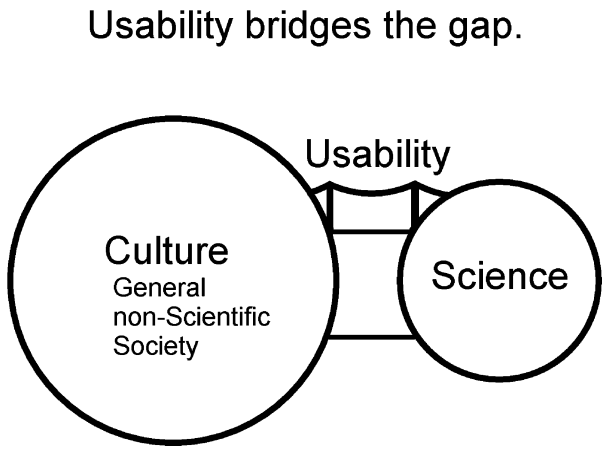

Fig. 4. Usability bridges the gap.

We assert that for usability to remain a healthy and productive field, it must consist of two flows: one scientific and replicable, and the other nonscientific research—rhetoric. This move enhances and rearticulates usability "beyond a narrow conception" (as Slack, Miller, and Doak have similarly rearticulated the role of technical communication authorship) [41]. Maintaining engineering and rhetoric as parallel knowledge-making enterprises promotes the communication between the realms of science and culture. Recently, Schneider [42] and Brady [43] suggested that contemporary rhetoric needs to consider audience more closely and consider rhetoric's role in participatory and newer user-involved design regimens. Schneider and Brady are right to approach rhetoric and suggest that it become user-centered **before** technical communicators can offer to help engineering become user-centered. So let us expand our vision: there are not two cultures, as Snow and others would have us think, but three (see Fig. 3).

Science and society continue to define the two most populous groups, but there are conduits of communication between these populations—interstitial groups—enabling communication between Latour's disembodied "minds in vats" and the unwashed and unprepared masses. Engineers might not be willing to risk their privilege among the scientific knowledge class, but rhetoric inhabits the space between certainty and ignorance, a place where solutions to specific problems are built. This is a realm not of certainty but of probability. Between the known and the unknown, between the privileged space of knowledge made in certainty and the space where solutions are desired but not (yet) available, exists a third space. This third space is a world of the probable, a place where argument and potential is marshaled into argument, and assessment of risk into probability. Usability inhabits the space between the known and the unknown, informing designers and decision-makers, articulating problems and potential. And it is not without risk.

Engineers, then, are responsible for the flow from science into culture, for applying the lessons learned from research. The process is commonly understood under the broad heading of "technology transfer." As user advocates, techno-rhetoricians complete the circuit, articulating messages that scientific culture needs to hear from culture-at-large [44]. Engineers and rhetoricians together bridge the two cultures of science and culture. Rather than repeating Snow's observation that the two cultures are separate with irresolvable differences, we can instead see the twentieth-century, from World War II to the personal computing revolution, as an era of bridge-building, and usability—and its adjunct, user-centered design—as the bridge (see Fig. 4). Unfortunately, the techno-rhetorical position is the subaltern of engineering, rather than sharing in equal partnership (hence the griping about status and compensation).

Pat Sullivan reflects on the past 20 years of bridge building:

> Zoetewey: *Can you fill in some history for us? What do you see as the major trends in usability over the last 20 or so years?*
>
> Sullivan: *I think there's been more context-based research than there was in the mid-'80s. And I also think that there have been advances in tracking of actions so that if people want to*

observe and track the paths that users take, that a lot of that is automated now in some of the labs and that's very helpful to somebody like myself who is interested in process...It allows you to think differently. If the episode that you're watching in a usability test, if that episode you're watching is the interaction of the user with the program, you can't really make many observations about the process. So then you break it down into task and subtask. And then if the episode link or the unit of analysis becomes each of those subtasks, you have a little bit more accuracy in your observations and you can make smaller and more detailed observations. If it gets broken down the way some of the new computer programs break it down so that you can hit a button every time you see a certain kind of activity and then it's time-coded into the tape, that allows you to think about other things you want to code into it.

Zoetewey: *It frees you up?*

Sullivan: *It frees you up, yes. Because you don't have to worry, you don't have to take notes about what the person is doing. What the person is doing is captured. That would be like some of my early tests; I would be sitting watching somebody using a computer and I would have an audio tape and a piece of paper there, and I would be madly scribbling notes. Well, that was not a very good way to observe process. So to the extent to which usability is interested in process—that micro-cognitive or even behavior process—there are many and more tools available that can help you do that.*

Zoetewey: *Are there any other trends you want to talk about?*

Sullivan: *I think it's been corporatized. That there's been a lot of people who have made names in usability who then marketed their names and developed shops. And so you have this particular shop of usability and maybe they've given a method that they use some kind of name. So they're the X shop that does the Y method. And I think Mary would like that a lot because it would strike her as efficiency. And she would say, "Whenever I need Y method I'm going to call X shop." And so that makes the services more visible and that helps the name of usability because the services and the people who do it are more visible. So that's the good part of it.*

Zoetewey: *Is there a bad part?*

Sullivan: *Um, the bad part is that...I just know from doing usability tests that I didn't often make any money because I always thought through the test at the time. I didn't say, "Come to me if you have certain kinds of tests, and I'll do certain kinds of things."*

Zoetewey: *So you had kind of a broader approach?*

Sullivan: *I just, each one was a puzzle that needed to be solved. So I think the perspective of corporatization and mechanization is useful in the sense that when you need certain kinds of tests you go to certain kinds of shops to have them done. But if you're trying to develop new methods, new activities to pay attention to, if you're trying to look at usability of emerging media, then I think you still need to be experimenting. And experimenting in the sense that you're seeing each new test as a puzzle.*

IMPLICATIONS FOR EDUCATION AND SCHOLARSHIP

In the arena of education, what we have presented here has many implications. However, only one is of the utmost import. Namely, **we** are charged with communicating to our students about the realities of what they will face in the workplace as usability specialists with a background in technical communication. Though most usability is currently being taught in new HCI programs through departments of information science, we believe technical communication programs should reassert their status as usability educators. This includes introductory usability testing courses (such as those offered by the RPI, Michigan Tech, Texas Tech, and Southern Polytechnic, for example) and more in-depth treatments, such as the "Survey of Usability Research Techniques" course offered by the Technical Communication program at the University of Washington. As Rachel Spilka observed in her keynote address at the 2005 Conference of the Council of Program in Technical and Scientific Communication, the number of research methods classes in technical communication Ph.D. programs is on the decline [45]. A restructuring of curricular priorities (always easier said than done) could mend that trend and would serve future usability specialists well.

One way to address these curricular problems and the possible "decline" of methods is to integrate usability methods into all relevant courses. As we imply, usability can be formal or informal. The formal methods take time and resources (such

as usability labs) and should usually be a part of full-blown courses dedicated to usability methods. These courses are invaluable for programs at the undergraduate and graduate levels that have such time and resources. However, many programs have no such luxuries. In these, and in the programs fully dedicated to technical communication, usability should be put into as many courses as possible at both lower and higher levels of learning. For instance, simple methods of user analysis can be taught in our service courses and introductory courses for our majors.

Beyond just introducing these methods, we must make these practices explicit. That is, we must discuss the rationale for these methods, their importance for product development, and—most importantly—why these methods are embedded in understandings of audience analysis. In fact, we should advocate that usability methods and theory should be integrated into relevant composition courses [46]. Technical communicators need not be the sole proprietors of user-centered approaches: all instructors of writing and communication should be involved and actively support these activities.

No matter which courses we institute, our ideals should remain high concerning what we want students to accomplish. These ideals, however, must be tempered with common sense of what can be accomplished in the usability advocacy role and, most importantly, the understanding that patience is a virtue in the fast-paced and frenetic context of the workplace. Teaching students the techniques of quick and dirty usability methods, imparting the importance of continually advocating for writing and documenting during development processes, and making sure that they get a taste of this through internships are all good starting points. In short, we have much to do in the classroom, but we have the expertise and tools as long as **we** use them.

Scholars of usability (in academics or elsewhere) should consider taking the broad view. For example, there are usability techniques that are continually put forward because they get the job done quickly. In many cases, these techniques are used for validation purposes in development cycles. This is a good thing as it helps to measure the usefulness of products to some degree. In other cases, however, time-sensitive methods such as web heuristics can be brought forward as a way to evaluate user needs at the early stages of a project. Such techniques draw upon longitudinal data that is already validated to some degree and, as such, they bring useful methods to student learning in a variety of contexts with relative ease.

Nevertheless, there are larger issues at stake. For instance, are we asking questions of "why usability?" We cannot just imagine that everyone will agree that usability is always a benefit. How do we justify its use? We can be practical advisors but we should be philosophers and theorists as well.

Without a theoretical justification for our actions, we will remain practitioners limited to applying the lessons learned by others in other realms of inquiry, excluding the potential for innovation and knowledge-making. Our final anecdote illustrates the value of the long scholarly view, and of participating in the expensive, slow, and long-term project of coining knowledge. Microsoft and Intel recently began experimental usability inquiries by hiring anthropologists and sending them into workplaces and homes to learn how users incorporate digital technologies into their lives [47], [48]. With a narrow and short-term view of technology, anthropology would have not been considered a legitimate field with which to make new knowledge. Coupled with a short-term perspective on research methodology, the exploration of anthropological, ethnographically-based usability would not have been pursued. However, armed with the scholar's long-term view, Spinuzzi [9] and Mirel [49] have recently articulated context as a key player in understanding usability, and in challenging many things that usability methods may have overlooked.

The long view, exemplified in both scholarship and theorizing, may be inefficient, but it remains the only avenue for innovation and coining new knowledge. Sullivan's article, "Beyond a Narrow Conception of Usability Testing," remains a watershed for usability inquiry that reminds practitioners and scholars alike of the value and importance of exploration, of innovation, of looking beyond current trends and practices to articulate new potentials for knowledge-making, and for understanding how people actually use and are frustrated by technology. Two decades after first articulating a broad, deep, and historical interdisciplinary definition of usability, Sullivan continues to assert its value to technical and professional writing, to engineering, and to technological culture. Revisiting Sullivan's definition of usability is in keeping with T-PC's 50th Anniversary: as the journal reflects on 50 years of publication, we have traced the development of usability and its impact on the design of technoculture. It seems appropriate to conclude with a final selection from our conversation with Sullivan:

Zoetewey: *What is the future of usability?*

Sullivan: *Well, I think that usability, if it thinks of itself as the Way, the Truth, and the Life, the way that sentence combining did in Composition, it's destined to die out because it gets connected to one approach, one way of doing things. I think that if usability stays an interdisciplinary activity—which it had forever been—that it's very important for Technical Communication to hold up its end in producing usability specialists. My reason for saying that is if they all come from Applied Psychology, who is better prepared for teaching methods and statistics than Tech Comm is? If they come from there, they may deemphasize the importance of the audience and the importance of the user's voice and the activity. So I think that it works as an activity when there are voices that are advocating users, and it doesn't work when it's more of a systems approach. I actually think the users approach/systems approach debate has never really gone away. And it shouldn't. I think it's healthy to think about the tension between looking at systems from efficiency goals and looking at systems from user needs.*

Zoetewey: *How do you feel about* [the] *placement* [of your article] *in* IEEE?

Sullivan: *I was happy it was in* IEEE. *I had a lot of respect for the journal. I knew that its readership was not just writers but engineers. And so I wanted to do a thought piece that engineers might read and think about. I actually thought that many people who did usability knew everything I was talking about and more...I was trying to write to decision-makers to tell them this is a big, big activity. It's not a small little thing.*

ACKNOWLEDGMENT

Listed alphabetically, the authors assert that all contributed equally to creating this collaborative document—each is first author; we believe all three made equal contributions. We are grateful for the opportunity presented by this 50th anniversary issue of the IEEE TRANSACTIONS ON PROFESSIONAL COMMUNICATION to reflect on the intellectual and methodological debt we each owe Patricia Sullivan. All three authors consider themselves students of Professor Sullivan and have benefited greatly from her insightful research and sage advice. All practice usability inquiry "beyond a narrow conception of usability testing."

REFERENCES

[1] R. A. Grice and L. S. Ridgway, "A discussion of modes and motives for usability evaluation," *IEEE Trans. Prof. Commun.*, vol. 32, no. 4, pp. 230–237, Dec., 1989.

[2] S. Rosenbaum, "Usability evaluations versus usability testing: When and why?," *IEEE Trans. Prof. Commun.*, vol. 32, no. 4, pp. 210–216, Dec., 1989.

[3] P. Sullivan, "Beyond a narrow conception of usability testing," *IEEE Trans. Prof. Commun.*, vol. 32, no. 4, pp. 256–264, Dec., 1989.

[4] R. R. Johnson, *User-Centered Technology: A Rhetorical Theory for Computers and Other Mundane Artifacts*. Albany, NY: SUNY Press, 1998.

[5] H. Bullinger, J. Ziegler, and W. Bauer, "Intuitive human-computer interaction: Toward a user-friendly information society," *Int. J. Human-Computer Interaction*, vol. 14, no. 1, pp. 1–23, 2002.

[6] A. Feenberg, *Alternative Modernity: The Technical Turn in Philosophy and Social Theory*. Berkeley: Univ. California Press, 1995.

[7] D. Haraway, "A cyborg manifesto: Science, technology, and socialist-feminism in the late twentieth century," in *Simian, Cyborgs, and Women: The Reinvention of Nature*. New York: Routledge, 1991, pp. 149–181.

[8] B. Latour, *Politics of Nature: How to Bring the Sciences Into Democracy*. Cambridge, MA: Harvard Univ. Press, 2004.

[9] C. Spinuzzi, *Tracing Genres through Organizations: A Sociocultural Approach to Information Design*. Boston: MIT Press, 2003.

[10] E. Morrogh, *Information Architecture: The Emergence of a 21st Century Profession*. New York: Prentice-Hall, 2002.

[11] R. J. Connors, "The rise of technical writing instruction in America," *J. Tech. Writing Commun.*, vol. 12, no. 4, pp. 329–352, 1982.

[12] J. Yates, *Control Through Communication: The Rise of System in American Management*. Baltimore, MD: Johns Hopkins Univ. Press, 1993.

[13] B. Longo, *Spurious Coin: A History of Science, Management, and Technical Writing*. Albany, NY: SUNY Press, 2000.

[14] F. W. Taylor, *The Principles of Scientific Management*. Sioux Falls, SD: NuVision Pub., 2007.

[15] D. Meister, *The History of Human Factors and Ergonomics*. Mahwah, NJ: Lawrence Erlbaum Assoc., 1999.

[16] K. T. Durack, "From the moon to the microchip: Fifty years of technical communication," *Tech. Commun.*, vol. 50, no. 4, pp. 571–584, 2003.

[17] C. P. Snow, *The Two Cultures and the Scientific Revolution*. New York: Cambridge Univ. Press, 1993.

[18] A. D. Sokal, "Transgressing the boundaries—Toward a transformative hermeneutics of quantum gravity," *Social Text*, vol. 46, no. 47, pp. 217–252, 1996.

[19] J. A. Labinger and H. Collins, Eds., *The One Culture?: A Conversation About Science*. Chicago, IL: Univ. Chicago Press, 2001.

[20] B. Latour, "Why has critique run out of steam? From matters of fact to matters of concern," *Critical Inquiry*, vol. 30, no. 2, pp. 225–248, 2004.
[21] D. J. Gillan and R. G. Bias, "Usability science I: Foundations," *J. Human-Comput. Interaction*, vol. 13, no. 4, pp. 351–372, 2001.
[22] J. Arnowitz and E. Dykstra-Erickson, "Usability as science," *Interactions*, vol. 12, no. 2, pp. 7–8, 2005.
[23] M. DeJong and D. Rijnks, "Dynamics of iterative reader feedback: An analysis of two successive plus-minus evaluation studies," *J. Bus. Tech. Commun.*, vol. 20, no. 2, pp. 159–176, 2006.
[24] J. B. Gilmer, Jr. and A. F. J. Sullivan, "Support to decision makers: The use of recursive simulation to support decision making," in *Proc. 35th Conf. Winter Simulation: Driving Innovation*, 2003, pp. 1116–1121.
[25] B. R. Philip and C. Rourke. (2006, Mar. 16). *Beyond Usability Testing: User-Centered Design and Organizational Maturity* Mercurytide. Edinburgh, UK. [Online]. Available: http://www.mercurytide.com/whitepapers/beyond-usability-testing/
[26] C. Spinuzzi, "The methodology of participatory design," *Tech. Commun.*, vol. 52, no. 2, pp. 163–174, 2005.
[27] P. Sullivan and J. Porter, *Opening Spaces: Writing Technologies and Critical Research Practices*. Greenwich, CT: Ablex Pub., 1997.
[28] R. Whitehouse, "The uniqueness of individual perception," in *Information Design*, R. Jacobson, Ed. Cambridge, MA: MIT Press, 1999, pp. 103–129.
[29] M. Hertzum and N. E. J. Hertzum, "The evaluator effect: A chilling fact about usability evaluation methods," *Int. J. Human-Comput. Interaction*, vol. 15, no. 1, pp. 183–204, 2003.
[30] M. J. Salvo, M. W. Zoetewey, and D. K. Agena, "A case of exhaustive documentation: Re-centering system-oriented organizations around user need," *Tech. Commun.*, vol. 54, no. 1, pp. 46–57, 2007.
[31] S. Zuboff, *The Age of the Smart Machine: The Future of Work and Power*. New York: Basic Books, 1988.
[32] H. Bullinger, J. Ziegler, and W. Bauer, "Intuitive human-computer interaction—Toward a user-friendly information society," *Int. J. Human-Comput. Interaction*, vol. 14, no. 1, pp. 1–23, 2002.
[33] F. Kemp, "The user-friendly fallacy," *College Composition Commun.*, vol. 38, no. 1, pp. 32–39, 1987.
[34] A. M. Kyng. (1994, Apr.). Scandinavian design: Users in product development, in Proc. SIGCHI Conf. Human Factors in Computing Systems: Celebrating Interdependence, 1994, pp. 3–9. [Online]. Available: http://www.doi.acm.org/10.1145/191666.191673
[35] K. Grønbæk, J. Grudin, S. Bødker, and L. Banno. Achieving Cooperative System Design: Shifting From a Product to a Process Focus. Comput. Sci. Department, Aarhus Univ., Aarhus, Denmark. Whitepaper. [Online]. Available: http://www.ul.ie/~idc/library/papersreports/LiamBannon/14/PDbkfin.html
[36] K. B. LeFevre, *Invention as a Social Act*. Carbondale: Southern Illinois UP, 1987.
[37] D. Haraway, *Modest_witness@second millennium.femaleman_meets_oncomouse*. New York: Routledge, 1997.
[38] A. Feenberg, *Transforming Technology: A Critical Theory Revisited*. Oxford: Oxford Univ. Press, 2002.
[39] B. Latour, *Pandora's Hope: Essays on the Reality of Science Studies*. Cambridge, MA: Harvard Univ. Press, 1999.
[40] Aristotle, translated by W. Rhys Roberts. (1954). Rhetoric. [Online]. Available: http://www.public.iastate.edu/~honeyl/Rhetoric/rhet1-2.html
[41] J. D. Slack, D. J. Miller, and J. Doak, "The technical communicator as author: Meaning, power, authority," *J. Bus. Tech. Commun.*, vol. 7, no. 1, pp. 12–36, 1993.
[42] S. Schneider, "Useable pedagogies: Usability, rhetoric, and socioculture pedagogy in the technical writing classroom," *Tech. Commun. Quart.*, vol. 14, no. 4, pp. 447–467, 2005.
[43] A. Brady, "Rhetorical research: Toward a user-centered approach," *Rhetoric Rev.*, vol. 23, no. 1, pp. 57–74, 2004.
[44] P. Ehn, "Manifesto for a digital bauhaus," *Digital Creativity*, vol. 9, no. 4, pp. 207–216, 1998.
[45] R. Spilka. (2005, Oct. 20). Technical communication research: A call for action. Keynote address at Conf. Council of Program in Technical and Scientific Communication, Lubbock, TX. [Online]. Available: http://english.ttu.edu/CPTSC_2005/CPTSC_2005Program.pdf
[46] R. R. Johnson, "Audience involved: Toward a participatory model of writing," *Comput. Composition*, vol. 14, no. 3, pp. 361–376, 1997.
[47] R. McGill Murphy. (2005, Jun. 1). Getting to know you: Microsoft dispatches anthropologists into the field to study small businesses like yours. Here's why. *CNNMoney.com* [Online]. Available: http://www.money.cnn.com/magazines/fsb/fsb_archive/2005/06/01/8261971/index.htm
[48] M. Barnett. (2005, Jun. 6). Keeping an eye on you. *USNews.com* [Online]. Available: http://www.usnews.com/usnews/biztech/articles/050620/20eespotlight.htm
[49] B. Mirel, "Advancing a vision of usability," in *Reshaping Technical Communication*, B. Mirel and R. Spilka, Eds. Mahwah, NJ: Lawrence Erlbaum, 2002, pp. 165–187.

Robert R. Johnson graduated from Purdue University, West Lafayette, IN, in 1991. He is Professor and Chair of the Department of Humanities, Michigan Technological University, Houghton, MI.

Michael J. Salvo graduated from Texas Tech University, Lubbock, in 2000. He is Assistant Professor at Purdue University, West Lafayette, IN, where he teaches professional and technical writing.

Meredith W. Zoetewey received the Ph.D. degree from Purdue University, West Lafayette, IN, in 2005. She is Assistant Professor of English at the University of South Florida, Tampa, FL.