Bridging the valley of death: The rhetoric of technology transfer

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Bridging the valley of death:
The rhetoric of technology transfer

by

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A dissertation submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

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ABSTRACT

This participant observer case study examines a new university institute that was established in 2007 to advance IT research and commercialization and to bridge the valley of death, a metaphor often used to describe the gap between university research and its commercialization. Using cluster analysis, this case study draws on Burke and Bourdieu to analyze the ways that rhetorical figures function to stabilize technology transfer by providing a framework for measuring its value and success. At the same time, that framework is always being constituted and is always contested. One key finding was a tension between a traditional Mode 1 conception of research and a more entrepreneurial Mode 2 conception, in which knowledge production is diffuse, crossing disciplinary and university boundaries. This case study highlights important trends in technology transfer, specifically in how university research is valued and success is defined by various stakeholders.
CHAPTER 1: INTRODUCTION

Contemporary discussions about technology transfer often hover around the tension between the traditional public role of the university and a more entrepreneurial one characterized by partnerships with industry. Many argue these partnerships are necessary not only to fund costly research programs, but also to stay competitive in a global economy. But others criticize these partnerships, saying such deals compromise academic freedom and remove knowledge from the public domain. One of the central issues in this division is the ways in which research is valued, whether as a public good or as a tool for economic development. Recently, the U.S. Department of Commerce (2008) and the National Science Foundation (2008a) called for new models to quantify the impact of the sciences and technological innovation on the U.S. economy. How do we measure the success of research programs, traditional or otherwise? As Mirowski and Sent (2002) argued, the answer to that question has often ignored the social structures of doing science in geographic, historical and economic contexts (p. 11). Many of these models also ignore language, or the rhetorical key figures, that give those models structure and meaning.

In studying technology transfer, I have long been interested in the rhetoric of technology transfer as economic development and the rhetorical figures that give that discourse meaning and structure. As Burke (1966) said, the terminology used in a discourse is a reflection, selection, and deflection of reality. “In brief, much that we take as observations about ‘reality’ may be but the spinning out of possibilities implicit in our particular choice of terms” (Burke, 1966, p. 46). Rhetorical analysis makes explicit the implicit assumptions and arguments of a given terminology. My question is what are the
assumptions and arguments that position technology transfer as economic development especially in relation to traditional narratives about science and technology?

This question is of increasing importance in a technological age when the complexities of today’s problems require a critical perspective about technological systems as a discourse with social, political, and economic dimensions. From the classical period to the present, the rhetorical tradition has been one of theories about language and the persuasive strategies involved in communicating complex knowledge to general or other specialized audiences. In technology transfer, the calls for new models to assess the impact of university research also means examining the arguments that underscore the model and the ways those arguments are authorized. This dissertation takes the position that technology transfer as economic development generates a different rhetorical ground for action than do traditional models that privilege the public good.

In this chapter, I outline this tension in technology transfer by analyzing a metaphor often used to describe the state of university research—the valley of death. As Coppola (2007) stated, technology transfer is often conceptualized in terms of barriers and bridges to success. And, although Coppola (2007) argued that the field needed a new metaphor to conceptualize the practice, these metaphors say a great deal about the context within which technology transfer is practiced.

The Valley of Death: A Gap Between Discovery & Application

In technology transfer, the “valley of death” is the metaphor often used to describe the gap between academic-based innovations and their commercial application in the marketplace. Although traditional definitions of technology transfer often assume a smooth
shift of intellectual property from university (or private) research laboratories to private or publicly held companies that commercially develop the technology, the valley of death suggests that the practice is anything but smooth. In fact, this rather grim metaphor implies that academic research is in some way cut off from the outside world. So why the valley of death and how do we get around it? These questions have taken on more urgency as funding agencies, ranging from the National Science Board to state governments, have increased pressure on university leaders to partner with industry, seeing technology transfer as integral to local economic development. As Cohen (2006) explained:

Communities are increasingly looking to their regional governments and universities to implement programs that stimulate the local economy. This community expectation is especially vocal when regions are trying to overcome an economic downturn (e.g. the post dot-com bust), or stimulate a particularly promising industry (e.g. nanotechnology). In response to these heightened outcries, government leaders eagerly assemble a plan corresponding to taxpayer-derived funding. Leveraging universities is frequently a key component of this solution (p. 27).

Although this idea of university research contributing to economic progress and public well-being is not necessarily new, its explicit connection to economic development is, signaling a change in the discourse about the systems and rules for managing science. As Mirowski and Sent (2002) said, “something rather drastic and profound has been happening to the social organization of science in America and Europe at the end of this century” (p. 3). In light of a newly globalized economy, those sweeping changes have a lot to do with accountability and impact of public funds.
But what precipitated those changes? Mirowski and Sent (2002) proposed three historical phases to describe science organization and funding in the United States, arguing that “each regime comprised a distinct set of structures that have in practice summoned quite differing versions of an ‘economics of science’ to justify and account for their regularities” (p. 12). The divisions are:

1. The protoindustrial regime (early 20th century to 1940), during which college and universities were organized primarily as an educational service; at this time, the U.S. federal government supported research through agricultural extension programs, what Miller (unpublished) identified as the “earliest systematic program of technology transfer” (p. 7).

2. The Cold War regime (World War II through the Cold War), during which federal policy and its support of research in the sciences and technology “created a situation in which teaching was now openly avowed to be complementary to research” (Mirowski and Sent, 2002, p. 18).

3. The globalized privatization regime (roughly the 1980s to the present), an era of shrinking federal budgets and changing policies regarding the expectations of individual faculty.

Each of these regimes are structured by routines, practices, and language that account for what researchers do on a day-to-day basis and the ways in which those activities are valued.

The distinctions among these practices have also been defined under what were first coined by Gibbons et al. (1994) as a Mode 1/Mode 2 framework for the sets of practices that characterize research. As defined by Gibbons et al. (1994), these modes do not represent a watershed moment in the history of science funding, but rather name a tension that describes
the structures of science and technology in an era of globalized privatization. According to Gibbons et al. (1994), “Mode 1 is discipline-based and carries a distinction between what is fundamental and what is applied; this implies an operational distinction between a theoretical core and other areas of knowledge such as the engineering sciences, where the theoretical insights are translated into applications” (p. 19). Under this mode, the research model is a linear one, in which knowledge “moves” from a disciplinary boundary out to a destination. By contrast, Mode 2 knowledge production is characterized by a diffuse trans-disciplinarity: “scientific, technological, and industrial knowledge production are becoming more closely connected,” resulting in open structures that blur distinctions not only among disciplines, but in what constitutes basic versus applied research (Gibbons, 1994, p. 48). In effect, this diffuse trans-disciplinarity disrupts the linear research model and its traditional categories and boundaries for what counts as knowledge production.

Furthermore, each of these modes has its own rules for what constitutes knowledge as wealth. One question that continually resurfaces in discussions about Mode 1/Mode 2 is the value of research. How are value and success defined in the new mode when its creation is de-centralized? In Mode 1, research proceeded under what Merton (1973) called the values of communalism, in which research is sanctioned and legitimized by the disciplinary community through its professional institutions (such as university departments, disciplinary journals, and professional meetings). Part of this value is constituted by the “disinterested” character of the scientist, which “equates scientists’ self-interest with the public interest to ensure that research contributes to the public good of expanding knowledge rather than to a narrower personal interest” (Lieberwitz, 2007, p. 56). Because narrower personal interests may have undue influence on the direction the research takes, the more disinterested, or what
Anthony Giddens (1990) called “disembedded,” the research is from its context, the more value it has as a public good. Because it was “made” outside of, and is therefore detached from, material interests, the knowledge is not tainted by those interests. It is pure.

But, how does this detachment work? As Giddens (1990) defined it, disembedding means “‘lifting out’ of social relations from local contexts of interaction and their restructuring across indefinite spans of time-space” (p. 21). It means erasing the traces of production. Giddens (1990) named two mechanisms for doing so: creating *symbolic tokens* and establishing *expert systems* (p. 22) or “systems of technical accomplishment or professional expertise that organize large areas of the material and social environments in which we live today” (p. 27). Furthermore, this “lifting out” of the local context, out of time and place, relies on abstract concepts, such as the *public good*, to organize the activity and practices taking place on the ground. In the case of technology transfer, these abstract concepts, or key terms, provide markers for defining the practices that are valued within that system.

For instance, the “disinterested scientist” took on value during the Cold War era of science funding and policies, which was marked by substantial federal presence in managing and financing academic science, by the large-scale development of Big Science and by the ideology of academic freedom—scientists needed to set their own research agendas outside of industrial interests (Mirowski and Sent, 2002, p. 20). The idea that scientists as experts required “disinterested” funds can be traced to Vannevar Bush’s *Science: The Endless Frontier* (1945). In his report to President Truman, he justified his recommendation to create a new governmental agency to fund long-range research programs by saying “the rewards of such exploration both for the Nation and the individual are great. Scientific progress is one
essential key to our security as a nation, to our better health, to more jobs, to a higher standard of living, and to our cultural progress” (p. vi). In the aftermath of WWII, this line of reasoning linked the need for renewed scientific talent and resources to progress and moving the nation forward.

But the justification also relied on solidifying the scientific community as an expert system: “Scientific progress on a broad front results from the free play of free intellects, working on subjects of their own choice, in the manner dictated by their curiosity for the unknown. Freedom of inquiry must be preserved under any plan for Government support of science” (Bush, 1945, p. 7). In other words, the scientific community needed to be left alone to do their work in the interests of the country. By privileging the sanctity of the research community, accountability is then couched in terms of scientific progress for the benefit of all—the public good, an abstract concept that transforms the institutional structure of the university from its pre-war service orientation to a post-war research orientation. It can do so, as Giddens (1990) explained, because the practice is disembedded from its context, serving “to open up manifold possibilities of change by breaking free from the restraints of local habits and practices” (p. 20). Additionally, it provides what he called “the gearing mechanisms” of modern organizations, giving them a dynamism for mapping local concerns on a globalized terrain. Concepts, such as the *public good*, “actively constitute what that behaviour is and inform the reasons for which it is undertaken” (Giddens, 1990, p. 41). In Burkean terms, it is “language as symbolic action” (1966, p. 44). Transformation happens via a common ground, in which key terms organize and generate systems and structures for its underlying activity.
But such transformation also relies on *trust* in the experts and the expert system engaged. Trust, as Giddens (1990) argued, “is much less of a ‘leap to commitment’ than a tacit acceptance of circumstances in which other alternatives are largely foreclosed” (p. 90). In technology transfer, that tacit acceptance of the model that accounted for the value of basic research began to erode in the 1980s. With falling productivity and stagnant economic growth in a newly globalized competitive environment, many began to question the efficacy of funding university research. As Kozmetsky (1990) characterized the situation, the traditional paradigm—in which industry concentrates on production and universities on basic research—failed to develop, commercialize, and diffuse technologies fast enough to sustain economic growth (p. 27). Mirowski and Sent (2002) called the separation of basic from applied science a “convenient fiction” that could not long be maintained in a changing economic climate (p. 23). Gibbons et al. (1994) pointed to an educated public that demanded accountability of public funding in light of several techno-science failures. In short, the value of research as a public good was held up for question.

**The Valley of Death: A Rhetorical Divide**

The power of these abstract concepts has to do with the continual negotiation and revision of their meaning. Although the *valley of death* suggests that technology transfer is about moving ideas from one entity to the next, technology transfer is about people in relationships. As Stephen Doheny Farina (1992) and later Nancy Coppola (2007) argued, technology transfer is about relationships and collaboration among individuals and groups (industry, government, and academia) with varied interests.
That is at their core these processes involve individuals and groups negotiating their visions of technologies and applications, markets and users in what they all hope is a common enterprise. This means that the reality of a transfer does not exist apart from the perceptions of the participants. Instead, the reality—what the transfer means to the participants—is the result of continual conceptualizing, negotiating, and reconceptualizing (Doheny-Farina, 1992, p. 4).

In Mode 1, the negotiated vision of technology transfer relied on a movement from basic to applied results, from expert systems to the public good. As a linear model, this conceptualization misrecognizes meaning as a transferable. Rather, meaning is always negotiated, always rhetorical.

But Mode 2 is also always negotiated, always rhetorical. To understand what constitutes its success means looking at the practice as it is made by its participants. This conception of technology transfer follows a definition of rhetoric as language mediating action: language organizes and generates reality (a provisional one) by providing a “ground” for taking action. This dramatistic view of language situates agents, their agency, and their motivation to act within context and structures. Following Burke, this “grounding” of action is dialectical in that one element defines the other. Burke (1969a) likened this dialectical relationship to an alchemic transmutation, in which the molten center is made and remade as various elements combine and congeal to make new forms (p. xix). This idea extends to the admixture and transmutation of Mode 1/Mode 2 knowledge production and the ways that each is enacted and transformed in relation to the other. As Bourdieu (1998) argued, value is constituted in the gap or difference between such categories: “when perceived through these
social categories of perception, these principles of vision and division, the differences in practices, in the goods possessed, or in the opinions expressed become symbolic differences and constitute a veritable language” (p. 8). As Bourdieu argued, linguistic competence is a kind of capital that can be exchanged for other types of capital, including monetary funds.

To explore how language constitutes value in technology transfers, I observed the Information Technology Institute¹ (ITI), which was established by Iowa State University’s (ISU) Board of Regents in May 2007 as a mechanism to bring together researchers, industry leaders and entrepreneurs, “pledging to turn a $1 million state investment into six new companies, three new industrial collaborations and a 40 percent jump in research funding” (Geoffroy, 2007). This pledge reflects a changing economic structure for organizing scientific research as profit centers that can generate intellectual property. In its own organization, however, the ITI experienced a lengthy and somewhat contentious definitional period. In the time that I observed the organization, its core members faced these challenges:

- Defining the organization’s mission and vision
- Instituting policies and procedures that met the needs of the university, the industrial partners, and other stakeholders
- Articulating the value of the organization to various stakeholders at an early stage of development, including university administrators as well as potential industry partners.

Although the ITI is a localized example, the problems it faced reflect larger issues in technology transfer as the practice is “grounded” by people with competing ideas over the ___________________________

¹Names of the organizations and the people involved have been changed.
value of research, working within organizational structures that both constrain and enable their actions. Although the linkages between technology transfer and economic development may seem logical and obvious, the valley of death continues to threaten organizations, including the ITI, as these various groups of people with diverse interests struggle to define a common ground that is mutually beneficial.

To analyze the ways in which that common ground is constituted by its participants, these questions guided my research and analysis:

1. What rhetorical devices are used to represent technology transfer to various stakeholders?

2. What role does ethos and representation of the organization play in defining the value and success of technology transfer? In other words, how does the organization represent its value and success?

3. How does audience affect the ways in which technological discourse is negotiated in public and private spheres, which is also to ask, how is the organization’s identity tied to other definitions of success and value in technology transfer?

In asking these questions, I was interested in the ways that ITI defined technology transfer, the places those definitions were contested and negotiated, and the language used to define its value and success to argue that technology transfer is constituted as a situated practice. As such, key terms, such as the public good and economic development, work to stabilize the activity by providing a framework for measuring its value and success. At the same time, that framework is always being constituted and is always contested. As Burke pointed out, the power of language and metaphor comes from the underlying conceptions of what it is not. It is in these ambiguities that concepts, such as technology transfer as economic development,
are both stabilized and uncertain—stable in that we can measure the value of an idea, uncertain because that measurement is always being constituted and is always contested.

The ways in which this discourse is constituted can also say something about our own agency when it comes to technological systems. As these systems get more complicated, there is often the sense that the systems have moved beyond our control. For instance, Dewey (1991), Heidegger (1977), and Borgmann (1999) all worried over a loss of agency and engagement in technological systems that are increasingly embedded in our day-to-day lives. When expert systems are so technologically sophisticated that they challenge the layperson’s ability to make decisions about the best route of action, who or what serves as the rhetorical ground for public deliberations about technological advances? Whose values are articulated in technology transfer as economic development? The results of this dissertation can lead to a critical discussion about our conceptual models for engaging in discussions about the development of new technologies.

In the chapters that follow, I address these questions. In Chapter 2, I provide a fuller account of the historical background in technology transfer, review current literature, and outline a theoretical framework that draws on Kenneth Burke and Pierre Bourdieu. In Chapter 3, I describe the methodology that framed my observations and analysis. Chapter 4 is a written account of my research and study of the Information Technology Institute. Finally, I conclude in Chapter 5 by suggesting that even though the ITI is but one case, the challenges it faced in defining its mission and articulating its vision represent larger trends in technology transfer.
CHAPTER 2: THEORETICAL FRAMEWORK

As a metaphor, the valley of death suggests that the path between academic innovation and its commercial application is a perilous and life threatening one at best. Indeed, regardless of its merit, an innovation’s success is never certain—many obstacles, including monetary resources, can stand in the way. But for public universities, the problems associated with the valley of death are compounded by the need to account for publicly funded R & D in academic sciences and engineering and to justify why those funds are necessary. In Chapter 1, I argued that terms, such as economic development, provide a framework for defining the value of success, stabilizing the uncertainties inherent in technology transfer as a practice. At the same time, that framework is always unstable as various interests compete to define the markers that are valued in the discourse.

In this chapter, I further develop that argument by examining the rhetorical ground in which a vision of technology transfer is negotiated and applied in a field of competing interests and motives. In doing so, I am interested in the use of rhetorical figures to constitute meaning and configure relationships and interests. As many have argued, technology transfer is not so much about moving ideas as it is about connecting interests: “That is, at their core these processes involve individuals and groups negotiating their visions of technologies and applications, markets and users in what they all hope is a common enterprise” (Doheny-Farina, 1992, p. 4). Technology transfer is a highly sophisticated rhetorical activity.

But since Doheny-Farina’s (1992), Rhetoric, Innovation, and Technology very little has been done to consider the rhetoric of technology transfer as an activity that is
continuously interpreted, negotiated, and re-negotiated by all the participants involved. In the current literature on technology transfer, these trends stand out:

- Models of technology transfer are often conceptualized as linear, point-to-point processes.
- Studies fail to broadly conceive characterizations of technology transfer’s success and value beyond the immediate participants—as a public good or as economic development.
- Few studies consider the language or key figures used to organize technology transfer discourse.

In this dissertation, I extend Doheny-Farina’s conception of technology transfer by looking at the ways in which key terms, such as the public good and economic development, direct, deflect, and reflect attention in the discourse. Following Burke’s ideas about terministic screens, terminology not only grounds the discourse, but it also reflects common interests or what Burke called consubstantiation. To move discussions about technology transfer forward means looking at how it is rhetorically figured, particularly in relation to the need to define models of success and the problem of who or what authorizes such criteria.

As I discussed in Chapter 1, ITI’s university research directors could not agree on the organization’s mission—what was at stake were differences in the model of success, between what Gibbons et al. (1994) called Mode 1 and Mode 2 knowledge production. In other words, ITI brought to the fore a clash of cultures between a research tradition that values the autonomy of the scientific community and a more entrepreneurial mode that includes “a wider, more temporary and heterogeneous set of practitioners, collaborating on problems defined in a specific and localized context” (Gibbons et al., 1994 p. 3). This new mode re-
conceptualizes knowledge not as a product or thing that moves from one locality to another, but as socially distributed across networks. Although one mode does not cancel out the other, they are seen as competing practices. In his discussion of the contrasting mentalities, Fuller (2006) succinctly identified the place of contention with the question, “to whom are you ultimately accountable for the quality of your research?” (p. 77). Practitioners in both modes are competing to define that accountability, each mapping out different definitions of technology transfer.

My project is to understand that map by analyzing the rhetorical figures that give the discourse shape and configure sets of relationships for who and what counts as research. In this chapter, I examine the ways that representations of technology transfer are used to create meaning, value, and presence by organizations such as ITI. In doing so, I am interested in how economic development is figured in technology transfer and what those configurations mean for the public good. As an interpretive and critical strategy, Burke’s method gives us a way to analyze these terms and their corresponding meaning and value as a discursive system. In the sections that follow, I situate ITI in an historical framework, discuss the limitations of hierarchical models of technology transfer, examine the concept of rhetorical figuration, and provide a Burkean framework for analysis.

**Historical Background**

Established in 2007, the ITI was created to bring together interdisciplinary faculty with industry leaders as a way to broaden the scope of research projects and to foster economic growth in the state. In many ways, ITI positioned itself as a response to the valley of death and current trends in funding academic science and engineering R&D. For one,
federal support for such research was in decline. In their *Survey of Research and Development Expenditures at Universities and Colleges*, the NSF found that in fiscal years 2006 and 2007 federal funding for such research failed to keep up with inflation (Britt, 2008, p. 1). These declines stood in stark contrast to the fairly consistent increases from 1972–2000 even after adjusting for inflation (NSF, 2008b, p. 5-5).

Furthermore, although the federal government has remained the largest source of funds for academic R&D, its share of the total has decreased, dropping from 64 percent in fiscal year 2005 to 62 percent in fiscal year 2007 (Britt, 2008, p. 1). As the NSF found, although the federal government’s share of the pie has increased significantly since 2000 when it provided 58 percent of the total, its share remains less than the 68 percent it provided in 1972 (NSF, 2008b, p. 5-5). Most interesting about NSF’s data, however, are those figures about nonfederal funding sources, which grew by 7.8 percent (or 5 percent in inflation-adjusted terms) in fiscal year 2007. Most notable of these increases are industry’s share of the total. In 2007, industry funding grew by 11.2 percent (Britt, 2008, p. 2), reversing three years of steady decline between 2001 and 2004. Despite these fluctuations, however, the overall trend for R&D has been one of general continuous growth in total funding and in share of support from the federal government and private industry. *R&D Magazine* called it a “monotonic trend” with “periods of retrenchment and readjustment, but always with the overriding pattern of general expansion” (Duga et al., 2008, p. 5).

In late 2008, even against a worldwide economic recession, *R&D Magazine* projected continued growth in its annual “Global R&D Funding Forecast.” But they were also quick to point to the “changing face of U.S. R&D” (Duga et al., 2008, p. 10), which complicated the projections they could make. Despite the stability and inertia of a well-established R&D
system, a “whole new generic set of actors” was creating rapid change (Duga et al., 2008, p. 4). In the past, their projections benefited from the relatively constant sources of research funds and types of research-performing institutions. But, increases in U.S. foreign outsourcing, increased foreign investment, and changes in the areas of technology pursued all contributed to a new instability that was difficult to gauge given the lack of historic data.

Against this backdrop of uncertainty, the ITI was also established in a culture of innovation, in which the idea that technology “drives” the economy was deeply embedded in the discourse—both in the popular press and in academic journals. For instance, in its September 22, 2008 issue, *Business Week* claimed that against the pessimism of America’s future, “economists and business leaders across the political spectrum are slowly coming to an agreement: Innovation is the best—and maybe the only—way the U.S. can get out of its economic hole” (Mandel, 2008, p. 52). Their question: How can smart ideas generate jobs and growth, keeping the U.S. competitive in a global marketplace? They concluded that throwing money at the problem was simply not enough. Rather what had to change were the ways Americans conceptualized the R&D process, recommending among other strategies that university and industry leaders step up their partnership efforts.

In academic circles, similar conversations were taking place. Scholars including Crow & Silver (2008) positioned this link between innovation and economic growth as a recent phenomenon, emerging over the last fifty years, and argued for new educational policies to respond to this demand (p. 290). Similarly, Lane (2008) argued that future federal expenditures on science and engineering research are going to be a major policy issue, cautioning that these research programs will be negatively impacted “unless new arguments can be made for favored treatment of R&D funds and new ways are found to deploy those
funds more efficiently” (p. 261). In 2008, the statement that innovation drives the economy was punctuated by questions surrounding current policies and practices for sustaining R&D networks in a globally competitive environment and the need to respond to a changing landscape for doing business.

However, questions about policies and practices in technology transfer are part of an extended conversation that dates prior to World War II. As early as the late 19th and early 20th centuries, technology transfer as a practice began to take shape in the agricultural experiment stations attached to land-grant colleges. Supported by state governments, university-based extension agents were sent out to work directly with farmers to diffuse information. Then, in 1914, with the Smith-Lever Act, federal dollars were added to those state and local funds to create an agricultural extension system. But as Alic (2008) found, the extension service was a response to a social problem, not a technological one. The objective was to raise the standard of living for farm families, many of whom lived in poverty and isolation without a network to learn about new innovations (p. 18). In their role, extension agents were teachers, demonstrating new techniques for working with livestock and crops. In this capacity, extension agents responded to local conditions, using innovation to solve practical problems in the field.

In general, around the turn of the 20th century, American research in the sciences and technology was relatively modest in scope. Outside of the extension services, universities received virtually no federal funding for research (Atkinson & Blanpied, 2008, p. 35). As Mirowski and Sent (2002) pointed out, Americans were skeptical of funding a scientific elite, regarding them as self-interested agents who could not be trusted to work on their behalf (p.
At this time, even with the extension services as an example, public funding for research was simply too radical of an idea.

Rather, the concentration of research resided in a few large corporations such as General Electric and American Telephone & Telegraph, which employed scientists and engineers mainly to protect the company’s standing and investments. As Reich (1985) explained, teams of researchers, who had little freedom over scope and nature of the work, toiled in an atmosphere of “rules, regulations, and red tape” with the expectation of producing a steady stream of results (p. 8). As a result, research directors tended to favor low risk projects that promised applicable results in the short term. In this scenario, science was driven more by maintaining a company’s market share than by groundbreaking discoveries. Defined by industry leaders and their managers, scientific research was about protecting the company’s bottom line.

That balance of scientific authority began to change after the Second World War, moving from largely corporate sites to university and federally-sponsored research labs. Following the war, the federal government took on a massive role in the funding and management of scientific research. During the war, the U.S. saw the power of science and engineering R&D in advances such as “radar, sonar, the proximity fuse, early computers, synthetic rubber, penicillin, sulfa drugs and other important innovations that contributed to the nation’s successful wartime effort” (Lane, 2008, p. 248). These innovations also included the Manhattan Project and MIT’s Rad Lab, federally funded research projects in which high risk paid off in high returns.

These wartime successes afforded a cadre of scientists the means to argue for further federal support of research projects aimed at discovery, not corporate interest. In *Science:*
The Endless Frontier, Vannevar Bush (1945), then director of the Office of Scientific Research and Development and advisor to Roosevelt and Truman, argued that given the importance of innovation to the successes of the wartime effort, federal funding of “basic” research was essential to the nation’s security and well-being, recommending that the research be located in universities and federal labs. This move not only helped to establish scientific authority in the university, it also institutionalized “big science” and “big technology” as systems of practice underwritten as a public good for the benefit of society.

As many have argued, Bush’s publication marked the beginning of an unwritten contract between academic scientists and the government; in exchange for government funds, academic scientists “discovered” the knowledge needed for the nation’s peace and prosperity. That knowledge became available primarily through publication in academic journals. The cornerstone of this narrative was a distinction between basic and applied science, two new categories that helped justify a substantial federal presence in science policy and planning. The result was a linear model for R&D in which knowledge moved from the source of discovery to an applied destination. According to Mirowski and Sent (2002), the linear model works in the following progression (p. 22):

“basic” science ⇨ “applied” science ⇨ “development” ⇨ production

In this model, scientists discover “basic” knowledge, which is then recorded as facts to be applied in other contexts. “Basic” in this sense meant “pure” research. Not being tied to corporate interests, scientists could pursue fundamental knowledge. Lab technicians “applied” those fundamentals, which were then “developed” by industry.
In this conceptualization, scientists were recast as *disinterested*, unencumbered by bottom-line politics of the corporate world. In making his argument, Bush (1945) claimed scientists had to be left alone to “win the Cold War” and the “fight against disease.” In other words, for peace and prosperity, scientists needed academic freedom to pursue research agendas defined by the scientific community rather than by industry leaders. In effect, this interpretation helped to institutionalize authority in the academy, creating boundaries around what counted as research problems and who got to solve them.

But this move was a rhetorical style described by Gieryn (1983) as *boundary work*, “in which scientists describe science for the public and its political authorities, sometimes hoping to enlarge the material and symbolic resources of scientists or to defend professional autonomy” (p. 782). In other words, science as a *public good* created a narrative around opposing categories that defined the boundaries of the activity: experts and non-experts, “basic” and “applied” research, theory and practice, and “disinterested” and “interested” scientists. Following World War II, this new hierarchy worked well in the light of protecting national interests, particularly military ones, from the threats of the Soviet Union and its allies. But with the end of the Cold War, one of this model’s key structural concepts—academic freedom—came under attack: “the academic freedom defense of self-directed inquiry grew to sound increasingly like an exorbitant luxury, if not a hollow catechism” (Mirowski & Sent, 2002, p. 30). With the justification to win the Cold War removed, the boundaries and distinctions surrounding science as a *public good* became difficult to maintain. The question is why.
**Technology Transfer: Hierarchical Models**

As a rhetorical move, the new narrative that privileged “basic” science as the starting point for knowledge production also helped to establish scientific authority in the university. While that category worked to professionalize a scientific community, it also created a technical sphere that stood apart from the public, making knowledge an output or thing that ended in public consumption—a trickle-down model of economics. But this model, based on the idea of supply and demand, is a double-edged sword. On the one hand, it established an expert community. On the other hand, when that expert community failed to provide the output deemed sufficient for the input, it lost authority with a dissatisfied public sphere.

In many ways, technology transfer is a by-product of this narrative. Although scholarly interest in the transfer of technology began in WWII with the connections between science, technology, and the military, the term was not actually used until the 1960s. As Carolyn Miller (unpublished) found, federal programs in the early 1960s were not talked about or promoted in terms of technology transfer (pgs. 8–9). Rather that term arose out of the need to show that publicly-funded research had a public benefit, “specifically in the weakening of the postwar consensus about the federal government’s role in supporting R&D” (Miller, unpublished, p. 5). A sluggish national economy provided an opening for public questions about whether the massive federal expenditures in basic science were creating the social benefits that Bush had promised in 1945.

By the late 1970s and early 1980s, another narrative began to emerge, one that began to pay attention to the demand side of the economic equation. Traditional justifications for Mode 1 research based on peace and prosperity began to give way to a “cooperate to compete” narrative that encompassed the needs of business and industry. That need was for
research that had value now, rather than somewhere down the road. In the technology
transfer literature in the late 1980s, many scholars began to question whether the traditional
paradigm, in which universities concentrate on basic research and industry on production,
made sense. As Kozmetsky (1990) argued, “technology innovation is taking on an ever-
increasing importance for setting our future domestic economic course as well as establishing
the nature of U.S. world economic leadership” (p. 22). In a globalized marketplace,
knowledge production was increasingly recognized as diffuse, disparate, and intricate in
composition. But, the traditional paradigm failed to develop, commercialize, and diffuse
technologies fast enough to sustain economic growth (Kozmetsky, p. 27).

What Kozmetsky (1990) was talking about was the valley of death. Conceptually, the
linear model that justified Mode 1 practices creates a gap between the technological and
public spheres. In their work, Williams and Gibson (1990) identified three models that have
time.

• **Appropriability** – The quality of the research defines the movement of ideas to the
  marketplace. The metaphor in this model is the “better mousetrap”—in other
  words, good technologies sell themselves.

• **Dissemination** – The expert informs willing users, who automatically adopt new
  technologies: “the new technology will flow from the expert to the nonexpert
  much like water through a pipe once the channel is opened” (Williams & Gibson,
  1990, p. 15).

• **Knowledge utilization** – Both parties identify the facilitators and barriers to the
  transfer, valuing interpersonal communication between researchers and clients.
Underlying each of these models is the assumption that technology transfer is the result of an automatic process: knowledge moves from one location to the next, from the scientist to the technologist to the capitalist. Even in the knowledge utilization model, a linear bias tends to reduce the overall process to chronological, one-way steps towards completion. It does so by making invisible any barriers that might prevent such movement.

With knowledge as an output, problems associated with the valley of death have been viewed in terms of bridging the gaps in the linear progression as knowledge moves from its source to a destination. For instance, in 1980, the U.S. Congress passed the Bayh-Dole Act, which provided the legal framework for universities to patent and license federally-funded research. According to the Council on Governmental Relations (1999), this act was in response to a debate surrounding the government’s “lack of success in promoting the adoption of new technologies by industry” (p. 2). The COGR stated that this was partly because of inconsistent policies and practices among governmental funding agencies, resulting in a “very limited flow of government funded inventions to the private sector” (p. 2). In the 1980s, the idea was to infuse the marketplace with academic innovations by removing the legal barriers and providing incentives for academics to transfer their work to the market. But do such solutions for increasing the flow of invention achieve their goal or do they simply reinforce a linear model by assuming that if the conduits are opened, the problem will go away?

The danger of models with information transfer at their core is that they often assume an illusory rhetoric of neutrality. As Miller (unpublished) suggested, the term technology transfer has become transparent and naturalized as a physical activity that moves a product from its origin to destination, making it hard to notice the motives and conflicts of interest
that may underlie the transfer (p. 4). And even though information transfer models are still in use and even advocated as a basis for ethical standards because they privilege clarity, directness, and accessibility (Eubanks, 2001, p. 113), this kind of model neutralizes the power of language. Although many have recognized the need for a new model, articulating a new one has been difficult. As Doheny-Farina (1992) argued, knowledge does not reside in the objects or texts or participants in the transfer. Rather knowledge is “what the participants construct and agree upon” (p. 17). As highly rhetorical processes, technology transfer is a process of continuous interpretation, negotiation, and re-negotiation of meaning by all the participants involved.

In those negotiations, there is a lot of resistance to the pressures that Mode 2 has put on practices. Some have argued that the net result of the Bayh-Dole Act is that the public pays twice for research, thereby undermining the public mission of the university. For instance, Lieberwitz (2007) reiterated a common viewpoint when she argued that the focus on the market as a valid or even superior destination for research results changes the view of the university as a public repository of knowledge (p. 61). Lieberwitz cautioned that the social cost of removing academic discoveries from the public domain are high and questioned whether private entities should own and profit from publicly funded research through patents and licenses. “By permitting universities to patent their federally funded inventions, the Bayh-Dole Act creates a double cost to the public, as the public initially pays for federally funded university research and pays again when the federally funded invention is removed from the public domain under a university-owned patent” (Lieberwitz, 2007, p. 61). In addition to the double cost of research, other social concerns include the public perception of research—is the research free of corporate influence? (Lieberwitz, 2007, p. 62).
As Rae-Dupree (2008) characterized the situation in the *New York Times*, one of the unintended consequences of the Bayh-Dole Act was to put profit ahead of wonder.

Against these criticisms of Mode 2 research practices, however, others claim that research based on industry partnerships is more transparent because more people have a say in the problems that are addressed. Gibbons et al. (1994) maintained that because of the varied composition of Mode 2 research teams, “social accountability permeates the whole knowledge production process. It is reflected not only in interpretation and diffusion of results but also in the definition of the problem and the setting of research priorities” (p. 7). In many ways, the linear model is inverted. Instead of moving from theory to practice, practice is valued as informing theory. As Fuller (2006) noted, in this new configuration, rhetoric is an ethic of productivity versus one of receptivity to new discovery (p. 71). In the tension between Mode 1/Mode 2 research practices, criticism has centered on the question of whether productivity represents a better measurement than receptivity and whether it really is a more socially accountable practice and a wise use of public funds.

Nevertheless, the pressure to increase Mode 2 research practices remains strong. In January 2008, the Chair of the National Science Board responded to the 2008 *Science and Engineering Indicators* report with a policy statement that made specific recommendations to redress declining support for U.S. research and development. In addition to recommending that the federal government increase its funding levels for basic research, he urged “industry, government, the academic sector, and professional organizations [to] take action to encourage greater intellectual interchange between industry and academia” (NSF, 2008a, p. 6). The NSB reasoned that this interchange is necessary for academic researchers to understand “the major research challenges that face U.S. industry and industrial
competitiveness” (NSF, 2008a, p. 5). They warn that the costs of not working together may be severe, particularly for U.S. companies to be able to compete in international markets and to employ the highly skilled engineers and scientists needed at home.

Other reports echoed this sentiment that for increased dialogue and partnerships among industry, government, and the academic sector. In a report funded by the U.S. Small Business Administration, Palmintera (2007) identified many factors that influence the capacity for universities to translate research results into commercially viable products and process, including resources such as financing, capital, and the skills needed to act as an entrepreneur. “The ‘commercialization side’ of research has been the missing link in the pipeline that moves innovation from research to the marketplace. NSF and national policy makers should not only be concerned about expanding the research pipeline but also accelerating the research through it” (Palmintera, 2007, p. ix). Again, the danger of not doing so relates to concepts of American productivity and competitiveness.

In addition, state governments have asked universities to expand the scope of their relationships. For instance, the State of Iowa’s Department of Economic Development commissioned the Battelle Memorial Institute to recommend ways to increase economic development activity in the state’s biotechnology, advanced manufacturing and information technology sectors. In their report Iowa’s Information Technology Strategic Roadmap, one key recommendation was to “increase R&D and technology relationships between Iowa IT industry and Iowa universities” (Battelle, 2005, p. xvi). Based on input from industry and government leaders, Battelle (2005) identified “key observed issues and gaps along the continuum from research to commercialization and IT business growth” (p. xvi). In addition
to issues relating to infrastructure and capital, IP ownership, and incentives for faculty and business, Battelle (2005) identified the need for the following:

- Need to increase proactive outreach by Iowa’s universities to gain awareness of their research capabilities
- Need dialog between key Iowa technology industry and universities regarding key priorities for future research
- Need to raise the profile of Iowa as an IT state (p. xvii, emphasis in original).

Although Battelle (2005) recognized that Iowa cannot expect to compete with states such as California, Massachusetts, Virginia, and Maryland in IT breadth and depth, it argued that Iowa has the ability to develop focused niche areas, targeting specific opportunities. Those opportunities, and their first strategy in their roadmap, are primarily based on a greater interchange between its universities and industry leaders.

What is at stake in the dialogue surrounding Mode 1/Mode 2 is not a crisis of normal science in which one paradigm replaces another. Rather the crisis is about managing boundaries and identities. In The Structure of Scientific Revolutions, Kuhn (1996) noted that the differences in paradigms are not only about the accumulated facts and theories within a field. More specifically, “they are the source of the methods, problem-field, and standards of solution accepted by any mature scientific community at any given time.” (p. 103). For Kuhn (1996), the replacement of one paradigm for another necessitates a redefinition of problems, standards, and methods for accumulating facts and theories. He envisioned a gestalt-switch between old and new and between speculation and real scientific solution. For Kuhn (1996), the result is incommensurability: “The normal-scientific tradition that emerges from a scientific revolution is not only incompatible but often actually incommensurable with that
which has gone before” (p. 103). In this sense, the old and new paradigms represent different worlds, each having its own vocabulary for theorizing facts and solutions.

But the problem with Kuhn’s vision is that it fails to recognize the exigencies of doing science and technology in an economic, social, and historic context. As Lessl (2005) argued, the boundaries of science are not just defined by internal scientific debate, but are also shaped by the broader world-view operating in society and culture. Specifically, M2 brings foreword issues about the freedom those outside the scientific community have in interpreting science. The crisis becomes one of managing boundaries and identities when authority is dispersed and direct access is allowed.

**Figuration: Managing Boundaries**

To see the points of contention and what is at stake means looking at the arguments that constitute Mode 1 and Mode 2 as structured discourses. As I have discussed, one of the key structural concepts in Mode 1 is the idea of the *disinterested* scientist doing “basic” or *pure* research motivated by discovery. The power of Mode 1 has to do with this positioning of the scientists as presenting substantive facts arrived at logically and without influence. In rhetorical terms, this presentation of fact assumes that language can be used unambiguously. Halloran and Bradford (1984) noted two characteristics of scientific and technical writing, with the first being the writer’s intention to “convey one and only one meaning” (p. 182). Ideally, scientific language is as concrete and exact as mathematics. The second characteristic of scientific prose is the absence of the writer, using “plain” language to suppress the writer’s individuality and personality. In other words, the style is considered arhetorical. As Crick (2004) said, the dividing line between science and rhetoric has been
traditionally drawn between logic and persuasion, and between substance and style, or what Lanham (2006) called “stuff” and “fluff.” Much activity in science is about proving it is not rhetorical, that its facts are logical and objective. In other words, the facts stand on their own. Scholars in the social sciences have described the ways that objectivity is constructed in scientific discourse. For instance, Latour and Woolgar (1986) discussed the transformation of conjecture into scientific fact. They called such transformation a process of “purification,” during which the observer and observed disengage from one another. In this disengagement, the observed is an “object” that can be examined in isolation by the observer. Latour and Woolgar (1986) argued that this objectivity is achieved through transcription devices, such as lab notebooks and reports, that record information about the substance. Once recorded, the information is then transformed into figures and diagrams that represent the substance. In that representation, the substance is bracketed off from the activity that created it, and the representation becomes the starting point for articles and discussions (p. 51). “An ‘object’ was thus achieved through the superimposition of several statements or documents in such a way that all the statements are seen to relate to something outside of, or beyond, the reader’s or author’s subjectivity” (p. 84). By erasing all forms of production, facts are stabilized as objective reports, creating a rift between ‘object’ and ‘subject.’

Although Latour and Woolgar (1986) considered the boundaries between subjectivity and objectivity, Haraway (1997) analyzed who and what is included within the boundaries. Drawing on Robert Boyle’s demonstrations of the vacuum pump in the seventeenth century, Haraway (1997) theorized how the roles in science are constituted. The modest witness is a key figure in her story:
The legitimate and authorized ventriloquist for the object worlds, adding nothing from his mere opinions, from his biasing embodiment. And so he is endowed with the remarkable power to establish facts. He bears witness: he is objective; he guarantees the clarity and purity of objects. His subjectivity is his objectivity (p. 24).

The modest witness embodies the separation of expert knowledge from opinion and the technical from the political. As such, this figure occupies a “culture of no culture,”—a culture stripped of persuasion and fluff (Haraway, 1997, p. 25). Such a position is what she called the “founding gesture” of the modernist narrative and its distinction between experts and nonexperts. Haraway (1997) called this distinction figuration: “performative images that can be inhabited” (p. 11). In other words, figuration constructs the identities and roles that various actors in the process play. The rhetorical style is the substance of the discourse.

This idea of figuration follows and extends a rich rhetorical tradition about the relationship between style and substance. In classical rhetorical theory, Quintilian (1856/2006) identified two definitions of figures:

The first signifies the form of words, of whatever it may be, just as our bodies, of whatever they be composed, have a certain shape. The other, which is properly termed a figure, is any deviation, either in thought or expression, from the ordinary and simple method of speaking, just as our bodies assume different postures when we sit, lie, or look back (9.1.10).

In the first definition, figures are the form itself; in the second, the form is postured—“a form of speech artfully varied from common usage” (9.1.14). Quintilian seemed to favor the second of the two views. Like tropes, figures take a turn or deviate from direct language.
They artfully shape ideas to give what he called “force” and “grace” to our speech. But he also stated that figures of speech are not to be taken as mere ornamentation, making what we say more attractive. As Quintilian (1856/2006) said, “though figures may seem of little importance in establishing a proof by which our arguments are advanced, they make what we say probable and penetrate imperceptibly into the mind of the judge” (9.1.19). The “force” and “grace” of figures get their power by making an impression on the mind of the audience.

In his definition of figures, Quintilian highlights an important and continuing problem: a divide between the literal and tropic. Central to scientific authority is the idea of a literal language. As Halloran and Bradford (1984) pointed out, the ambiguity of figures, particularly tropes, runs counter to the scientific enterprise. “Modern science has been slow to acknowledge its use of figurative expression, probably due to the long-standing tradition which contends that the figures are not suitable for scientific and technical discourse” (Halloran & Bradford, 1984, p. 180). They traced the reaction against figurative language to the emerging sciences in the seventeenth century, which opted for a plain style over the ornate Renaissance style, a “confusing verbal smoke screen, a cloak of mystical gibberish with the antithetical goals of expression and obscurity” (p. 181). As they stated, Francis Bacon and others sought to uproot the view that science was little more than witchcraft or verbal smoke screens of gibberish. The plain style tradition advocated in the seventeenth century is still valued. Although figures add to comprehension, they violate “correctness” when they embellish the facts.

A two-domain theory of language, in which some language is literal and other figurative, creates the idea that language can be concrete and exact. It also allows the writer to remain distant from the content. Hence, passive voice is often favored, letting the objects
stand on their own representation. But as Fahnestock (1999) asked, “At what point do the figures cease and does ‘ordinary language’ take over?” (p. 37). Although Quintilian settled on figuration as artful variance from common usage (9.1.14), he acknowledged the evident sophistry of language, “for the same things are constantly expressed in different ways, and the thought remains the same while the language is altered” (9.1.16). Though the same idea may be expressed differently, its essence remains intact. Such a conception raises the question of which expression is literal and which is extraordinary. As Lanham (2006) argued, “rhetorical figures are patterns of speech or writing that provide patterns for thought.... The figure itself is dead simple: It is a fundamental template, a basic habit of mind in how we pay attention to the world” (2006, p. xiii). As a fundamental template, rhetorical figures give voice to interests and principles within an historical and cultural context. It places the modest witness back in context, as a construct with a history and persuasive power.

As I argued in Chapter 1, the terms economic development and the public good also figure the discourse and stabilize the activity by providing ways to define success in the transfer of technologies. But these terms are also conflicted and unstable among those who have a stake in how technology transfer is practiced and who gets to participate. In her essay “Power, Technology, and the Phenomenology of Conventions,” Star (1991) argued that in the processes of standardizing and stabilizing sociotechnical networks, power comes from being able to navigate or negotiate insider/outsider status. Part of the process of negotiating that status has to do with stabilizing the people, the technology, the partnerships, and the meaning of the activity long enough to develop a narrative that makes sense to its stakeholders. Star (1991) concluded that power is about “whose metaphor brings worlds
together, and holds them there” (p. 52). It is the central metaphor that sets the standards and conventions for the collective and has power to authorize discourse.

Why do these figures have so much persuasive power? From Aristotle, we understand rhetoric as the art of persuasion to unite speaker and audience. But how does that connection happen? As Bitzer (1959) suggested, “The aim of rhetorical discourse is persuasion; since rhetorical arguments, or enthymemes, are formed out of premises supplied by the audience, they have the virtue of being self-persuasive” (p. 408). While typically defined as a syllogism with a suppressed premise, enthymemes are more than a strategy for constructing an argument. Rather, they are the strongest of possible proofs because they are jointly produced in a “cooperative interaction between the practitioner and his hearers” (Bitzer, 1959, p. 407). As Crick (2004) noted, what makes enthymemes successful is not that the audience provides the right piece of an incomplete picture, but that “they can cooperate with the speaker in creating an entirely new picture” (p. 24). Power comes through this joint effort to understand the situation at hand.

Many have expanded Bitzer’s view to argue that enthymemes are not just cooperative interaction, but a structuring principle of discourse—they rhetorically constitute a framework for common interests to take shape. Crick (2004) argued that this kind of space is necessary: “it provides a common ground on which imagination and reason can stand together to form new ways of understanding the world around us” (p. 38). What we know as science is built on cooperative interpretations of the world in which we live. Figures, such as enthymemes, provide a rhetorical space for that cooperative interpretation to work itself out.
As a rhetorical space for cooperative interpretation, figures can also operate as boundary objects for reconciling meaning. In their work, Star and Griesemer (1989) defined a boundary object as follows:

An analytic concept of those scientific objects which both inhabit several intersecting social worlds… and satisfy the information requirements of each of them. Boundary objects are objects which are both plastic enough to adapt to local needs and the constraints of several parties employing them, yet robust enough to maintain a common identity across sites (p. 393).

As Star and Griesemer (1989) argued, boundary objects help develop and maintain coherence across heterogeneous groups. They can do so because their structure is recognizable to more than one group. For instance, in the sciences, figures such as the public good are ambiguous enough and specific enough to manage the translation of various interests into a common goal.

The structure of figures is a key insight to their function as a boundary object. Although figures may have different meaning to different people, they represent lines of argument and reasoning. As Fahnestock (1999) argued, what figures do particularly well is communicate arguments and reasoning iconically. In her analysis of scientific figures, she defined figures as epitomes or “techniques of scientific reasoning” that epitomize analogical patterns of thinking. Fahnestock (1999) asked:

What does it mean to say that a verbal figure epitomizes a line of reasoning? An epitome, from the Greek verb meaning ‘to cut short or cut upon,’ is in one sense a summary, an abstract containing all the essential parts of a larger work or text, and, in a slightly different sense, it is a representative or exemplary
selection from and then substitution for something longer. The figure, then, is a verbal summary that epitomizes a line of reasoning. It is a condensed or even diagram-like rendering of the relationship among a set of terms, a relationship that constitutes the argument and that could be expressed at greater length (p. 24).

As epitomes, figures both abstract from and act as substitutes for larger works and texts. They represent the essential parts of an argument. But, they also represent relationships among terms and, as such, are integral to constructing scientific thought. For instance, terms such as the *public good* are figured against what they are not.

In short, figures oscillate between “stuff” and “fluff,” in which the substance and style are inseparable. By examining the figures that constitute technology transfer, we can analyze the boundaries that both constrain and enable its practices. In the 1960s, *technology transfer* as a term helped provide a rhetorical space to account for publicly funding university research programs. We might ask how the term acted as a boundary object and what other devices figured the discourse. As epitomes, the figures in technology transfer not only summarize the reasoning behind systems of practice, but they also express relationships across boundaries, describing the interests of various groups who have a stake in how those practices are defined, including universities, businesses, governmental agencies, and the public. As boundary objects, the figures epitomize strategies for consolidating and describing scientific authority.

The question I ask is how have the figures that constitute technology transfer changed in the nearly 50 years since the term was coined? Furthermore, whose values, truths, and
principles are figured in that discourse, and how do those values gain authority and legitimacy? Finally, what has happened to the public good?

**Rhetorical Framework**

In the chapters that follow, I analyze the rhetorical figures that epitomize technology transfer as it is situated in an historical and cultural context. To do so, I draw on Kenneth Burke’s theory of language as symbolic action. As Burke (1966) argued, language doesn’t convey information, but is rather an “aspect of ‘action’, that is, ‘symbolic action’” (p. 44). As symbol-using animals, we externalize who we are in language. As action, language is the substance of our material practices, the starting point or basis for our interactions in the world. From the Greek word *hypostasis*, meaning that which stands under, substance for Burke (1969a) is metaphorically that “which lies at the bottom of a thing, as the groundwork, subject matter” (p. 23). As substance, language sets the stage for people to identify and connect interests and ideas and is an act for organizing those interests in material practices. In other words, human interaction is rhetorical.

Central to his theory is that key terms in the discourse generate and organize what we know as reality. As Burke (1966) said in *Language as Symbolic Action*, our terminology directs, reflects, and selects reality. Terministic screens filter the ways in which we perceive, record, and interpret an event. As Burke (1966) pointed out, “we must use terministic screens, since we can’t say anything without the use of terms; whatever terms we use, they necessarily constitute a corresponding kind of screen; and any such screen necessarily directs the attention to one field rather than another” (p. 50). Even scientific discourse, in which scientists can take on the role of an objective reporter, is figured within terminologies that not
only reflect those observations, but also direct and select the realm of possibilities. As Burke (1954) made clear, what we know about the world is implicit in how we talk about it, saying:

Indeed, as the documents of science pile up, are we not coming to see that whole works of scientific research, even entire schools, are hardly more than the patient repetition, in all its ramifications, of a fertile metaphor? Thus we have, at different eras in history, considered man as the son of God, as an animal, as a political or economic brick, as a machine, each such metaphor, and a hundred others serving as the cue for an unending line of data and generalizations (p. 95).

Each of these metaphors acts as a lens that frames a field of observation and directs an interpretation of reality. As Crusius (1999) explained, in Burke’s view, it is not “data” or “reality” that drive research. If that were so, the same story would be told again and again in each area of inquiry. “Rather than the data compelling conclusions, the conclusions are implicit in our frameworks of interpretation, each with its own ‘fertile metaphor’” (Crusius, 1999, p. 61). Data and reality are a result of our interpretive frameworks that tell us where to look, what to observe, and what counts.

But such an interpretation of language does not presume that language determines our actions or that humans have no agency. As Crusius (1999) said, Burke “is unwilling to part with the individual moral agent because that would mean parting with the rhetor. If language amounts to strategies for encompassing situations, there must be a strategist” (p. 85). As strategist, the rhetor negotiates a point of view, or what Burke (1954) called “orientation,” a “bundle of judgments as to how things were, how they are, and how they may be” (p. 14). Our orientation is about our sense of relationships and the expectations surrounding conduct
and what is proper. As Burke argued, orientation is largely bound up with motives and our sense of why people act the way they do. Motives in this sense are a response to a situation, an externalization of an action, particularly in instances of conflicting stimuli. “A motive is not some fixed thing, like a table, which one can go and look at. It is a term of interpretation, and being such, it will naturally take its place within the framework of our Weltanschauung as a whole” (Burke, 1954, p. 25). The assigning of motives, then, is a matter of appeal, of aligning and articulating one’s interests and expectations in cogent terms and as part of a set of relationships.

As interpretations of reality, motives represent a stance that one takes in response to a larger situation. But these interpretations are realized and articulated through language. As such, Burke makes no distinction between literal and figurative language—all language is figurative. Crusius (1999) described Burke’s definition of reality as “not a neutral ‘thereness’ but the projection of a ‘chosen’ (actually mostly learned or inherited) description” (p. 61). In other words, language always mediates our reality, and as Crusius said (1999), “is the medium in which we live” (p. 62). By collapsing the literal/figurative distinction, Burke’s method lets us look at the power and currency of metaphor and other rhetorical figures as they are constituted in relationships among people who act with a purpose and within a social context.

Furthermore, by erasing the distinction between the literal and figurative, all language is rhetorical. No language is privileged as unmediated or neutral. Burke (1969b) defined rhetoric as a function, a realistic act, necessary to social cohesion and cooperation, moving the key term in rhetoric from “persuasion” to “identification.” In doing so, we can understand rhetoric as negotiated in relationships between rhetors and audience. This does not mean,
however, that persuasion is no longer functional. From classical rhetorical theory, we
understand persuasion as the key term for analyzing discourse. For instance, Aristotle (trans.
2007) defined rhetoric as “an ability, in each [particular] case, to see the available means of
persuasion” (p. 37), extensively categorizing and cataloging techniques public speakers used
to help their auditors come to a decision. It is the art of seeing the means of persuasion in a
given situation. But as Charland (1987) pointed out, “persuasion” as the key term suggests
that an audience exists prior to and apart from the discourse to be judged: “it assumes that
audiences, with their prejudices, interests, and motives, are given and so are extra rhetorical”
(p. 133). In this assumption, “persuasion” as a term separates the audience from the discourse
and fails to conceptualize the audience as integral to and participating in the discourse.

With “identification” as rhetoric’s key term, we can rethink the role of the audience.
Rather than standing apart, the audience embodies the discourse. In Burke’s terms, the
audience and speaker are consubstantial. Burke (1969b) explained this idea as follows: A and
B are not identical. “But insofar as their interests are joined, A is identified with B. Or he may
identify himself with B even when their interests are not joined, if he assumes that they are, or
is persuaded to believe so” (p. 20). In this relationship, however, even though A and B are
substantially one, they are separate, “at once a distinct substance and consubstantial with
another” (p. 21). This doctrine recognizes the give and take of identifying and aligning
interests among various people and organizations. That alignment happens through figured
language: “we might well keep in mind that a speaker persuades an audience by the use of
stylistic identifications” (Burke, 1969b, p. 46), identifying interests to bring the two
together—to identify with one another. Rhetoric is a joint act of speaker and audience.
By examining the terms in technology transfer, we can get at the *substance* that stands under and “grounds” the discourse in an historical moment. Burke’s definition of rhetoric lets us see interpretation, terminology, and persuasion within a larger framework that includes not only the speaker, but also the motives that ground the action and the resources that bring interests together. As Crusius (1999) argued, for Burke nothing is more ‘substantial’ than interpretation, the logic of language, and persuasion (p. 121). “For substance, in the old philosophies, was an *act*; and a way of life is an *acting-together*; and in acting together, men have common sensations, concepts, images, ideas, attitudes that make them *consubstantial*” (Burke, 1969b, p. 21). Language encompasses those actions. With this framework, we can ask about the strategies the rhetor uses to bring together common interests and that drive an interpretation of reality. In this way, the rhetor’s agency is constituted through those strategic moves and interpretations.

But understanding the rhetor as strategist also means looking at the cultural, social, and economic practices that create meaning and value. In practice, technology transfer is about the interchange among individuals and collectives, following social practices that have regularized rules, resources, and properties—an embodied history of dispositions and distinctions which generate and organize practices and representations. As Bourdieu (1998) argued, *difference* is nothing other than “a gap, a distinctive feature, in short a *relational* property existing only in and through its relation with other properties” (p. 6). For Bourdieu, social spaces are not external to the individual, but are produced and reproduced in relation to a set of distinct and coexisting dispositions. This theory of difference or *distinction* gives us a way to examine the relative value or the symbolic capital of certain gestures, routines, and positions as economic and cultural power.
A key concept in Bourdieu’s theory of distinction is that of “routine” or the habits of daily life that are for the most part transparent. As Faber (2002) said, routines are the “touchstones” in our daily activities that help us interpret and structure our interactions without spending a lot of time thinking about what we are doing. It is what we accept uncritically. Bourdieu (1990) called this act the *habitus* or “the embodied history, internalized as second nature and so forgotten as history” that give practices a relative autonomy (p. 56). These routines and habits are the unconscious acts that people use to interact within larger societal structures. *Habitus* acts as a system of cognitive structures that is generative, durable, and transposable. In other words, it is both product and producer of history and it can be altered in form. Central to this scheme of perception and appreciation is language as marks of distinction, identification, and division. In other words, language is the symbolic capital through which people perceive and recognize difference and value, a kind of capital that can be exchanged for other types of capital, including monetary funds.

In light of Bourdieu’s ideas about *distinction*, we might ask about the relative value of key terms in technology transfer. To extend Burke’s theory that terms encompass a situation, we might consider the value of key terms in a discourse in relation to an organization’s ability to generate interest and create the relationships needed to build and sustain the organization. Faber (2002) called this ability “image power,” arguing that power in organizations comes from the ability to manufacture and control an external image that has holding power in the minds of its stakeholders. “*Image power* is not constant but situational and highly dependent on context. It enables people to define others while resisting definitions of one’s self. Image power can be fleeting and always operates in strategic accordance within and against existing structures” (p. 122). That power comes through knowing how those key
terms translate into routines. It comes from knowing the terms of the discourse. As a case study, the ITI is interesting because its discourse calls into question the traditional, taken-for-granted discourses that have stabilized science and engineering as institutionalized practices. One way to understand how that stability is managed, maintained, and even altered is to analyze the rhetorical figures that ground the rules and systems in routines and habits.

**Conclusion**

One of ITI’s key challenges was to communicate its interests. But as Burke said in *Permanence and Change*, “the mere fact that something is to a man’s [sic] interests is no guaranty that he will be interested in it” (p. 37). Even if the communication is stated clearly, it is hardly communication if the auditor isn’t interested. In the case of ITI, its directors struggled with defining those interests internally to each other and externally to potential investors. The central question they had to answer was how do we define and communicate the value of the institute to a variety of stakeholders, having their own interests and motives for working with the institute, or not. And, as Burke (1954) concluded, “we may interest a man [sic] by dealing with his interests” (p. 37). In many ways, the ITI had to establish not just a physical space for conducting business, but also the rhetorical ground for negotiating and structuring those interests.

As part of structuring those interests, ITI’s directors had to actively foster meaning in the imaginations of its investors to make the institute reality. They had to create an imaginable narrative framed in recognizable social meanings to get the legitimacy and support needed to bring the work forward. Their story is about what Lanham (2006) called the “economics of attention” — attention, not a product, as the central resource in an
information economy. It is about demonstrating possibilities, getting people to imagine success, and creating presence and space for that success to happen. As Bazerman (2002) said, “technologies emerge into the social configurations of their times and are represented through the contemporary communicative media” (p. 3). By looking at the communication media through which ITI externalized its existence, we can begin to better understand the valley of death and the social configurations that define technology transfer as a successful enterprise. Their story is about communication arrangements shaping and transforming the world in which people act.
CHAPTER 3: METHODOLOGY

To better understand the “valley of death” and why organizations such as the ITI struggle to develop and maintain relationships that extend beyond the traditional boundaries of the university, I conducted a case study analysis of the ITI as a bounded system with a set of problems and relationships that exemplified the many issues and concerns in the field of technology transfer. As defined by Stake (1994), a “case” is a set of practices that have boundaries and working parts. And although the parts may not always work well, they are part of an integrated system that we do not sufficiently understand. Yin (2009) furthered this definition by describing the “case” as a place to examine contemporary events within a real-life context when the investigator has little control over events (p. 2). As such, the purpose of this type of study is not to generalize the results beyond the case, but to develop an in-depth understanding of the complexities and issues that surround it, looking for common themes that may transcend the case and help to develop theories within the field of study (Creswell, 2007, p. 75 and Yin, 2009, p. 38).

My study was bounded by time and by a single case. Consistent with case study design, I used a variety of techniques to explore the ways in which those involved in the ITI made sense of and articulated their vision for the organization. As Herndl and Nahrwold (2000) argued, “qualitative research elicits an understanding of communication practices and the social practices and subjectivities they produce in ways that other kinds of research cannot” (p. 259). To examine these structures and subjectivities in technology transfer, I collected data through participant observations, interviews with the people who were
associated with the organization, and documents that were helping to will this organization into existence. My study ran from October 3, 2007 through July 31, 2008.

In the sections that follow, I describe my methodology for this research study. I begin by describing the organization and the participants in my study. I then discuss the benefits and limitations of my status as an “insider” to the organization as well as the document set collected. I conclude this chapter by outlining the methods used to collect and analyze the data, including a discussion of Burke’s cluster analysis.

**Site Description**

In the fall of 2006, the ITI received a $1 million state grant in start-up funds to organize and develop university/industry partnerships as a way to stimulate economic development. In the funding proposal, the ITI research directors projected that the $1 million investment would leverage $7.9 million in external support and provide a return to the state through the creation of six new companies, three new major industrial collaborations, and a 40 percent increase in research funding. In short, the organization had two goals: to make ISU more competitive for large research grants from public and private sources and to increase IT-based economic growth. They would meet those goals by collaborating. The model brought together five IT-related university research centers, including the following areas of specialization:

* Emerging interface technologies

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2 On October 3, 2007, my university’s Institutional Review Board ruled my study exempt. In addition, the ITI provided a letter in support of the study.
In addition to these university research centers, the ITI had an advisory board that included industry leaders from a handful of Fortune 500 companies as well as several entrepreneurial start-up companies. It was hoped that the corporations would eventually commit to research memberships.

Although university/industry partnerships are not new, ITI’s model is different for two reasons. First, the Director of ITI envisioned that all of these players would be co-located in the same place. He described his vision as follows: “Industry will bring in people to be in a think tank to address unique problems of the company. Companies bring their problems to the Institute to be worked on and solved in a collaborative environment” (start-up proposal, July 21, 2006). In effect, this co-location would encourage the kind of water-cooler talk and think-tank atmosphere needed to foster broad collaboration. Second, ITI’s model also brought together directors of five different university research centers with the idea that they would work together on problems that spanned their areas of expertise. In a press release in 2007, the director of ITI summarized the idea behind this organization by saying, “All of us agree that we’re stronger working together than apart” (Geoffroy, 2007).

In many ways, the ITI was modeled after the largest of these five university research centers—the Emerging Technologies Applications Center (ETAC). ETAC is an interdisciplinary research center with $20 million in ongoing contract research with industry and government. It supports more than 50 faculty and 200 students from departments across

- Information infrastructure
- Information security
- Algorithmic models of intelligence
- Informatics and combinatorial experimentation for materials discovery and design
the university, offering PhD and Masters degrees in Human Computer Interaction.

Considered an entrepreneurial atmosphere, ETAC supports interdisciplinary teams working on a range of contract research projects for corporations and the Department of Defense as well as receiving grants from funding agencies such as the National Science Foundation and the National Institutes of Health. ETAC’s director is also the Director of the ITI. When envisioning ITI, he said: “We want to infuse the cross-cultural and entrepreneurial nature of ETAC to other groups” (field notes, October 4, 2007).

But the ITI had a relatively short history. Table 1 outlines the major milestones relating to the organization’s beginning phase.

Table 1: Major milestones in the ITI’s organizational beginning phase.

<table>
<thead>
<tr>
<th>Date</th>
<th>Milestone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall 2006</td>
<td>Secured $1M from State of Iowa</td>
</tr>
<tr>
<td>May 2007</td>
<td>Received approval from ISU Board of Regents</td>
</tr>
<tr>
<td></td>
<td>• Website is live</td>
</tr>
<tr>
<td></td>
<td>• Postcard is distributed</td>
</tr>
<tr>
<td>June 2007</td>
<td>Leased facility in research park</td>
</tr>
<tr>
<td>October 2007</td>
<td>Gave presentation to ISU president &amp; provost</td>
</tr>
<tr>
<td>November 2007</td>
<td>Held Industrial Advisory Board meeting</td>
</tr>
<tr>
<td></td>
<td>• Website updates left unpublished</td>
</tr>
<tr>
<td>December 2007</td>
<td>Locked into a holding pattern</td>
</tr>
<tr>
<td></td>
<td>• All marketing materials put on hold</td>
</tr>
</tbody>
</table>
After receiving $1 million in start up costs from the State of Iowa, it was formally approved by the State of Iowa Board of Regents and announced to the public in May 2007. To prepare for the opening, the marketing team created a website and postcard. By June, the ITI had a physical location in ISU’s research park, and it began renting out space to local start-up companies. In November, it held its first advisory board meeting, bringing together industry leaders from the Fortune 500 companies with university faculty from across the campus, and start-up companies located at the site. The meeting was meant to be a starting point for defining the ITI’s purpose and scope. For that meeting, the marketing team prepared a page for the website about those industry leaders. It was never posted to the site. By December, all marketing materials were put on hold and activity relating to the ITI seemed to come to a standstill. No one, I was told, could agree on the organization’s vision and mission. Without that agreement, the directors struggled to move forward.

When I began my research in January 2008, there seemed to be very little to study in terms of “technology transfer.” No technologies were being developed. No partnerships with industry had been established, and very little was happening toward fulfilling the promises the organization had made in its funding proposal. But, the problems the ITI faced were certainly not unique to the organization. Their struggle to define the institutional structure raised important questions about the durability of “economic development” as a structuring term. As the pressure continues to mount for such partnerships between academia and industry, the ITI as a case offers the opportunity to see how the value of that term is constructed by the participants who have a stake in moving the organization forward. This case also gives us an opportunity to take a critical look at the structural relations of the transfer of academic science and technology as a “public good.” What makes this term
durable and portable across disciplinary and institutional boundaries? In other words, what kind of work do these terminologies do in the context of technology transfer, particularly in relation to the valley of death?

Insider Status

Prior to and during my study, I worked with all of my participants on a variety of public relations projects, including print and electronic materials for the ITI. When considering a site for my dissertation, I initially resisted the idea of studying an organization of which I was a part. That resistance had to do with the kind of trust and commitment that qualitative researchers ask of their participants. I questioned whether I wanted to enter that relationship with my co-workers. Furthermore, I was an insider, having been a part of the organization prior to, during, and after my study.

But my status as an insider had several advantages. First, because of my relationship with my participants, I had access to documents and information that an outsider simply would not have had. One participant even said that he could give me such access because he knew me, and he trusted me. Second, having worked for the organization, I knew the questions to ask in the interviews. I had an understanding of the issues the participants faced as they worked on the ITI project. I knew their histories and concerns. Finally, having worked with these people, my presence and role in the organization were defined. Being there as a participant observer gave me a different vantage point. I could tell the difference between what Geertz (1973) called the blinks and winks of a particular culture. As he explained, two boys are rapidly contracting the eyelid of the right eye: is it an involuntary twitch or a conspiratorial wink? (p. 6). The act of ethnography is not the techniques and
procedures, but the sorting through of “piled-up structures of inference and implication” (p. 7). For Geertz (1973), ethnography is the “thick description” that comes from being there. Finding our feet, he said, is the difficult part, because this kind of research is more than just talk. Rather, it is about conversing and sorting through the “structures of significations” (p. 9). In this case study, my own interpretations of the case had a lot do with sorting through layers of meanings. As an insider, I was privy to many of the significations used to construct meaning within that culture—my feet were well grounded in the cultural discourse surrounding the ITI’s development. At the same time, however, this case was limited by the fact that it was not a multi-dimensional voicing of the phenomena. My access to participants was limited to people I had worked with at ITI and ETAC. Because of those relationships, I had to be more cautious in selecting participants than if I had been an outsider.

Finally, some researchers might call sites such as mine a “sample of convenience.” My reasons for studying the ITI, however, had little to do with convenience. Rather, my study followed an interest in teaching and studying technical communication and the ways people make complex knowledge available to different audiences with different needs, particularly in workplace settings. Because the ITI was new, it represented an opportunity to not only see how the directors positioned the organization in a situated context, but also to be able to examine the ways in which they managed and articulated several difficult issues in technology transfer: the public-private partnerships needed to develop technologies; technology seen as a tool for economic development; and the value of public-private partnerships as it is captured and communicated to various stakeholders. As a case, the ITI typified technology transfer as a negotiated activity in a complex network of people and organizations having varying needs and interests.
Methods

When my study began in October 2007, the ITI existed primarily on paper. Although the organization had leased office space, only a few start-up companies were located there. Therefore the idea of observation was problematic—there was no organization, per say, to observe. My access to the ITI came through to my job managing and writing publications for the Emerging Technologies Applications Center, the largest of the five research centers that came together to establish the ITI. The director of ETAC was also the director of ITI. Given the close relationship between ETAC and ITI, several ETAC staff members also did work for the ITI. I was one of those staff members.

I began working for ETAC in January of 2006. As a member of ETAC’s marketing team, I wrote and coordinated production of its newsletter, websites, and other marketing materials related to special events. In my role, I was involved in defining and crafting the message as well as writing text and coordinating production. As the largest of the five centers belonging to ITI, ETAC also assumed responsibility for ITI’s communication needs, developing marketing materials, writing reports, and interacting with the news media. Beginning in late 2006, I led the creative team in designing a logo, a website, and a postcard announcing the Institute’s creation. These materials had to be in place before the ITI’s public announcement in May 2007. For the website, I was the primary architect and writer, using language from internal documents written by the director and imposing a standard architecture: Home, About ITI, and News & Events. The website became a major point of rhetorically defining the organization. Most of my field notes came from my interactions with other ITI staff as we were working on the website and other marketing materials for the public.
During my study, I took notes during ETAC staff meetings on items relating to ITI as well as to informal conversations and meetings that I had with my participants about the ITI. My status as a participant observer was tied to my part-time research assistantship with ETAC. My field notes are transcriptions and reflections on discussions or comments made about the ITI during my regular working hours at ETAC.

**Interviews**

During the study, I interviewed five people directly involved with ITI to discuss themes related to my research questions. I had intended to interview all of the research directors involved with the ITI. But, during the course of my study, the tensions between ETAC staff and the research directors were high, and I understood from ETAC staff that interviewing these research directors might have exacerbated the problems. I had to respect that sentiment.

These single interviews were audio-recorded (with participant’s permission), transcribed, and erased within 48 hours of the interview. Participants included:

- John—Director of ETAC and the Information Technology Institute
- Kay —Administrative Specialist (ETAC and ITI)
- Daniel — Director of Research Center II and member of ITI
- Guy — Graphic designer for ETAC and ITI
- Mark — Science writer for the university’s news service

I invited these people to participate because they were involved in conceptualizing, writing, or designing materials for the ITI. Participation in this study was voluntary with each participant signing an informed consent document outlining the parameters of the study and their role. Participants were told that prior to publication they would be asked to make
comments on drafts. Their names are fictitious. In general, all of my participants were open to being interviewed and were thoughtful, reflective, and forthcoming in their view of the ITI. In the following, I describe these participants in more detail.

• **John** is the Director of ITI and wrote the initial white paper and proposal to the Battelle Infrastructure Platform Grants program. John is also the director of the Emerging Technologies Applications Center (ETAC) at Iowa State University, an interdisciplinary research center that manages more than $20 million in ongoing contract research for industry and government agencies. The research supports more than 50 faculty members and 200 students. At ETAC, he directs its graduate program in Human Computer Interaction. John is a full professor in mechanical engineering, but also has industry experience, serving as a vice president of product development for a Minneapolis startup company and heading product development for another startup company in Ames. He is a Fellow of the ASME, holds three U.S. patents, and is the recipient of numerous professional honors and awards. In conversations with me about his work, he has said he always tries to find ways to combine his industry/university experience.

• **Kay** is the administrative specialist for ETAC and ITI. She has worked for the university for more than 30 years in various departments and has a degree in business. In many ways, Kay was the first stop and gatekeeper to John. Having worked for ETAC for seven years, Kay facilitated growth in its research program, helped create and expand the HCI graduate program, and managed ETAC’s external image via a newsletter, the website, and other public relations projects, including demos and tours. She was also involved in administering ITI and
participated in their meetings and facilitated communication and email traffic among the members. During my time at ETAC, I worked closely with Kay on a number of marketing projects. She was my direct supervisor and took marketing very seriously. When it came to the ITI projects, she was excited to take what we had done for ETAC to the ITI.

- **Daniel** is the director of one of the research centers that joined with ETAC to work on ITI. Daniel is a University Professor in Electrical and Computer Engineering. In addition to teaching and research, Daniel runs an NSF-sponsored statewide project to work with high schools to get students involved and interested in IT. He is also founder and CTO of a private company. In the past, I worked with Daniel on writing projects related to his work with the high schools.

- **Guy** is a full-time graphic designer for Holmes Lab, a government-owned, contractor-operated research facility of the U.S. Department of Energy that is run by Iowa State University. Holmes Lab Graphics outsources its creative talent to other departments and research centers on campus, including ETAC. Guy and I worked together on a number of marketing pieces for ETAC, including a twelve-page newsletter that came out twice a year. When the ITI was funded, Guy was part of the team that worked on developing a name, logo, and website for the organization. I interviewed Guy because I was interested in his ideas about how new organizations build their identity, particularly organizations related to technology transfer.

- **Mark** is a science writer for ISU’s News Service, working with various units on campus to disseminate information about research at ISU. In addition, Mark is
also on the university’s research and economic development council. I worked with Mark on a number of press releases for ETAC and ITI. I wanted to interview him because he was not directly involved in the ITI’s day-to-day activities. As such, he had a more “outside” view of ITI and its position in the university that neither the other participants nor I had.

The interviews were semi-structured (see Appendix A for interview questions). For the interviews, I prepared a set of questions relating to defining technology transfer. In short, I was interested in the rhetorical devices used to represent technology transfer to various stakeholders; the role of ethos and representation in defining the value and success of technology transfer; and the ways that the organization’s identity was tied to other definitions of success and value in technology transfer. These questions framed the interview and helped to guide the conversation.

Documents

In addition to interviewing people, I analyzed many documents related to ITI’s creation, including:

- A white paper written by ITI Director John called *ITI: Advancing Iowa’s IT Economy* to outline initial concept for the organization. Dated June 2006.

- The start-up proposal to the Battelle Infrastructure Platform Grants program. ITI Director John wrote this proposal with four other research center directors signing on as co-principle investigators. Dated July 21, 2006.

• **Press release** written by ISU News Service announcing the establishment of ITI. Dated November 5, 2007.

• **News article** in Des Moines Business Record about the ITI and its mission. Dated January 19, 2009.

• **Website** written and designed for public announcement of the ITI in May 2007. Following its initial posting in May, the site was revised to include more content. One of the first revisions included a new page in preparation for the November Industrial Advisory Board meeting of the corporate leaders who were on the Advisory board. The page was never published. Several of the research directors seemed to take issue with the role of the industry leaders.

• **Electronic slide presentation** written and presented by John to the University President and Provost. Dated October 12, 2007.

Although I had access to many documents relating to the ITI, I selected the above list for two reasons. Except for the website, I had nothing to do with writing the documents. The white paper and start-up proposal were written by the director of the ITI with the other research center directors acting as co-principle investigators. The press releases and news articles were written by two science writers: one affiliated with the university and one from a local business publication. I also chose these documents because they all had to do with defining a new organization, introducing its purpose and trajectory for different audiences. In a sense, they are the touchstone narratives that map out the organization’s qualities and activities, defining the ITI’s situation and reasons for its existence. In addition, I compared the ITI’s website content to that of the other research centers that had joined the ITI. Those sites were accessed and recorded in March 2009.
Cluster Analysis

To interpret the symbolic actions in my case study, I followed Burke’s method known as cluster analysis to uncover the cultural principles that were shaping and shaped by the discourse. In “The Philosophy of Literary Form,” Burke (1941) explained cluster analysis:

Now, the work of every writer contains a set of implied equations. He [sic] uses “associational clusters.” And you may, by examining his work, find ‘what goes with what’ in these clusters—what kinds of acts and images and personalities and situations go with his notions of heroism, villainy, consolation, despair, etc. And although he [may] be perfectly conscious of the act of writing…, he cannot possibly be conscious of the interrelationships among all these equations. Afterward, by inspecting his work “statistically,” we or he may disclose by objective citation the structure of motivation operating here. There is no need to “supply” motives. The interrelationships themselves are his motives…. The motivation out of which he writes is synonymous with the structural way in which he puts events and values together when he writes; and however consciously he may go about such work, there is a kind of generalization about these interrelations that he could not have been conscious of, since the generalization could be made by the kind of inspection that is possible only after the completion of the work (p. 20).

In this passage, Burke emphasized that motives do not exist prior to a situation, but rather are an interpretation of the situation. By examining key words for “what goes with what,” we can begin to critique the interrelationships that constitute the situation and the motives at play.
In this type of analysis, it is important to note Burke’s use of the term “motive.” For Burke, “motives” are not merely a response to a situation, but are synonymous with the situation itself. In *Permanence and Change*, Burke (1954) suggested,

> Man’s [sic] words for motives are merely a shorthand description of *situations*. One tends to think of a duality here, to assume some kind of breach between situation and a response. Yet the two are identical…. The situation was our motive, and our word for the motive characterizes the situation (p. 220–221).

In this passage, Burke (1954) calls to mind Bitzer’s (1968) ideas about *situation*, but removes the illusory duality between the situation and response. Although Bitzer (1968) argued that the situation always precedes the response, he maintained that the response follows, and therefore stands apart from, the situation. In Burke’s conception, motives as situations are about articulating a worldview and identifying one’s own position in that situation. As Jasinski (2001) argued, rather than duality, Burke set up a dialectical relationship between orientation and situation. Motives, then, are constituted in the interaction between the two.

> “Motives exist in the vocabularies that we use for grasping situations and formulating responses to situations. Motives, in short, appear to be cultural principles embodied in vocabularies that shape and guide human perception and action” (Jasinski, 2001, p. 370). In this way, motives are not conceived as standing “behind” an action. Nor are they singular in purpose. Rather, motives saturate actions and are embodied in vocabularies that constitute “terministic screens”—selections, deflections, and reflections of “reality.” To understand “motive” means examining the cultural principles embedded in human action. Cluster
analysis of key terms opens up a way to examine the how people identify and articulate their position in a discourse.

In my study, I followed these procedures for cluster criticism:

1. Formulated research questions about the rhetoric of technology transfer and selected a rhetorical artifact for analysis
2. Identified key terms
3. Charted the terms that clustered around the key terms
4. Analyzed the clusters, looking for patterns and themes that helped to explain the case.

In suggesting methods for conducting cluster analysis, Foss (2004) outlined two ways to identify key terms: frequency and intensity. In my case, frequency had little to no bearing on my choice of terms. Although frequency is often a useful starting point in a grounded approach to understand the shape of the discourse, in my case, the selection of terms followed a theoretical approach to coding, drawing and building on theory when examining data. Therefore, I looked at the intensity of terms, words that were central to my research questions and informed by my theoretical frame. For instance, economic development has been widely used in the literature about technology transfer to justify the call for increased partnerships between university and industry leaders. I was interested in the ways that term was figured as a cultural principle, particularly in relation to ideas about the public good—a concept that has historically situated research practices. In paying attention to these terms, I wanted to examine the way these terms are negotiated in the discourse and the ideas that “clustered” with those terms.
To do so, I read and reread the data, transcribing my own field notes and interviews, reviewing the transcriptions and other documents for emerging patterns and themes surrounding the use these key terms. To organize and code the data, I used the software package Atlas.ti6 to help manage coding and analysis. I proceeded as follows:

1. Searched textual data to find key terms and to mark the paragraphs in which the key terms appeared
2. Analyzed the clusters surrounding key terms, using the memo tool to annotate specific passages
3. Examined the clusters in context and in relation to other textual data
4. Made inferences about the data based on these results.

In this process, Atlas.ti6 helped me explore and annotate the data as I searched for and coded the figures that clustered around economic development in the texts. I then analyzed the clusters, highlighting relationships to other terms, and making notes with Atlas.ti’s “memo” tool. In the end, however, I returned to my hard copies of the transcripts and documents, reading, rereading, and making notes about the patterns and themes relating to the rhetorical figures that clustered around my key terms, the organization’s ethos, and its audience. As Miles and Huberman (1994) suggested, text segments can be read and analyzed on different levels. Descriptive codes identify predefined areas of interest, such as key terms or figures in the discourse. Interpretive codes add a layer of meaning—in this instance, charting the terms that surround the key terms. And, pattern codes consider how themes and concepts identified at the descriptive and interpretive level relate across the dataset. In my work, I looked at the rhetorical grounding of these terms as a way to theorize about the ways language constitutes technology transfer as a dialectical set of positions that is always being constituted.
In chapters four and five, I present my analysis of the rhetorical figures that organize the discourse in technology transfer. These rhetorical figures simplify a complex situation by providing a visualization technology to situate technological practices and configure relationships. We can study these practices and relationships through the rhetorical devices that give those models of success structure and meaning as it is negotiated and renegotiated across academic, industry, and public boundaries.
CHAPTER 4: RESULTS AND DISCUSSION

In the preceding chapters, I outlined a theoretical and methodological framework for analyzing the ways in which technology transfer is rhetorically figured, particularly in relation to defining success and the rhetorical ground for authorizing such criteria. As I argued, current discussions about technology transfer today are often about differences in how academic research is valued in different discursive realms. As Carolyn R. Miller (unpublished) pointed out, the question at the center of technology transfer is an old rhetorical one—“cui bono?” or “for whose benefit” (p. 12). One of the key findings in my study was a tension between a traditional Mode 1 science for science’s sake model and a more entrepreneurial Mode 2 set of practices that values partnerships, crossing disciplinary and university boundaries for the sake of economic development.

In conducting my case study, I wanted to understand the power of “economic development” as a figure for activating a model of research—in other words, to bridge the valley of death. In many ways, the linear model that has typified technology transfer as the flow of objects from one point to the next has become a naturalized discourse. But embedded in that seemingly smooth transfer of knowledge are motives, interests, and investments that seek further advantage in the political and economic landscape. As Miller (unpublished) suggested, “it is the appearance of death that gives the metaphor its power, by cloaking its appeals in the guise of (objective) reference” (p. 13). Mode 2 research practices and the attendant “economic development” narrative call the guise of Mode 1’s objectivity into question. Although some have argued that Mode 2 does not replace Mode 1 knowledge production (for instance Gibbons et al., 1994, Mirowski & Sent, 2002), others have described
this change as the “new economy” for universities, moving from a public good/learning regime to an academic capitalist knowledge/learning regime (Slaughter & Rhoades, 2004, p. 7). In my data, the tension between these two regimes is paramount. As a new organization, the ITI had invested heavily in the “economic development” narrative to describe the benefits of its alignment with Mode 2 practices.

As in many rhetorical analyses, this story is about language, authority, and power, particularly in relation to the dialectical relationship between identification and division. In his A Rhetoric of Motives, Burke (1969b) said, “identification is compensatory to division” (p. 22), describing identification as a place in which individual interests are joined or identified by a common shared principle. At the same time, the individual remains unique, a “locus of motives” (p. 20) that is at once a distinct and mutually adjusted set of terms. Burke (1969b) described this tension between division and identification in terms of a neurotic who is ultimately at peace:

Rhetorically, the neurotic’s every attempt to legislate for his [sic] own conduct is disorganized by rival factions within his own dissociated self. Yet, considered Symbolically, the same victim is technically “at peace,” in the sense that his identity is like a unified, mutually adjusted set of terms. For even antagonistic terms, confronting each other as parry and thrust, can be said to “cooperate” in building of an over-all form (p. 23).

In technology transfer, the parry and thrust between the two modes of research practice also work to build an overall symbolic form within which people act. The results of this case study illuminate the locus of motives at issue in structuring publicly-supported academic research programs.
This chapter explores how Burke’s doctrine of consubstantiality can be used to see technology transfer as a symbolic and rhetorical discourse, which is at once organized and disorganized by rival factions cooperating and confronting each other to build an overall form. In my analysis, the tensions between Mode 1 and Mode 2 and between the public good and economic development were for the most part articulated as differences between basic and applied research—categories instantiated in the linear model. Although scientists in general and my participants in particular most likely have a much more sophisticated understanding of technology transfer, the linear model is often used as a resource for persuading and appealing to different audiences. As Goodnight (1982) discussed, the separation of such spheres are used to categorize argumentation. For Goodnight (1982), the spheres are “the branches of activity—the grounds upon which arguments are built and the authorities to which different arguers appeal” (p. 216). As separate categories, the spheres stand apart from one another with different purposes, strategies, and resources. My participants articulated places of identification and division by drawing on the categories implied in the linear model.

In this chapter, I share my findings, returning to the research questions that framed this research study.

- First, I analyzed the rhetorical devices used to define technology transfer. I identified two kinds of metaphors in the data: platforms and bridges. These metaphors functioned to create a rhetorical space for the ITI as well as Mode 2 practices, acting as a visualization technology that allowed people to see how they may or may not fit into the organization. These figures constituted a space for
various audiences to think through the ITI as a virtual prototype of a new organization. They also worked to circumscribe a space for Mode 2 practices.

- Second, I examined these rhetorical devices in relation to ethos, an appeal to an interpreted set of motives or cultural principles. In this case, I look at the ways in which ethos was used to structure a rhetorical ground for authorizing Mode 2 and the ways in which those grounds were contested and structured against Mode 1. The ITI’s website, its primary mode of ethos, is central to this discussion.

- Third, I considered audience and the ways various audiences acted as co-constituents of the discourse surrounding the ITI. Although the rhetorical devices used to describe the ITI enabled several external audiences to engage with the organization, these devices constrained relations among an internal audience—the ITI’s research center directors. Without a strongly contextualized goal, these audiences failed to find a common ground in which competing interests could cooperate.

As is often the case, my treatment of these three topics—logos, ethos, and audience—are intertwined because each term modifies the other. Nonetheless, these categories frame the ITI’s story and the ways in which economic development configured a rhetorical authorizing grounds for identifying and negotiating interests. I conclude this chapter by suggesting that although certain boundary objects kept the group together despite their disparate goals, in the end, those objects were not enough to bridge the valley of death.
Rhetorical Figures: Platforms & Bridges

In Chapter 2, I discussed Mode 1 and Mode 2 knowledge production as narratives that describe and characterize the authority and structure of academic research programs. Key terms in those narratives externalize the interests and motives that organize the discourse. In my study, I found that economic development as a key term represented a significant point of conflict within the ITI—it represented a different version of reality. As Burke (1954) stated:

> We discern situational patterns by means of the particular vocabulary of the cultural groups into which we are born. Our minds, as linguistic products, are composed of concepts (verbally molded) which select certain relationships as meaningful. These relationships are not realities, they are interpretations of reality—hence different frameworks of interpretation will lead to different conclusions as to what reality is” (p. 35).

In other words, key terms function as indices for relationships. Saturated with motives, these terms reflect an interpretation of cultural formations, structuring and revealing contested grounds. In the case of the ITI, the rhetorical grounds of technology transfer as economic development were highly contested.

The vignette below was taken from my field notes in early January 2008. It describes a point when the ITI was rhetorically creating a space to justify and explain a set of relationships as a new model for technology transfer. One of those spaces was the website: a virtual space that articulated a set of motives and relationships. This vignette followed a lengthy period of outlining a vision and identity for the ITI and summarizes the disagreement...
among the research directors over conceptualizing the ITI as a unique “platform” and new mechanism to “bridge” academic-led research and innovation in the marketplace.

**Vignette I: What’s the difference?**

At our meeting this morning, Kay told me that all marketing for ITI is on hold for now. The problem is that the center directors disagree, particularly about the vision and goals of the institute and what the institute should do…. As Kay said, these differences have to do with traditional research and traditional definitions of an institute and John and Daniel want to push the boundaries of those definitions. Kay said the questions at this time are:

- Who gets to be leader?
- How does the money get spent?
- What are the goals/vision?

The upshot for marketing is that we cannot put out a newsletter or “fluff” piece without knowing the vision or direction for ITI. Kay said maybe in the fall, but the problem is that ITI loses out on the momentum of a marketing piece at this early stage. In the fall, ITI will be halfway into its 3-year commitment. She asked, in fall, is it too late to be effective?

**Field notes, January 4, 2008**

When I wrote this entry in my research journal, I had no idea that things were going to come to such a standstill. Up until that point, the marketing team had worked on developing a name, logo, website, and a postcard announcing the ITI, and we had plans to
create a brochure and newsletter. The purpose of these materials was to help establish the
institute’s identity and to get industry leaders to participate in what was being positioned as a
new concept for technology transfer—university and industry leaders would not only
collaborate but also co-locate to work on complex problems that crossed disciplinary and
university lines. But as shown in the vignette, the five research center directors who had
come together to form the institute had a fundamental disagreement over this definition of
technology transfer. That disagreement, as Kay pointed out, had to do with the tension
between traditional definitions of university research and this more entrepreneurial mode of
structuring a research program.

When the above vignette was written, the ITI faced its own valley of death. The
research directors disagreed on how to build the “bridge” needed to move from the idea of
the institute to sustainability. Questions about leadership and money all related to the
organization’s goals and vision. If they couldn’t agree on the vision, then how could they
agree on how to spend the money or who gets to lead? Exacerbating the problem were its
public representations of the organization, i.e. its website and other marketing materials that
characterized the ITI for external audiences. In large part, the purpose of the marketing
materials was to create an organizational identity to help the ITI move from a virtual
prototype to a functioning organization. To begin to understand how that identity was
constituted, I looked at two documents written by the John to examine how the institute was
positioned in relation to its audience. These documents, a white paper and start-up proposal,
were written in 2006 to secure funds for the organization. But they were also the basis for all
the marketing materials, providing the language and vision for the text and images. In these
documents, technology transfer and the ITI were defined in relation to the need to build a
new “platform” for university and industry partnerships as a way to “bridge” the gap and empower IT economic development—all structural terms that give the discourse a substance or ground for individual actions.

The Terms of Structuring an Institute: A Unifying Home & Unique Platform

From the very beginning, the ITI was positioned in terms of Mode 2 research and the economic development narrative that seems to follow as its justification. Indeed, the impetus for the ITI came from a set of recommendations made by the Battelle Memorial Institute to the State of Iowa’s Department of Economic Development following a research study about the state’s IT sector. The Battelle study included:

- Economic analysis of the state’s IT sector
- Assessment of the infrastructure needed to support the IT sector compared to other states
- SWOT analysis: strengths, weaknesses, opportunities, and threats
- Proposed strategies for making the state’s IT sector more competitive
- Implementation plan, including initial steps (Battelle, 2005, p. ix).

In its final report, *Iowa’s Information Technology Strategic Roadmap*, Battelle (2005) concluded that Iowa did not yet have the critical mass of IT activity that would place it among leading states in either IT R&D or IT commercialization. At the same time, the report identified IT-based economic development as a potential area for the state to build a “notable presence” (p. ix). To do so, Battelle (2005) outlined five strategies meant to further the state’s research base and to build its IT industry. The first strategy included several action items to “strengthen and accelerate” the connections between Iowa universities and Iowa’s IT
industry, calling for a Strategic Technology Platform Grant program to fund projects that enhanced those relationships (p. xvii).

In response to the Battelle recommendations, ETAC and ITI Director John wrote the start-up proposal with the four other center directors signing on as co-principle investigators for funding the ITI. In their proposal, they envisioned the new institute as a “unifying home,” bringing together ISU’s IT-related research centers and serving as a “unique platform” for science and technology commercialization, extending beyond the confines of the university to include industry partners and entrepreneurial start-up companies (start-up proposal, July 21, 2006). These structural metaphors—home and platform—suggest that the infrastructure for moving the institute from an abstract idea to a sustainable organization had yet to be laid. Rhetorically, John’s start-up proposal worked to outline a vision for the ITI in relation to the needs identified in the Battelle report.

But the start-up proposal also circumscribed a space and value for Mode 2 practices. In this document, the ITI was positioned as a response to the valley of death and the need to take “better economic advantage of the research strength in our universities” (start-up proposal, July 21, 2007). Although these structural terms worked to establish the “groundwork” or foundation for building an institute, they were also making room for Mode 2 knowledge production as a substantive and authoritative discourse. As Burke (1962) explained, substance is both literally and metaphorically that which stands beneath—the bottom, prop, or groundwork of the subject matter or argument of a narrative (p. 23). In this way, substance is a starting point or beginning on which to build. In the case of the ITI, the function of terms like a “unifying home” and “unique platform” was to set the stage, creating
substance by positioning the organization within a set of arguments that structured the organization one way and not the other.

But while metaphors “new home” and “unique platform” implied that a new model was being proposed, they were also at the same time positioning the ITI as a new conduit for speeding up the technology transfer as it has been traditionally conceptualized. In John’s start-up proposal, the underlying substance for his line of argument was about “bridging” gaps between basic research and applied technologies and between discovery and solutions. In the proposal, the PIs sketched out a model to “expand our capacity for foundational research and accelerate its transformation into new technologies addressing real-world problems that provide the impetus for economic development” (startup proposal, July 21, 2007). Specifically, this model would increase IT research and commercialization by:

• Broadening the scope of IT research by expanding the disciplinary boundaries
• Addressing real world problems with foundational research
• Nurturing new connections in an entrepreneurial culture.

This new platform, the PIs wrote, would attract national and transnational companies to bring their projects to ISU, make ISU more competitive in securing large-scale grants, help recruit and retain IT faculty, and increase the impact of ISU’s research on Iowa’s economy (start-up proposal, July 21, 2006). In short, they described ITI as “the bridge [italics added] that is currently missing between academic IT research that is the engine [italics added] of innovation and industry-led commercialization and entrepreneurial activity that is essential for successful IT-driven economic development in Iowa” (start-up proposal, July 21, 2006). These two metaphors—“bridge” and “engine”—positioned the ITI as a new mechanism to fix an “old” problem. As shown in Figure 1, the diagram developed to explain the ITI was
based on the linear model of Mode 1, adding conduits or “bridges” between academe and industry. But the diagram also redefines the “bridge,” describing the links between the two spheres in terms of economic benefits.

![Diagram of Information Science and Technology Institute](image)

**Figure 1:** A conceptual model of the ITI (start-up proposal, July 21, 2006).

In addition, this model suggests that the problems associated with the *valley of death* can be fixed by building the right structure. By “bridging” the gap between research and its impact, the ITI provides a structure for “accelerating” and “transforming” research into tangible benefits. But in fixing those problems, these metaphors suggest a deficiency that needs to be remedied and a set of oppositions to be reconciled: between movement and stagnation, between applicable and non-applicable results, the tangible and the intangible, and the most striking “real world problems” and its implied opposing term. Under these terms, the implication is that current practices are too slow to have an impact. In the start-up proposal, “bridging the gap” meant accelerating that process by expanding disciplinary
boundaries, addressing real world problems, and nurturing partnerships. It also meant
disrupting the traditional boundaries of who and what is included in the production of
scientific knowledge.

As Kay pointed out in the opening vignette, the differences among the research
directors had a lot to do with two of those five directors pushing the boundaries of traditional
definitions of research: what does it mean to create presence, a “unifying home,” or “unique
platform?” According to Burke (1969a), these terms are defined by what they are not. In A
Grammar of Motives, he called such definition the pun of language—in observing what a
thing is, its intrinsic value, we refer to it by its context, by that which is outside of or external
to the thing itself. “And a thing’s context, being outside or beyond the thing, would be
something that the thing is not” (Burke, 1962, p. 23). In other words, the ITI’s presence and
g value as a “unifying home” and “unique platform” were constituted in context, in relation to
its exterior, or, in Burke’s terms to what it is not—traditional Mode 1 knowledge production.

In specifying a presence and value, John’s start-up proposal to Battelle is much like a
position statement that describes the organization in a field of competing interests. In an
interview, I asked Guy, the graphic designer, about the purpose of position statements in
relation an organization’s visual identity or presence. He said: “The position statement is
supposed to differentiate them from their competition. They are trying to find what it is that
they do differently so that they can promote themselves to their funders with the goal of
getting more funding” (interview, May 22, 2008). The differences implied in the metaphors
used in ITI’s position statement worked to create value and success not only for the
organization, but for Mode 2 in a field of competing interests as a whole.
In Bourdieu’s terms, these metaphors functioned to define and redefine what he called *space*—the set of coexisting positions and relationships inscribed in the social categories that describe the space, its practices, goods, and opinions.

This idea of difference, or a gap, is at the basis of the very notion of *space*, that is, a set of distinct and coexisting positions which are exterior to one another and which are defined in relation to one another through the *mutual exteriority* and their relations of proximity, vicinity, or distance, as well as through relations of order, such as above, below, and *between* (Bourdieu, 1998, p. 8).

In that mutual exteriority, individuals articulate and read that space through symbols, such as language, which describe those positions and their relative economic and cultural value. As Bourdieu argued (1998), those sets of differences exist in a state of virtuality, “not as something given, but as *something to be done*” (p. 12). In other words, the *terms* of a given space are under constant negotiation and revision by the individuals involved, each term modified and defined in relation to a set of co-existing relations. As a space, *economic development* revised the public good model in two ways. First, it redefined technology transfer as cooperative action. Second, it restated the answer to “cui bono?” in terms of tangible benefits. In effect, these revisions upset the set of co-existing relations defined under Mode 1.

*Economic Development as Cooperative Action*

In many ways, this tension between Mode 1 and Mode 1 knowledge production is about boundaries. The ITI was constituted as a set of differences between traditional Mode 1
knowledge production and a more entrepreneurial Mode 2 that promoted a problem-based, collaborative approach to define a research agenda that spanned disciplines and university boundaries. As they were creating an institutional structure, they were also attempting to redefine the expert community and the kind of activity in that community. In the interviews, the tension surrounding these boundary lines became quite apparent.

The interviews I conducted took place in March and April, several months after I am told that all marketing efforts must come to halt. As the opening vignette described, the research directors disagreed with the vision outlined in the ITI’s texts. In the interviews, John and Daniel described their differences. In his interview, John told me:

The vision for the space was that it would be a place where big companies, faculty, graduate students, and start-ups would all work together in the same place—not necessarily together, but sort of the water cooler talk where you find out what people are doing and it causes a synergy to happen (interview, March 31, 2008).

The idea was to create synergy or cooperative action, enacting the presence outlined in the proposal. John elaborated on the proposed vision, saying the model was different for two reasons. First, the research projects funded via memberships by the larger companies would be general enough so that those companies “might pitch in with their potential competitors” (interview, March 31, 2008). This line of reasoning follows the cooperate to compete narrative that had been taking hold since the 1980s, most recently with calls from bureaucracies including the National Science Foundation and state governments to increase the intellectual interchange between universities and industry. As Kay told me, “the thing is for companies to put problems forward to share because the world is so sophisticated they
have to have a quick answer. ITI brings players together. In the past, you would never share problems, but now they have to” (field notes, June 11, 2007). In other words, they have to cooperate to compete in a globalized marketplace.

But the model was also different in its vision that the research projects would span the skill sets of several of the academic research centers involved with the ITI. Spanning the skill sets meant creating teams made up of not only academic researchers, but also of industry leaders. John said the goal is to have “six to eight or ten member companies on each of these teams and to have lots of different types of projects going on and then continue activity that way every year. That’s the goal (interview, March 31, 2008). Cooperate to compete means altering the boundaries of both who and what gets included on the research agenda.

But what does this change in model do to the perceived value of research? When I asked Daniel about the value of the proposed for ITI, he responded by saying,

Well I think the intended value is that we hope it offers a new paradigm for the way we interact with industry. It’s kind of a tough sell. Again, it’s back to this bottom line and how does whatever we do help the industry, so the goal is to try to get to the point where we are helping and working with industry more closely on their problems and taking things a little further than just the pure research stage. We tend to leave things. Once we’re done with the research, we tend to walk away from it. Here the goal is to continue to extend that farther and into a more entrepreneurial type of mode. Again that’s tough for the university—tough for the university, tough for industry to get used to that newer model of us taking it farther down the road than we normally take it (interview, April 29, 2008).
In Daniel’s view, the “new paradigm” changes how the university has typically interacted with industry. This “new paradigm” represents a shift in the rules, structures, and habits that have organized research practices since the Cold War regime of funding and managing American science. It does so by extending the responsibilities of the researcher to work more closely with industry. As Daniel said, this shift in conception is a tough sell—tough for both the university and industry. Given the structures that have governed systems of practice, how does the organization effect such a change in practices that takes research results “farther down the road?”

Economic Development as a Tangible Benefit

As I argued in chapter 2, the linear model of basic-to-applied research was constructed around a narrative that scientists needed to be left alone to do their work in the name of national security and health. Following the Second World War, this narrative emerged as a rhetorical style and set of arguments for the autonomy of scientists, creating an expert community in the universities that authorized knowledge production as “disinterested” agents working for the public good rather than the corporate bottom line. Since then, this narrative has worked to rationalize and operationalize “Big Science” and “Big Technology” as systems of practice largely underwritten by the federal government. As a system, “expert” knowledge is diffused through various channels, including publications and conferences organized by the disciplines. In this traditional Mode 1 progression of knowledge, ideas move as objectified knowledge from one location to the next.

But as I discussed, technology transfer as a term emerged in the 1960s as a metaphor to describe the benefits of directing substantial federal funds to academic science and technology programs. Prior to the 1960s, discussions focused on innovation and the problems
associated with “diffusion”—a metaphor, Miller (unpublished) argued, that makes the process itself seem relatively agentless (p. 10). The advantage of technology transfer was that it activated the model by implying that people were engaged in moving knowledge from its source to its destination—knowledge was transferred. This metaphor worked in the 1960s, Miller argued, because “the ‘active’ model of transfer is what critics of government R&D expenditures needed—a way of guaranteeing that along with federal funds came the active responsibility for ensuring that research results would be made use of for public benefit” (p. 21). As a metaphor, technology transfer grounded the Mode 1 knowledge production by making more explicit the idea of linkages between academic research and its impact as a public good.

In the case of the ITI, I looked at the press releases to examine the transfer metaphor in this more public forum. In the press releases about the ITI, the discussion surrounding the benefits of technology transfer repositioned the public good in terms of economic development. For instance, on October 3, 2006, when John Brighton, Iowa State University’s vice president for research and economic development, announced awards for $3.69 million in state funding for technology and commercialization research at the university, he emphasized the potential economic impact of the awards, saying “these research projects will help the state reach its goal of creating high-wage, high-growth industries.” And he related the projects to ISU’s vision of applying science and technology in the state: “One of the university’s priorities is to translate discoveries into economic impacts for the state and the world” (Brighton, 2006). That vision included funding for the new Information Technology Institute to develop collaborative research and development projects with private industry with the publicly announced expectation that it would spin off as many as six start-up
companies within five years—a benefit for the state in terms of economic development and for the university in relation to opportunities for students and faculty.

Again, in another press release, the benefits of the $1 million award are stated as tangibles: ITI Director John was quoted as calling the ITI “the vehicle…to turn research into new licensed technologies and start-ups” (Bzdega, 2008). And as the president of the university stated:

The new Information Technology Institute is very important to the university and the state. The institute will build on the university’s strengths in information technology. It will develop the expertise and technology that can help Iowa companies compete in a global economy. And it will help the state create opportunities that can keep talented and educated young people in Iowa (Geoffroy, 2007).

These tangibles are based on building strengths and opportunities that can be counted in numbers of licenses and new companies as well as job opportunities for young Iowans. And although these outcomes include the overtones of a traditional Mode 1 public good narrative—developing expertise and educational benefits—the benefits are couched in a cooperate-to-compete, economic development narrative about helping Iowa companies compete in a global economy.

As in the start-up proposal, the rhetorical ground for the ITI is based on the implied assumption that this new model is doing work that the “old” model did not do—“leveraging its research strengths to benefit the state’s economic development” (Geoffroy, 2007). The terms “building” and “leveraging” suggest that research is not used to its full potential. Again, the idea is not to replace the old model, but to simply build on that model to
“leverage” its potential. Like a mechanical lever, these metaphors about “building” and “leveraging” ISU’s current research suggest a simple manipulation in the placement of force to apply the more pressure can solve the problem.

In the start-up proposal and white paper, the PIs developed a narrative that gave the institute structure, answering the questions of what will the ITI look like and what will it do. In drawing on economic development as a resource, John redistributed the value of academic research by enlarging the influence of applied research, calling IT the “driver” and “engine” of innovation. Technology, not basic science, is the valued commodity in this narrative. As such, Mode 2 de-emphasizes the routines, habits, and regularized social practices organized under Mode 1. But how does this new narrative get legitimacy, particularly as it is constituted against the Mode 1 narrative that has organized research practices since the end of World War II?

In The Constitution of Society, Giddens (1984) suggested analyzing the conditions that govern the continuity or transformation of structures to understand the reproduction of social systems. Giddens argued that structure is not external to individuals. Rather structure has to do with the rules and resources—the organized properties of social systems—that agents draw upon in their interactions. One such resource is language. The directors drew on the language of economic development to give their idea shape and power. But, as Giddens made clear, structure by itself is marked by an “absence of the subject,” existing out of time and space (p. 25). In other words, terms such as economic development get their meaning in context as part of situated social systems that have regularized sets of relationships and activities. As Faber (2002) argued, “our cultural discourses, meaning the jargon, dialects, intonations, vocabularies, and other linguistic features that we use to create and maintain our
communities, are important because they make up and reflect the structures that dominate our routinized, habitual world” (p. 62). One of the problems for the ITI was a clash interpretive frameworks between the language and routines of Mode 1 and Mode 2 as structured practices. In the next sections, I consider ethos and audience as structuring principles, examining the symbolic power of these resources for negotiating authority.

**Structuring Principles: Ethos**

In Aristotle’s tripartite scheme (logos, pathos, ethos), ethos is the persuasive appeal of the speaker to his or her audience, which judges the speaker’s credibility by their perceptions of that speaker’s character. “For it is not the case, as some of the handbook writers propose in their treatment of the art, that fair-mindedness on the part of the speaker makes no contribution to persuasiveness; rather, character is almost, so to speak, the most authoritative form of persuasion” (Aristotle, 2007, p. 39). Since Aristotle, the definition of ethos has expanded to include more than making the speaker’s character “look right” (p. 112). While the speaker in Aristotle’s time was a citizen representing himself in civic affairs, the speaker in technology transfer today is often the voice of the organization. Researchers, such as Halloran (1982) and Hunt (1986), have separately expanded Aristotle’s definition of ethos from an appeal based on an individual’s character to that of an organization’s character, drawing on the Greek meaning of ethos as “a habitual gathering place” (Halloran, 1982, p. 60), or a public space where communal values and collective acts inform how the audience perceives character and credibility.

To understand ethos as a structuring resource, I analyzed the ITI’s ethos through the term *motive*. For Burke (1954), motive is a term of interpretation: “When introspecting to
find the explanation for his attitudes, he would naturally employ the verbalizations of his
group—for what are his language and thought if not a socialized product?” (p. 20). To
analyze ethos through motive means understanding organizational character not as a response
to a situation as one might “dress for success,” but rather as constituting the communal
values and collective acts as they are externalized in language. As Burke (1954) argued,
motives are shorthand words for situations (p. 31). In this way, ethos as a persuasive appeal
is not “put on,” but is rather an appeal to an interpreted collective value. As an appeal, ethos
draws upon a set of interests of actors and their motives within a field of action.

The following vignette underscores the divisions within the ITI. As it indicates, ethos
and power were interrelated. In this section, I present my analysis of the ways in which ethos
was used to establish a structure a rhetorical ground that authorized Mode 2 and why those
grounds failed to act as a place of identification for the ITI.

**Vignette II: Flattening the Power Structure**

Kay said that she thinks ITI is going to take off this summer. She said that
now that power has been flattened, that John is not seen as controlling the
organization, other members have stepped up. She said that the lack of
consensus early on really took the wind out of his sails. But, now that the
power issues are taken care of the group has jelled and John is really
beginning to pick up the economic development piece. The others really don’t
care about that piece. They are working on the research part.

*Field notes, April 22, 2008*
I talked to Kay about the possibility of writing a newsletter for ITI. She said the trouble is that not all the directors are on the same page as to what the organization should be doing. Some days she feels good about the group—it has cohesion. Other days she thinks they have nothing in common.

Field notes, June 10, 2008

As I read through my field notes, I could not help but notice the back and forth speculation about whether the institute would survive. In meetings with Kay, we occasionally revisited the idea of going ahead with a newsletter or other marketing piece to make the organization more visible. But other than revisions to its website, very little was done to market the ITI. As Kay said, the group had difficulty figuring out what it wanted to be—some days the directors were on the same page, other days they had nothing in common. In that back and forth, the directors did two things to try to build consensus. First, they organized different councils within the organization, splitting the responsibilities between the research and economic development components. Second, they decided to hire three post-doctorates to act as liaisons between the research centers and to coordinate activity with industry. These two actions were seen as having a “flattening” effect. But even these actions failed to move the organization forward. It was in perpetual identity crisis, largely surviving on rhetorical hype. The directors disagreed on the identity constituted in the texts that were helping to will the organization into existence—the website in particular. The space, or rhetorical ground, which “grounded” the ITI, became a point of contention. At issue seemed to be the authority of the external representation of the organization—its projected ethos.
An Entrepreneurial Ethos

In its very early stages, the ITI had to not only outline the structure of the organization, but it also had to build confidence in and support for the project. It had to establish its credibility for being able to take the organization from an idea to sustainability. To see how the ITI understood its ethos in relation to its audiences, I looked at the start-up proposal and the white paper for the ways ethos grounded the organization. In these documents, the ITI’s ethos draws on the concept of an entrepreneurial, market-driven culture associated with both initiative and risk. Throughout these materials, the ITI is defined as “innovative” and groundbreaking, providing a new way and a “unique platform to pioneer [italics added] new ways for universities to solve today’s complex challenges” (start-up proposal, July 21, 2006). As pioneering, the organization is positioned as taking risks with the potential for high returns.

The ITI also appealed to tradition, stating in the start-up proposal that the organization “builds on six well-established but independent IT research centers” (start-up proposal, July 21, 2006). In doing so, it specifically highlighted ETAC’s work as an example of ISU’s “tradition of fostering IT-based economic development, spanning startups to long-term relationships with established regional industries” (start-up proposal, July 21, 2006). In this example, the appeal to “tradition” and ETAC’s success moderates the newness of the ITI by showing that such work can be done. In doing so, the ITI was positioned as an innovative “bridge” to transform results into tangible outcomes. As John said, “we want to infuse the entrepreneurial, cross-cultural nature of ETAC to other groups” (field notes, October 3, 2007). But, in the interviews, the predominant metaphor changed from building bridges to the “bottom line.”
As shown in Vignette II, the ITI continued to struggle to move beyond envisioning the possibilities. Throughout the interviews, the explanations for this struggle had to do with the “selling” and “buying into” the model proposed. As Kay said in her interview:

It will be interesting to see what happens with ITI. People haven’t bought into it: they aren’t committed to its success, they didn’t like how it was initially developed, and they aren’t in agreement in how to spend the money. So all those things could end up killing it (interview, March 17, 2008).

In large part, that lack of “buy in” had to do with a perception that John and his staff at ETAC were taking over the organization. As Kay said in her interview,

ETAC is huge—we’ve got a great reputation, the staff to support it, and I think John is a nice guy. He’s the type that when Brighton says I want to do this, John says okay. Whereas the rest would say we can’t do it for these ten reasons, John says we can do it for these ten reasons, and so he’s the kind of guy someone would want to go to. The problem is that John can’t get the other centers to be on the same page, not even with each other and it’s really frustrating. They are really unhappy about the building. They are really unhappy about the money being diverted to support the space at the research park (interview, March 17, 2008).

In many ways, John was the right person to initiate an organization such as the ITI. Because of his experience as director of ETAC, he knew how to collaborate with industry and across disciplines. And even though two of the “unhappy” research directors were faculty members
of ETAC, they resisted their position in the ITI. What difference did this change in position make?

In many ways, the difference seemed to be one of status. As faculty members of ETAC, their individual research programs were supported through ETAC’s resources. But as directors of ITI, their individual research programs were called on to play the supporting role, and they did not like that structure. For one, they disliked the hierarchy that seemed to be in place. As Kay told me, “I think this group is annoyed because they don’t think John is an expert from the publications and refereed journals perspective to be in the right position to be the director of this institute” (interview, March 17, 2008). Although John is a full professor at the university, his work at ETAC was considered ‘second tier’ or one step removed from ‘foundational’ research. John was acting the role of a Mode 2 leader, but his colleagues seemed to dismiss him because he did not have Mode 1 credentials. The entrepreneurial ethos was too dominant. Even though the entrepreneurial ethic followed the categories inscribed in Mode 1’s linear model of research, it redistributed the relative value of basic versus applied research. It was a change in motive or the interpreted values of these categories, particularly in relation to its authorizing power.

In her interview, Kay told me that this problem had persisted ever since ITI received its start-up grant from the state:

The money was received, but none of the centers at that point had been asked for their opinion. They had not been part of the process. When things started falling down, it was pretty much just a John thing, and Brighton said you know we’re going to have to sell the concept now that it’s been funded. These center directors are pretty independent and autonomous with a pretty good
idea of what they want done, and number one, they didn’t like all those things decided without them being a part of it. But now hey we’d like you to be a part of this ITI. I think that is there now. We are still in that process (interview, March 17, 2008).

From the very beginning, several of the research centers occupied a marginal position, a place they did not like. As Kay said, the directors are independent and autonomous. In some ways, they did not seem to know how to enact the role of researchers in a cooperate to compete scenario. In his interview, John talked about this internal dynamic:

We’ve been going around and around on how to spend a certain portion of the budget which was set aside for research. And, it’s a substantial amount of money. The last three meetings have been trying to decide how best to spend this money…. I’ve been reluctant to lead because my style is one that if I’m not getting any input or feedback is to do what I think is best and then I sometimes get accused of being unilateral. So in this most recent round I sort of took a back seat (interview, March 31, 2008).

In selling the concept internally, John struggled to reconcile competing interests from within and seemed to be constantly fighting the impression that he was acting in his own interests. The response to his gestures seemed to be one of retrenchment, indicating a lack of “buy in” to the proposed model. In an interview, Mark (the science writer) said, “most of these research directors come up as faculty members and probably not necessarily entrepreneurial faculty members. They are not John…. Entrepreneurship is not on their radar at all” (interview, May 19, 2008). The directors did not know how to act together in this model.
To help facilitate their actions, the ITI retooled the internal structure to help build consensus among the research directors. As I mentioned earlier in the chapter, it separated the research component from that of economic development and assigned the directors to one side or the other. As John said,

> We have proposed and have nominally started acting on a more or less functional organization where we have three of us leaders are aimed at defining the research, three are aimed at economic development, and three are aimed at educational, academic type things, and I can’t remember the fourth category (interview, March 31, 2008)

As a way to manage the disagreement, they structured the organization around the divisions that underscored their predicament. As Kay said,

> I have this piece of paper that says research council, economic development. They divided up power among the center directors. So John can’t say how the $250k is going to be spent. He’s not in charge anymore of that. I wouldn’t say his directorship is meaningless at this point to him, but it was the only way that they could get the directors to engage (interview, March 17, 2008).

This new organizational structure was put in place to “flatten” the perceived hierarchy in which John and ETAC were seen as making all decisions on behalf of the organization. Kay told me that this “flattening” effect gave the organization a way to move forward, to build what she called consensus.

In Mode 2, knowing how to act together is a challenge because the range of actors destabilizes the roles that these actors have traditionally played in Mode 1. As Nowotny et al.
(2001) stated, in Mode 2 “other actors, once dismissed as mere ‘disseminators’, ‘brokers’ or ‘users’ of research results, are now more actively involved in their ‘production’” (p. 89). One of the characteristics of Mode 2 knowledge production is its rather diffuse power structure. As Nowotny et al. (2001) stated, in Mode 2 “there is a high degree of uncertainty; there is no clear-cut direction but many competing ideas, theories and methods; and no one is in overall charge” (p. 115). In Mode 2, the heroes in science and technology change, moving from individuals to organizations as the key agents in the transfer of knowledge, creating a much more distributed model for maintaining, evaluating, and exchanging knowledge as capital. As Kinsella (2005) noted, “contemporary science and technology are characterized by unprecedented degrees of institutionalization, and that in these settings the locus of agency has increasingly shifted from the individual to larger systems of power/knowledge” (p. 302). These shifts, Kinsella contended, make organizations and their activities—identifying research questions, producing methodological standards, writing peer reviews, and funding research—the primary social actors rather than individual scientists.

Representations of Space: The Website as a Primary Mode of Ethos

The differences among the research directors can also be described as boundary work or the protection of the symbolic space. As Gieryn (1983) explained, boundary work of scientists is “their attribution of selected characteristics to the institution of science (i.e., to its practitioners, methods, stock of knowledge, values and work organization) for purposes of constructing a social boundary that distinguishes some intellectual activities as ‘non-science”’ (p. 782). That boundary between science and “non-science” includes divisions between basic science and its application to problems in the “real world.” The projected ethos as set forward in the ITI’s texts revised Mode 1’s social boundaries. The website in
particular became a site of boundary work and an object for demarcation, most notably when additions were proposed in preparation for a board meeting in November 2007.

Although several of ITI’s research directors disagreed with the ITI’s stated mission from the beginning, the divisions among the research center directors flared in November when John hosted the first and only Industrial Advisory Board meeting for the ITI in ETAC’s conference room. Preparations for the meeting began in September with invitations to a handful of corporations for the purpose of formulating an effective strategy to engage industry in the ITI. To prepare for that meeting, the marketing team was asked to include a page on the ITI’s website with a picture and bio of the industrial board members. This page was meant to complement the already existing page about the research center directors who were involved in the ITI. But the industrial board member page never went live. By November, the undercurrent between the research center directors about the role of the industrial leaders had become too strong. When the Industrial Advisory Board meeting was held, tensions among the research directors were high, particularly over the role that this body should have in the operations of a university institute. By December 2007, I am told all marketing was put on hold—the research directors could not agree on leadership or vision. Without those elements, how could we market the organization to external audiences?

As a public document, the ITI’s website was a statement of identity. As a rhetorical actor, the website was the ITI’s primary mode of ethos—it stood in for the organization’s character, articulating a set of identifications. In essence, it is a stabilized version of the organization, and like business cards and letterhead, an integral part of an organization’s identity—a must-have for a new organizations to announce it is in business.
When the ITI was formally announced in May 2007, the website included mission statement language taken directly from the start-up proposal and white paper. It also included bios and pictures of each research center director. The opening statement on the home page read:

Motivated by the increasing pace of advances in information sciences and technologies, the ITI is a new institute that brings together interdisciplinary research teams to enhance research competitiveness and to collaborate with industrial partners. These partnerships span the spectrum from start-ups to well-established companies with a regional presence, expanding the capacity for foundational research and new technologies to address real-world problems in areas as diverse as the biological sciences, agriculture, engineering, and business (website, March 2007).

The mission was to research and collaborate. By November, other pages included “About Us” and “News and Events.” When working on the initial site, I had understood that the directors agreed it would be a good idea to identify several research foci that the centers could pursue collectively. But that text was difficult to develop. Prior to the November meeting, that idea resurfaced. Kay asked me to work with John to modify the site’s content—the other research center directors felt the site was not “researchy” enough (field notes, October 3, 2007). The problem was identifying a project that would exemplify the ITI’s mission. The proposed addition to include the industrial advisory board members on the website seemed to tip the delicate balance between the research and economic development sides of the organization.
Indeed, in looking at the websites of the dissenting research directors, their work is clearly positioned as ‘foundational.’ For instance, one center described its mission as addressing the university’s “research and educational needs in accordance with the land-grant mission of the university” (website). Another represented its mission with a diagram (Figure 2) that placed their research as the beginning or starting point for the transfer of knowledge.

![Figure 2: A schematic of research as the top of the hierarchy.](image)

A third research center described its purpose as providing the foundation and fundamentals for advancement. They too included a diagram of their role in advancing knowledge (Figure 3), placing their work at the center of knowledge production with academic research acting as a foundation or base. On its website, this graphic is explained as the research center “pursues fundamental research and research-based advanced training.” In addition, its “core faculty have significant breadth and depth of expertise” who “are engaged in transformative research on cyber-enabled discovery in collaboration with their colleagues in several areas. Some of this research is leading to fundamental advances.”
All three of these research centers construct similar boundaries around their work within the public good/learning regime. In many ways, the projected ethos comes from its distance from a larger social context. Giddens (1990) called this mechanism disembedding or “the ‘lifting out’ of social relations from local contexts of interaction” (p. 21), a detachment from private interests that may have undue influence on the results. And, even though these research centers all proclaimed to engage in collaborative work, that collaboration is strictly within the boundaries of the university and funders such as the National Science Foundation. In all three instances, the research centers listed collaborative partners that extended to other universities and funding agencies, but all were within the discipline and none included industrial partners. Collaboration in this sense is defined as ‘inside’ disciplinary boundaries, within the expert community.

In addition, the research centers described their contact with the private sector strictly in terms of providing education and training. For instance, one research center stated that it
provides “research-based training opportunities in cyber-enabled discovery to a diverse cadre of graduate and undergraduate students.” A second research center also outlined its involvement in relation to education and training:

[The research center] is making impacts in education and industry on statewide and national levels by enhancing learning and scholarship, providing guidance and continuing education opportunities to industry professionals, addressing the needs of IT professionals, and promoting the development of new IT technologies and their applications.

In all of these descriptions, the emphasis is on the university as the locus of expertise, as the starting point and foundation for new technological developments.

As such, these texts describe a social space and the connections and responsibilities of its actors to other social spaces. The ITI’s projected ethos disrupted that description by including and even privileging “non-science” activities in the boundaries that have traditionally structured how work gets done in the academy. But as Gieryn (1983) argued, such boundary work is a rhetorical style, concluding that different rhetorical goals call for different rhetorical styles. For instance, to expand authority or expertise into other domains, the rhetor’s repertoire may include oppositions that heighten the contrast between rivals (p. 792). As a rhetorical style, contrast between rivals was quite evident in the ways each interpreted the cultural values or ethos of the other.

In the interview, I asked John about these tensions over the role of the industry leaders. When I asked John whether the issue was about industry funds “tainting” research, he replied:
I don’t think that it is that so much as a sort of natural rift within university of basic versus applied research and the people who value one over the other. So the people who are primarily funded by the NSF for instance would think that industry work is not interesting enough. First of all, industry would fund you to work on a specific problem, not necessarily whatever you like. So they are calling the shots as opposed to you. Even though it is contract research, they can’t force you to do anything—they just won’t fund you again.

Second, it is also that, I don’t know what the issue is generally, but that it is a sort of a second class type of support, that these are problems that are too near term, too pedestrian to get PhD material to work out of, even though we do it all the time at ETAC. So it’s sort of a natural kind of division in the university and I think you see it in our group (interview, March 31, 2008).

For John, the issue of industry funds is not necessarily about tainting the research as invalid. Rather it has to do with a structural difference relating to who decides what counts as a problem. And the issue seemed to be about keeping that hierarchy in place, what John called a “natural rift between basic and applied research.” Contract research is considered “second class.” In his interview, Daniel reiterated this view by saying, “some people view company money as being substandard money. All money is green, but some money is greener. NSF and those moneys are considered to be better moneys” (interview, April 29, 2008). This tier is considered “uninteresting” and “too pedestrian” in value and worth.

In many ways, these tiers of funding, the greenness of money, described a social position and the economic and cultural power of that position. In his explanation of the difference in social spaces, Bourdieu (1998) argued that the “position occupied in social
space, that is, in the structure of the distribution of different kinds of capital, which are also weapons, commands the representations of this space and the position-taking in the struggles to conserve or transform it” (p. 12). As the directors worked to structure ITI, they maintained the categories that describe the distribution of capital in the linear model, but revised the relative positions in the representation of that space. Inscribed in that space were distinctions and differences in practices and goods. As Bourdieu (1998) said, these symbolic differences constitute a language, a set of distinctive features that “constitute a mythical system, that is as distinctive signs” (p. 9). In the case of the ITI, the distinctions between basic and applied science described a social space full of symbols that inscribed the distribution of capital and its relative worth.

**Ethos as Spatial**

In the last section, I considered ethos in relation to the symbolic attributes that delineate the boundaries of science. In this section, I analyze ethos as a spatial dimension to further my argument that keys terms that describe the social structure are not just stylistic devices, rather they become the substance of the discourse, a part of the regularized routines and habits, institutionalized in practical matters such as how the money gets spent, who gets to lead, and what the vision/mission of the organization should be. As substance, the ITI’s entrepreneurial ethos realigned the economic and cultural value attributed to basic research and its technological application, and on a practical level, getting all of the research directors to buy into the space it created became a problem.

It was problematic for two reasons. First, the dissenting research directors had no incentive to fully commit to the ITI, and second, there seemed to be a general discomfort with the spatial relationships its membership entailed. As Kay said,
I think each one of them comes to the ITI from the perspective of their own center. What would it take to my center successful and in turn ITI successful? They can’t get past their own center to determine what would make ITI successful. I think it is because ITI has very little value or impact. They wouldn’t view that as offensive but just their honest opinion (interview, March 17, 2008).

The dissenting directors failed to see the benefit to their individual programs. In her interview, Kay speculated what it would take to get the research directors to buy into the model. “If the center director’s could feel there is an incentive—for them it has to be tangible money or extra grants—they would buy into it. But I don’t think they see any of that yet” (interview, March 17, 2008). The irony of the situation was that the ITI as a space was physically and rhetorically structuring as a “trading zone” for different groups with different interests to come together to get things done, but that common ground held little interest to those who constituted its core. It was not so much that they failed to understand the language. The dissenting research directors did seem to grasp the situation. The language provided the coordinates for cooperation, but the directors failed to see the incentive.

But in addition to lack of incentive, there was also a lack of comfort with the model, not necessarily on an ideological level, but on a practical one—it was an uncomfortable place for some people to be. In his interview, Daniel said to me:

The model is kind of ambitious because most centers here on campus are singularly focused typically on research. This center has not only that as its mission but also the economic development piece as its mission makes it a little more challenging. Not all faculty are comfortable with the economic
development piece of the mission…. Very few centers have played on that path. There are a few. But it’s an uncomfortable place for a lot of people to be (interview, April 29, 2008).

Daniel pointed out that the model is rather ambitious because it is an unknown to the faculty who have been asked to “play on that path.” Expanding the mission from research to include economic development was not something they necessarily knew how to do. Likewise, Mike noted the discomfort factor in his assessment of the difficulties this model faces:

I wonder if these people would tell you this or not, but I think this whole economic development piece is something that most of these, you know the Bloedels and Brightons, aren’t necessarily comfortable with. They are the VP of research and they have to deal with economic development so they have to make the best of it. So I think there is still some, there’s just discomfort in academia dealing with economic development. But, that is the reality (interview, May 19, 2008).

In his explanation, this economic activity, entrepreneurship is not in their realm of experience. Although they may be good researchers, they have no experience outside of the “basic” research realm as it has been traditionally defined. As Bourdieu would say, they have no “feel for the game”—the acquired system of preferences that orient the perception of and response to a situation (p. 25). Perhaps this discomfort has to do with “economic development” as asking them to switch sides in the sets of oppositions that have structured traditional practices since the end of the Second World War. The “economic development” narrative alters the marks of distinction and the ways in which the “playing field” is read and interpreted.
But what is most striking about these explanations about the economic development model is that they retain the structure of the linear model. Structurally, the ways in which John and Daniel talked about the proposal model for ITI simply enlarged the arena in which faculty are expected to take responsibility. At the same time, however, their conceptualization also shifted the focal point, moving the key justification from public good to economic development. As Burke would say, this movement in focal point constitutes a different terministic screen. For Burke (1966), terministic screens shape “the range of observations implicit in a given terminology” (p. 50). While Burke used the analogy of a color filter on a camera lens that creates a different photo of the same object to describe terministic screens, I am also reminded of the drawing “Draughtsman Drawing a Nude, 1538” by Albrecht Durer (1471–1528), a German painter, draughtsman, and engraver known for his prints and drawings, particularly because of his technical skill and subject matter. Aside from the aesthetic of his work, Durer is interesting because he and others (including Da Vinci) were playing with perspective and proportions, using grids and other devices to render linear perspective on a flat page.

Figure 4: “Draughtsman Drawing a Nude, 1538” by Albrecht Durer.
In Durer’s drawing, the draftsman’s perspective is mediated by the grid. Like a terministic screen, the grid directs, deflects, and reflects reality. But, as Haraway (1997) argued, these perspective devices are “the artifacts with which we convince ourselves our histories are true” (p. 180). By applying “real” methods, such as the screen in the drawing, that sorts the data points, chaos can be ordered and the natural can be “real.” The draftsman can “see” his subject just as the scientist sees the object. The line of sight is mediated by the visual technology providing focus and point of view. In the case of the ITI, the conflict among the research directors was largely a struggle to control the perspective device that stabilizes the activity. In other words, whose metaphor dominates? As Haraway (2007) argued, “Durer’s engraving attests to the power of the technology of perspective to discipline vision to produce a new kind of knowledge of form” (p. 180). Like Durer’s drawing, the line between pornography and art, non-science and science is paradigmatically constructed. For Haraway, power had to do with the someone or something that directs the focal point, and hence gets to name and label the categories for knowing.

For the ITI, power was about whose vision was adopted or which perspective was the measure of success. In her interview, Kay summarized the situation as:

I think the group was very supportive of ITI, but each has a very narrow, different view of what that success would be. I think they would tell you it’s not a power struggle, but a difference in vision. But when they have a difference in vision, they use their power to make sure another vision isn’t adopted (interview, March 17, 2008).

In this quote, I am reminded of Burke’s neurotic, the disassociated self in which antagonistic terms are in conflict with one another. But even as those terms confront one another, they
“can be said to ‘cooperate’ in the building of an overall form” (Burke, 1969b, p. 23). As Kay said, the struggle was over whose vision is adopted, each drawing on their resources to make sure the other’s vision was not. For each, the projected ethos reflects the understanding of the situation, the interpretations, an expression of reality and the data points that are literally and figuratively gridded: an entrepreneurial ethic that expands the field of agency to include those outside the university or a research ethic that values the autonomy of the scientific community as experts.

**A Structuring Resource: Audience**

As I argued in previous chapters, technology transfer is often conceptualized as linear movement, in which information is transferred across boundary lines from one entity to the next. In the previous section, I analyzed the ways in which the ITI’s entrepreneurial ethic drew on this model, upsetting the traditional hierarchical relationships between basic and applied research. And I argued that ethos represents an understanding of the situation, providing local coordinates that allow audiences to visualize how they fit into the situation. In this section, I examine audience as a co-constituent in the ways technology transfer is conceptualized. As Bourdieu (1991) argued, “the conditions of reception envisaged are part of the conditions of production, and anticipation of the sanctions of the market helps to determine the market of the discourse” (p. 76–77). All expressions are marked by an anticipation of what is acceptable. It is this anticipation of the acceptable, not a rational calculation toward maximizing symbolic profits, that determines not only the choice or level of language, but also what is possible or not possible to say. In this way, the audience does
not stand apart from textual production. Rather, the audience is embedded in the persuasive appeal.

In this case, however, the audience failed to fully participate in terms put forward by the ITI. We often think of audience as external, sitting in front of the speaker listening silently and intently to what is being said. But as the ITI found, it also had an internal audience that was also a necessary constituent of ITI’s organization. The rhetorical grounds put forward by the ITI to its external audience presented a motive or interpretation of the situation that several directors resisted. As I discussed earlier in the chapter, the metaphors including “unifying home” and “unique platform” referenced a new kind of space for material action. But these metaphors were more than stylistic devices. They were also visualization technologies. As Haraway (1997) said: “figurations are condensed maps of whole worlds” (p. 179). They allow people to “see” the space and where they fit. As such, they embody the values, norms, and habits of a given field, epitomizing the tensions between Bourdieu’s (1991) conditions of reception and production.

But, figures are powerful because they draw on formal patterns, such as antithesis, that invite the audience to participate. In technology transfer, the arguments that underscore the oppositions between Mode 1 and Mode 2 are powerful because the audience can co-construct the divisions that stand under the discourse. Burke (1969b) described this form as a “collaborative expectancy” (p. 58), which, because the audience can readily grasp the construction, they can easily participate. In A Rhetoric of Motives, Burke (1969b) described the form as follows:

Imagine a passage built about a set of oppositions (‘we do this, but they on the other had do that; we stay here, but they go there; we look up, but they look
down,’ etc.). Once you grasp the trend of the form, it invites participation regardless of the subject matter. Formally, you find yourself swinging along with the succession of antitheses, even though you may not agree with the proposition that is being presented in this form. Or it may even be an opponent’s proposition which you resent—yet for the duration of the statement itself you might ‘help him out’ to the extent of yielding to the formal development, surrendering to its symmetry as such (p. 58).

In this passage, Burke described antitheses as having a certain rhythm with recognizable successions of statements. Burke (1969b) went on to say, however, that some forms are stronger, because they are more agreeable, than others. Even though the audience may surrender to the symmetry, to the rhythm of statements, it may reject the form—the weaker the agreement, the weaker the surrender.

For the ITI, the succession of statements that gave the organization form failed to resonate with several of its members—they failed to surrender to its symmetry. Why did the rhetorical ground or space built around the ITI fail to bring the participants together? As Burke (1954) said, just because something should be of interest, does not mean that someone will be interested. As I quoted Daniel in the last section, the ITI was “a tough sell” (interview, 4/29/08). What the ITI had to “sell” was not objects, but a dynamic. In this section, I examine the role of audience in defining technology transfer particularly in relation to the problems with Mode 2 as a rhetorical space for coordinating the interests of different people with different needs. This last vignette from my field notes frames my analysis because it is an early articulation of how the key participants in ITI’s organization conceptualized both the audience and its relationship to that audience. Following this
vignette, I discuss the ways in which this audience restructured the value of technology transfer by redefining its terms.

**Vignette III: Can You Hear Me Now?**

We met today to talk about writing a newsletter for the ITI. Kay told me that the audience is mostly external to the university—people who give, people who want to give. It’s all about selling the invisible. The goal is to get some energy, to make ITI look dynamic. Kay’s question: How do we let people know it’s an invitation to them, an opportunity to collaborate, that ITI is facilitating that cooperation. She went on to say, ITI brings players together. How do you say, yes, we’re ready? ...ITI can do it. But, it’s got to do it quickly. We don’t want the [industry leader] sitting out there all by himself waiting for this thing to take off.

Field notes, October 4, 2007

Early on in ITI’s organization, I was told that the marketing materials had to tell a success story. As the above vignette indicates, selling that success meant selling the invisible—a dynamic, an energy, and a set of relationships for cooperative action. The question was, as Kay asked, how do we let people know we are ready. As she went on to say in my field notes, “companies don’t want to come in to build a collaborative environment. They want to come in and solve problems” (field notes, October 4, 2007). At this very early stage, “building” the institute meant establishing relationships, primarily with Iowa’s corporate sector.
But the ITI focused on this external audience for a very practical reason—it needed to get into cash flow. The ITI had invested a significant portion of its start-up funds on renting office space, what the ITI called its Technical Collaboration Facility, near the university’s research park. In his interview, Daniel explained to me: “the bottom line is that it has to be self-sufficient in some number of years in order for it to continue” (interview, 4/29/08). It planned to do so by renting space in the Technical Collaboration Facility to small start-up companies and by selling research memberships to larger companies. As Kay said in the vignette above, the target audience was “people who give, people who want to give” (field notes, October 4, 2007). But the ITI had to get players together quickly. It had to create the dynamic and momentum to make the organization sustainable. The rhetorical exigency was defined in relation to self-sufficiency and the steps needed to get there because the initial start-up funds would not last indefinitely.

But, the irony of the vision that was put forward—“a new home” and a “unique platform”—was that very little cooperative action was going on. These metaphors suggest a certain unity. They hold the promise of unifying discordant practices, referencing a kind of trading zone, in which various interests co-mingle to get work done. Introduced by Galison (1997), trading zones coordinate action and belief among different traditions: “a site—partly symbolic and partly spatial—at which the local coordination between beliefs and action takes place” (p. 784). In his history of 20th century physics, Galison (1997) examined three distinct subgroups — theorists, experimentalists, and engineers—who worked together in the weapons laboratories of World War II. Galison’s trading zone represented a space for these distinct groups to come together at the same time as they retained their separate identities and practices. Like Burke’s doctrine of consubstantiation, trading zones recognize groups as at
once together and apart, allowing autonomy and interconnection. For Galison (1997), cultures in interaction can agree on rules of exchange despite vast global differences. In the case of the ITI, agreeing on the rules of exchange was a problem for two interrelated reasons. First, as I discussed, Mode 2 tends to collapse traditional power structures, and second, Mode 2 tends to situate knowledge production within social, economic and cultural contexts. For the ITI, that contextualization rearticulated the terms of exchange.

**Mode 2: Contextualizing Knowledge Production**

With a shift in agency from individuals to larger systems of knowledge production comes a different conceptualization of the relationship between academic research and those ‘outside’ the university. Mode 2 represents a broader engagement with society, contextualizing research agendas within larger social systems. This broader contextualization of academic research brings into question what activities now have a “research” component. As a consequence, it is hard to distinguish between the categories that have traditionally defined research, complicating the role of audience.

For one, the state took on a larger role in defining the scope of the ITI and its activities. John described the conflict to me as follows:

> I think there is a general perception among my colleagues that my emphasis has been on economic development and industry outreach and entrepreneurial activity and all that, whereas the mission of the ITI is to strengthen our research capacity. I’ve always agreed with that. It’s a matter of chicken and the egg. For me, the funding came from the state with a economic development mandate and that’s where I’ve focused the most time certainly
and my colleagues with a research bent are convinced that small projects for them and their friends will inspire new research and that has been a tough battle to fight too. So it’s been a struggle (interview, March 31, 2008).

For John, it is a matter of which comes first: research as the foundation for defining problems and methods or the broader context of application that drives the research? Which approach is to stabilize the research agenda?

This metaphor also extended to the role that industry was asked to play in the model put forward by the ITI. In his interview, Daniel referred to a need to enroll company support to make the organization viable. He said:

In a few years, I think we need to basically have enough companies to have a critical mass of being able to support people that we need to have. It’s a little bit of a chicken and egg. You got to have some people there who you can rely on to get things done, but you can’t afford to pay the people until you get some companies to come in with some work. So it’s sort of balancing act. If we reached the point where we had enough income to maintain a staff of students that did the work, so when somebody new comes on, they are able to slot right in and continue that process, then I think we’d be closer to being successful at that point.

In other words, the internal and external components need to be built simultaneously. ITI staff and company support need to act in conjunction to be able to balance or stabilize the process toward sustainability.

But in trying to establish this “new home” and “unique platform”—a trading zone for conducting the business of science and technology—the role of these external audiences
continued to drive a wedge between the entrepreneurial and traditional modes of knowledge production. Throughout the interviews, I continued to get the sense that several of the research directors were not committed to developing these partnerships. But for the ITI, this internal resistance to the model made it difficult to bring in external players. In my interview with Guy, the graphic designer, about the ITI’s organizational identity, he said,

> It’s an unknown even inside the inner circle. They can’t agree as to what it is, where it should go in the tight circle of the five research groups that are there. So how are they going to present a positive image to the corporate environment they are trying to connect with and also the public in general, the taxpayers who support it? They’ve got a long, long uphill battle (interview, May 22, 2008).

Presenting that positive image continued to be problematic for the ITI. As Nowotny et al. (2001) argued, the change of context necessitated by Mode 2 is often met with resistance, with many scientists believing “they are engaged in nothing more than a public relations exercise which is inconvenient but necessary” (p. 111). As a result, they do not take full advantage of the opportunities offered in the more entrepreneurial environment only going through the motions, making small gestures that failed to amount to more than business as usual.

**Trading Zones: The Terms of Exchange**

As I stated at the beginning of the chapter, following the ITI’s Industrial Advisory Board meeting the ITI’s research directors found themselves locked into a holding pattern—they disagreed on how to build the “bridge” over the *valley of death*. The “bridge” meant
different things under Mode 1 and Mode 2. As Burke (1966) said, “basically, there are two kinds of terms: terms that put things together, and terms that take things apart. Otherwise put, A can feel himself identified with B, or he can think of himself as disassociated with B” (p. 49). “Bridge” in the economic development narrative meant something entirely different than under the public good narrative. As an internal audience member, several research directors seemed to disassociate with the ethos being constructed by the ITI, primarily because they saw it as having little value.

First, several of the research partners saw no need to partner with industry. As Daniel said, “most smart people optimize their path to success. Economic development is not part of that equation” (interview, April 29, 2008). In his interview, Daniel recognized that once you “leave the research realm, you start running out of ways that students can write papers and those sorts of things that benefit the students” (interview, April 29, 2008). He described the project as an “interesting middle ground” for responding to real needs in the broader societal realm as well as the academic realm. Interestingly enough, applied research has occupied that middle ground in the linear model since World War II. In this instance, the bridge is not only between Mode 1 and Mode 2, but between basic and applied as categories. In his interview, John countered the criticism that the proposed platform lacked opportunities for students and untenured faculty to get publishable work by saying, “we do it all the time over here [at ETAC]” (interview, March 31, 2008).

Second, there was a certain amount of uncertainty about the role the industry leaders should play in the organization. Following the Industrial Advisory board meeting, John told me that the problem was in the kind of help the companies needed whether short-term, fee for service kind of jobs or longer term partnerships focused on “strategic vision…the big
problems, the hard problems that companies don’t have time or resources to work on” —an idea “soundly rebuked” by his academic colleagues (interview, March 31, 2008). Identifying the role of these industry leaders/advisors became increasingly contentious, particularly in relation to the “research” part of the ITI. In his interview, Daniel told me,

When you talk about the economic development piece, I think that is where industry has its strongest say. I think they play much more of a minor advisory role when you start to talk about influence. If they want to influence the core research, the harsh reality of it is, they need to put the money on the table. If they want to see us focus on some research piece that we don’t do now, they have to put money on the table. The bottom line is that faculty can’t change research areas without some financial support to pay the grad students. But their biggest influence would be in the area of where the economic development arm of where this goes and again that’s a sort of money talks sort of thing also (interview, April 29, 2008).

As indicated in this quote, ITI directors struggled to find a balance between economic development and research arms of the organization, wanting to keep them separate, but at the same time recognizing that “money talks”—it has influence.

But getting industry to participate was also a challenge. For industry, some have said its resistance to working with universities is that there is too much risk for the potential return on investment (Cohen, 2005). Others point to the perception that universities can’t act fast enough (Spielman & von Grebmer, 2006), and still others identified differing incentive structures (Davis, 2005), problems associated with intellectual property rights (Grose, 2006), or lack of communication among the participants (Spielman & von Grebmer, 2006, p. 299)
as reasons to not partner with universities. These responses to the *valley of death* are further complicated by legislation, bureaucratic structures, and differing worldviews about the ways in which research “moves” out to practical benefit. As John told me in his interview,

> But everybody struggles with the intellectual property issue and trying to define a value for your partners. That’s the real hard part. What’s in it for me if I just throw in with you guys, what do I get. That’s hard to articulate; we need a value a really distinct value proposition. It’s not a goodwill project. We’ve got to be able to appeal to the bean counters (interview, March 31, 2008).

Defining the value for the internal and external audiences was the challenge. As Nowotny et al. (2001) explained, “the success of these exchanges depends on each participant bringing something that is considered valuable by someone else—whatever that value might be. Participants usually will return to their ‘home-base’ with their gains, thereby reinforcing in typical Mode 2 fashion the links and exchanges that have already occurred by sharing with others” (p. 146). As an evolutionary process, Mode 2 makes the first tenuous connections between science and society. These connections are the symbolic and concrete spaces where potential participants decide on the terms of the trade or transaction.

But with several directors too intent on protecting their time and resources, the ITI became an exercise in boundary work as differentiation rather than integration. The language surrounding *economic development* brought the ITI together, but failed to provide the *substance* needed to keep them there. The body of identifications embodied in narrative surrounding the ITI’s version of the “bridge” did not translate to all parties. In their analysis of the Museum of Vertebrate Zoology (MVZ), Star and Griesemar (1989) argued that
translation or the “process of developing and maintaining coherence across intersecting social worlds” (p. 393) is achieved through standardization and boundary objects. They claimed that MVZ’s director was successful in bringing together diverse groups including university administrators, professors, research scientists, and amateurs for two reasons. First, he developed, taught, and enforced a set of methods to “discipline” the information collected by expert and non-experts. Through such standardization, the allies could become a part of the process in such a way that “their pleasure was not impaired” (p. 407). Second, from these standard methods, a series of boundary objects (specimens, field notes, museums, and maps) emerged. All of these related to a larger goal that many of the participants shared—to map California as a field laboratory. As they said, this goal gave California itself the status of boundary object, recognizable and usable in multiple social worlds.

The story of the MVZ is interesting to the story of the ITI because in many ways, the ITI struggled with the standard methods. How could they institute a shared goal? In an electronic slide presentation to ISU’s president and provost in October of 2007, just prior to the Industrial Advisory Board meeting, John outlined the goal as follows:

**Where are we going?**

Goal: Build a reputation for being one of the best institutions in the country for cyber-enabled discovery & cyber-enabled economic development

**How are we going to do it?**

- Establish industry partners for collaboration and support
- Establish a strong science-based computer-aided discovery
• Significantly increase the funding, infrastructure, and expertise

• Establish ongoing core funding of $5M/yr within three years through university, state, and industry resources

**What does it take?**

• Faculty working as individuals (funding, publications, professional activities)

• Faculty collaborating across discipline boundaries in seeking support

• Faculty participating in the ITI

• President and provost buy-in and support

• College and department leadership and support (electronic slide presentation, October 12, 2007)

Like the MVZ director, John drew on a narrative for a common goal—make ISU the best institution in the country. Like the MVZ, it was a goal that was malleable enough to intersect several social worlds. In the slides that follow, he furthered that vision by showing the ways the various social worlds intersect: some will work on discovery, others on economic development; faculty will work as individuals and collaborate across boundaries; and it will bridge the industrial and science-based discovery. So why didn’t the narrative work? This overarching goal that was guiding the mission and vision statement looked adaptable to other local sites.

Those sites included the university, the state, industry leaders and the research center directors who were asked to join. For university leaders, the pressure to show that the state’s tax dollars have an impact is great. In an interview, Mark, the science writer, explained it to me this way:
Part of it is, if ISU can be an engine of economic development, can convince state house leaders and the governor that it is an engine of economic development, that can lead them to provide more support for ISU. You know, graduating 10,000 undergraduates every year may not do it anymore so you have to be…we’re doing this other thing, building jobs, building industries that weren’t here before (interview, May 19, 2008).

As Mark’s quote indicates, definitions of the public good for ISU might be changing in light of its own audience at the statehouse. When I asked Daniel about the expectation on faculty to engage in economic development activities, he exclaimed,

Oh they’re expecting a lot of that! They expect a lot out of us. But there is a disconnect between what the regents say and what the faculty member pays attention to. The higher you get up the food chain, the less the faculty member will pay attention. What the regents say is absolutely meaningless to most people (interview, April 29, 2008).

Although the expectation is there, getting people to pay attention is another matter. And that was the problem for ITI—getting all the research directors to buy into the ITI as a way to “build a reputation for being one of the best institutions in the country for cyber-enabled discovery & cyber-enabled economic development” (electronic slide presentation, October 7, 2007). Unlike the MVZ, other boundary objects failed to emerge around which the different groups could have coalesced.

For one, the ITI did not yet stand as an indexed repository that various stakeholders can borrow from “for their own purposes ‘without having directly to negotiate differences in purpose” (Star & Griesemer, 1989, p. 410). The idea of a repository is somewhat problematic
for the ITI because unlike the MVZ, its specimens or objects are code. Given the pace of IT, this object is much more ephemeral than other objects in a university setting, particularly with respect to intellectual property. As John explained in an article in ISU’s College of Engineering magazine Innovate, it is “very difficult to protect, to try and quantify what’s unique about an algorithm that’s written into software” (p. 8). He continued by saying that software is so flexible and fast, its development is about speed and relationships, making the dynamic of the organization the selling point or main asset. The ITI’s website was about creating and selling that dynamic more than it was about locating and describing a repository of ordered objects. And that tension over the purpose of the site seemed to reflect the differences among the research directors. As a rhetorical actor, the website seemed to force the question: was the ITI a dynamic set of relationships or a repository of knowledge? The contentions over the website content had a lot to do with resolving the answer to that question.

In their discussion about Mode 2, Nowotny et al. (2002) stated that identifying boundary objects are particularly difficult in Mode 2 because of its diffuse nature. In their analysis of projects involving a range of actors from different sectors, they found that the projects that had the most success were ones that were strongly contextualized around a common goal. For instance, the Central Artery/Tunnel project in Boston was an example of a project that was from the outset strongly contextualized. As Nowotny et al. (2002) stated, it appeared messy. No single person or agency was in charge and management was inclusive and participatory. Second, participation was iterative: “views [were] solicited, advice sought, designs modified and then the whole cycle was repeated” (p. 142). Third, all participants perceived the outcome as a better approach. This last criterion echoes Galison’s statement
that the stability of a trading zone comes from a commitment to the exchange: “They can even both understand that the continuation of exchange is a prerequisite to the survival of the larger culture of which they are a part” (p. 803). Throughout the process, all parties see the value of the working together. This idea of contextualization raises the question of whether the ITI might have taken off if its inception had revolved around a specific project or technology rather than an idea of how they might approach such a project.

But, this case study may also indicate that economic development as a key justification was not contextualized strongly enough to sustain interest across the university/industry divide. As a “bridge” over the valley of death perhaps this narrative and its attendant figures are too weakly contextualized for key players to make it their own. At the points at which all the stakeholders were in the same room (the Industrial Advisory Board meeting), the common goal or organizing vision represented a demarcation rather than an integrative exigency. In their work, Wilson and Herndl (2007) found that boundary objects, such as knowledge maps, can function to encourage an integrative rather than a demarcation exigency. The knowledge maps they discussed made “discordant language and knowledge understandable by demonstrating how these ways of thinking and speaking fit within a common project and how they emerge from different contexts for action and different institutional purposes” (p. 132). This integrative exigency combined with the boundary object provided a trading zone, a space for cooperation and exchange among different groups with different needs. In the case of the ITI, its available boundary objects were not enough to provide a trading zone.

As Galison (2007) noted, trading zones coordinate symbolic and material actions. For disparate groups to work together, it is not a question of getting rid of categories, but of
coordinating an approach. But in a trading zone, different traditions meet without losing their individuality. Metaphorically, “trading zone” suggests that an exchange takes place—each partner brings something of value for exchange. For Nowotny et al. (2001), trading zone are “transaction spaces” in which all partners not only bring something for exchange or negotiation, but they also take something away as well. For the ITI, this idea of exchange never really took hold. In his interview, Daniel reiterated that there is a place for everyone in the university:

> We’ve got to help the state and the country. That’s what we are here for. And so some people are going to help by doing basic research and others are going to, I’ve always argued that there is a place for everybody. We don’t all want to look the same. And that’s where the struggle comes in. I wouldn’t expect that most of the faculty would want to play in economic development but don’t prevent those that do, don’t put up roadblocks for those that do want to do that (interview, April 29, 2008).

In Bourdieu’s terms, Mode 1 and Mode 2 are habitats with different sets of dispositions that characterize the habitat and its inhabitants. These differences are marked in how speakers use language socially. In other words, business is accomplished and capital is converted and transferred by knowing the linguistic market of the receiver. In the case of the ITI economic development, did not hold the same value across different markets. And as Daniel said, that is where the struggle comes in—we don’t all look the same (interview, April 29, 2008). Even though the economic development narrative worked well in speaking to its external audiences, it distanced its internal audience. As Bourdieu (1991) said, “the competence adequate to produce sentences that are likely to be understood may be quite
inadequate to produce sentences that are likely to be listened to, likely to be recognized as acceptable in all situations in which there is occasion to speak” (Bourdieu, 1991, p. 55).

Competency in a given linguistic market may not transfer to other social spaces. Being listened to is not a matter of grammaticality. It is a matter of competency in a linguistic market. In a social space, the dominant competence measures the value of linguistic products, functioning as linguistic capital. For Burke (1969b), the difference in competencies is rhetoric. “And often we must think of rhetoric not in terms of some one particular address, but as a general body of identifications that owe their convincingness much more to trivial repetition and dull daily reinforcement than to exceptional rhetorical skill” (p. 1328). In this case, the rhetorical actors drew on different linguistic markets with differing valuations on the terms of technology transfer.
CHAPTER 5: CONCLUSION

At the beginning of this study, when I asked Kay if I could use the ITI as a research site, she was really pleased, saying the ITI’s main problem was a lack of communication. With my expertise in communication, I could solve the problem. My field notes read:

Kay thought the study was going to be very interesting and from a practical point of view what the ITI needed. She was envisioning a report where in the end we could implement a checklist of recommendations and action items. And, by the end of the study, we could say done, done, done. She said poor communication has been a consistent problem (field notes, January 28, 2008).

In many ways, Kay’s request reminded me of the checklist in Star and Griesemer’s (1987) article about the Museum of Vertebrate Zoology (MVZ). As a boundary object, the checklist functioned to maintain coherence across disparate groups of people with different needs and interests. From a practical point of view, the checklist made sense for the ITI—it seemed to lack a common language to talk about the future direction of the organization. I am not quite sure, however, what that checklist would look like. Unlike the MVZ, the ITI had yet to define the scope of its work or to identify a project that might stabilize the situation by providing points of entry for each participant—what Star and Griesemer (1987) called a means of ‘translation’ or a common ground in which allies could become a part of the process without compromising their interests. In other words, individual needs are not “lost” in translation. Participants can “see” how they fit into a larger goal. Although the ITI’s economic development narrative translated well to some audiences, it did not with others, specifically
several of the research center directors who had been included in the ITI’s administrative apparatus.

In this dissertation, I focused on the key terms or terministic screens that reflect, deflect, and select reality (Burke, 1966, p. 45). These terms figure a rhetorical ground or a general body of identifications, specifying motives in a field of competing interests. In technology transfer, economic development emerged as a new response to the valley of death, revising the answer to the central question in technology transfer—for whose benefit? Although federal, state, and university leaders have called for new models to increase the intellectual interchange between university and industry, several key participants in the ITI saw no value in changing the practices that have organized their work. As I think about Kay’s request for a kind of checklist, I think about how much of the work the ITI did was related to trying to find a ‘middle ground’ for these various interests. The question for me has been why wasn’t the rhetorical ground successful? What are the difficulties in ‘bridging’ categories such as Mode 1 and Mode 2, basic and applied research, and university and business interests?

These questions are not new and are the subject of many articles and books across many fields, including economics, history of technology, public administration, and technical communication. But few consider the rhetorical grounds that authorize these various discourses as structured practices. To understand key terms as figuring a rhetorical ground, I have drawn on Kenneth Burke and Pierre Bourdieu to frame my analysis of the ITI as a fully rhetorical discourse, drawing on recurrent social practices that constituted a rhetorical ground or space in which value and meaning are constituted and negotiated through principles of identification and division.
To analyze those principles, I first identified the rhetorical figures used by the ITI and the function of those figures. I then analyzed the ways in which its participants interpreted those rhetorical figures through the lenses of ethos and audience. In the end, I argued that figures are visualization technologies that stabilize the uncertainties in science by providing local coordinates for competing groups in complex situations. These coordinates are articulated in communication artifacts such as start-up proposals, diagrams, and websites that instantiate a vision for mapping relationships and coordinating action—structures for thinking through the ITI as a virtual prototype. But as the case of the ITI showed, *economic development* as a visualization technology in Mode 2 worked to bring together different groups with different interests, but ultimately failed to hold them there. As Burke (1969b) said, “Identification is affirmed with earnestness precisely because there is division” (p. 22). The specificity of *economic development* was constructed in opposition to the traditional *public good* model. As a new justification, it failed to provide key participants the means to see how they fit into a larger goal without losing their identity.

**Rhetorical Figures: Platforms and Bridges**

Before my study began, I had been leading the marketing team in creating marketing materials to announce the new ITI as a “unifying home” and “unique platform” to “bridge” the perceived gap between research results and new technologies. In short, the ITI was being put forward as a new way to bridge the *valley of death*. In early 2007, we created a website and postcard with plans to do a brochure and newsletter. But in late 2007, following the ITI’s first (and only) Industrial Advisory Board meeting, I am told all marketing production was put on hold—the organization could not agree on its mission. As Kay explained to me, the
disagreement was an issue of boundaries: ITI Director John and research center director Daniel wanted to push the boundaries of traditional research. In many ways, the purpose of the ITI was to establish a kind of trading zone or rhetorical space between Mode 1 and Mode 2.

To understand the conceptualization of the ITI, I analyzed the texts in which John was laying out a vision or virtual prototype of the organization: a start-up proposal and white paper written for state and university leaders. These texts were the basis for subsequent presentations to external audiences and included the website, electronic slide presentations, and press releases. In analyzing start-up proposal and white paper, I identified two sets of metaphors that described the proposed vision of the ITI: platforms and bridges. In many ways, these metaphors were meant to call the organization into being, visualizing the ways in which the ITI would unite different actors under a new configuration. In this section, I argued that these figures functioned in two ways. First, they provided a structure for thinking through the ITI as a virtual prototype. Second, they worked to circumscribe a space for Mode 2 practices.

**Platforms: The ITI as a Virtual Prototype**

In the start-up proposal and the white paper, the ITI was positioned as a “unifying home” and a “unique platform” for science and technology commercialization, extending beyond the confines of the university to include industry partners and entrepreneurial start-up companies. What made the ITI “unique” was its vision to co-locate, have flexible intellectual property relationships, and provide a new mechanism for teaming. Although some may argue that these metaphors are more stylistic than substantive, I interpreted their use within an historical and cultural context. In many ways, these metaphors functioned to call an audience
into being—industry leaders. Although the start-up proposal and white paper responded to a call by state and university leaders to partner with industry, these documents needed to respond to the perceived barriers that make such partnerships difficult. As many have discussed in the technology transfer literature, the barriers are many, including legislation, resources, and issues with intellectual property. As Kay said in her interview, “in terms of economic development, businesses don’t see universities as able to solve real problems in real time” (interview, March 17, 2008). These references to “a unifying home” and a “unique platform” seemed to be put forward to dispel that perception both in the minds of state and university leaders who would give the ITI a start-up grant as well as the industry leaders who would be invited to join the ITI. These terms functioned to describe the space, both symbolically and physically, helping various participants to think through the ITI as a virtual prototype, mapping relationships and creating a “grounds” for action.

**Bridges: Connecting Mode 1 and Mode 2**

In addition, the metaphors in the documents were working to circumscribe a space and value for Mode 2 in relation to Mode 1. In my analysis, I found that the narrative in the ITI’s texts was firmly embedded in the idea of transfer and “bridging” the valley of death. But it revised the metaphors. For instance in the start-up proposal, John summarized the outcomes of the ITI as follows: “In short, ITI offers the bridge [italics added] that is currently missing between academic IT research that is the engine [italics added] of innovation and industry-led commercialization and entrepreneurial activity that is essential for IT-driven economic development in the State of Iowa” (start-up proposal, 7/21/2006). This rather mechanistic terminology suggests that the problems associated with the valley of death can be fixed by building the “missing” link. It also implies a deficiency or lack in the current
model, creating an argument by antitheses or a set of oppositions between Mode 2 and Mode 1: movement and stagnation, applicable and non-applicable results, and the tangible and intangible. In essence, the ITI borrowed the metaphors from Mode 1, reactivating their meaning by supplying a new result.

In essence, the concept for the ITI as a “bridge” between academic research and its development and commercialization did more than transfer knowledge from one place to the next. It revised the boundary lines that had traditionally described academic research by defining research in economic development terms. It did so in two ways. First, this shift in justification reframed the gaze on the end result: tangible benefits such as numbers of licenses, partnerships, and start-up companies. Second, the “bridge” was to be created through cooperative action or partnerships that spanned both sides of the valley of death. As they were visualizing the institutional structure, however, they were attempting to redefine the expert community and the kind of activity in that community.

Central to my analysis were the ways the ITI’s identity was structured as difference. Drawing on a Burkean framework, I argued that by positioning itself within Mode 2 as a set of arguments the ITI’s identity was constituted by what it was not—Mode 1. With economic development as Mode 2’s key justification, cooperative action and tangible benefits were juxtaposed with Mode 1’s public good model of autonomy and academic freedom. These rhetorical figures function as places of identification and division. They are a mutually adjusted set of terms that provide local coordinates for participants to “see” how their interests fit. Rhetorically, the ITI’s documents were working to create a space in Bourdieu’s sense of a set of distinct and co-existing positions defined through relations of order (Bourdieu, 1998, p. 8). The ITI had to rhetorically manage those relations of order between
Mode 1 and Mode 2 actors, particularly the *between* space or middle ground. Why did its attempt fail to articulate cooperative action?

**Ethos as a Structuring Principle**

In this dissertation, I have argued that rhetorical figures are visualization technologies that reflect the structures, rules, and habits of actors situated in systems of practice. In attempting to find a middle ground between Mode 1 and Mode 2, the ITI had to negotiate the structural resources that organize the systems of practice. To understand the tensions between the modes, I drew on the rhetorical concepts of ethos and audience as structural resources. In doing so, I defined *ethos* as an appeal to a set of motives or cultural principles, articulating a rhetorical space where communal values and collective acts are interpreted. But following Bourdieu’s conditions of reception and production, in which the message is produced in relation to a perceived receptivity, this space is also co-constituted by the audience. As I noted in Chapter 4, the external representation of the ITI continued to present problems for the organization—the research directors had difficulty figuring out what the ITI wanted to be. It was in a perpetual identity crisis throughout the time of my study, surviving largely on rhetorical hype. At issue was an entrepreneurial ethos that emphasized the industry-side of the “bridge” between university and industry. In the interviews, that “bridge” was discussed in terms of the “bottom line” and what it would take to make the organization sustainable and to get participants to “buy into” the model.

As I found, the ITI envisioned its audience as an external one—industry partners and start-up companies who would provide research dollars via membership and rental income. But a second, more internal audience complicated the ITI’s appeal. As a rhetorical appeal,
the ITI’s ethos challenged the hierarchical categories instantiated in the traditional linear model. Structurally, that model concentrates the locus of scientific authority within academic disciplines by asserting that ‘pure’ research is the foundation for innovation and the economy’s ability to make technological advances. Nowotny et al. (2001) described such a process as follows:

Scientific literacy (and also perhaps cultural authority) would trickle down to, or be imposed upon, the general population with the help of university-educated school teachers, state officials, members of established professions and (more doubtfully) private-sector managers within a framework characterized by social and intellectual deference” (p. 81).

Even if such a linear model were rejected as naïve, the key role of ‘pure’ or disinterested science was to contain knowledge production within the walls of the university.

Under Mode 2, however, that concentration of authority is challenged as more actors are invited into the process. As was the case with the ITI, the building it occupied was meant to accommodate both university and business leaders in the production of knowledge. By transcending university and disciplinary boundaries and expanding the number of actors who engage in research, boundaries between what counts as ‘inside’ and ‘outside’ the scientific community somewhat dissipate. The consequence, Nowotny et al. (2001) noted, is that “the university structures of faculties and departments, institutes, and centers that create and sustain these communities become less relevant” (p. 89). In the case of the ITI, however, the values attached to those structures did not become less relevant. In some ways, they became more pronounced and were made manifest in the tension over leadership. As one participant stated, several directors felt that John did not have the expertise—publications—to be the
director of the institute. As a Mode 2 leader, John was being judged by Mode 1 credentials. His ethos was not translating well in the Mode 1 reward system. The problem was how to mitigate these value systems.

But mitigating these value systems was a practical problem. In her interview, Kay described the problem by saying that the dissenting research directors simply failed to see the benefit—they had no incentive to participate. Others commented on incentives as well, saying that such partnerships did not lead to publishable work for graduate students or untenured faculty. Furthermore, both Daniel and Mark (the science writer) speculated that the problem of getting the dissenting research directors to participate in the model had to do with a discomfort with it—they simply had no experience partnering outside academic disciplines. As Mark said in his interview, entrepreneurialism is not on their radar at all.

In the case of the ITI, the research directors struggled to move the organization forward and, for the most part, remained a divided group with each side drawing on different images of science to promote their authority. As Gieryn (1983) argued, such boundary work is a rhetorical style, a set of cultural repertoires that are deployed to advance or protect professional authority. There are repertoires for rationalizing public support for science and repertoires to discredit other activities as ‘non-science.’ In the case of the ITI, such repertoires drew on ethos as a resource for justifying one structure over another and to demarcate the lines between basic and applied research and between Mode 1 and Mode 2 knowledge production. As such, no repertoire is neutral or objective.
Audience as a Structuring Principle

As I argued in Chapter 4, Mode 2 represents a broader engagement with society, contextualizing research agendas within larger social systems. As such, audiences such as business leaders are called upon to play a different role. In the documents I examined, the purpose of the rhetorical devices John used seemed to be to bring this audience forward. As I stated earlier, the language surrounding the “bridge” metaphor suggested an antitheses between the “old” and “new” ways of working with industry. His goal was to counter the perception that universities cannot solve what Kay called “real world problems in real time.” In this way, the audience is a co-constituent in the conception of technology transfer. As Bourdieu (1991) said, all expressions are marked by an anticipation of what is accepted. The audience is embodied in the appeal.

The rhetorical figures John used when writing the start-up proposal and white paper were powerful because they drew on antithesis, a formal pattern that invites audience collaboration. As Burke (1969b) said, the form has a certain rhythm with recognizable successions of statements: “we do this, but they on the other hand do that; we stay here, but they go there; we look up, but they look down” (p. 58). But although the audience may surrender to the symmetry, to the rhythm of statements, it may reject the form. The stronger the agreement to the succession of statements, the stronger the surrender. For the ITI, the succession of statements that gave the organization form failed to hold all the participants together.

When the ITI first received start-up funds, John and Kay recognized the state, university, and industry leaders as the primary audience—those who give and those who want to give money. From a practical point of view, this focus on this audience made sense.
It needed to get into cash flow. The rhetorical exigency was defined in relation to self-sufficiency and the steps needed to get there. But John also had to define the value for industry partners. He was anticipating the response to “what’s in it for me…what do I get” (interview, March 31, 2008). As he said, the ITI was not a goodwill project for anyone. In his appeal, John conceptualized the “bridge” as both cyber-enabled discovery and cyber-enabled economic development. Working together would both broaden the scope of IT research, making ISU more competitive for research grants, and address the IT needs of national corporation, making them more competitive in the marketplace. In his appeal, he needed to rhetorically “bridge” these various interests.

In the electronic slide presentations that John gave to these external funders, he continued to refine the narrative that would serve as a common goal, but the theme was one of making ISU a leader in IT research and economic development. And in many ways, it worked. The ITI received start-up funds, it had an audience of industry leaders willing to serve on its industrial advisory board, and it had many start-up companies located in its Technical Collaboration Facility. Its internal audience, however, did not necessarily buy into the narrative. Although they understood the succession of statements that were defining the ITI, they did not surrender to the symmetry. They failed to see the exchange value.

In Chapter 4, I concluded by suggesting that one of the reasons the ITI had problems communicating was that the economic development narrative of Mode 2 weakly contextualized an important constituent. The configuration of its metaphors distanced the “basic” research category by de-emphasizing its place as the starting point of knowledge production much in the same way the Mode 1 narrative distances the “application” and “development” side of the linear progression. How ironic. The Mode 2 narrative as
exemplified by the ITI was not so much a new model as it was a change in focal point, directing the attention on and redefining the role of that audience. The narrative surrounding *economic development* was not enough to contextualize all of the ITI’s constituents.

**Limitations**

Every study has its limitations. As Stake (1994) argued, qualitative research is highly personal based on relationships developed in the case and the researcher. In my research, the ITI was a local example reinforcing the larger picture in technology transfer. In my analysis, I did not seek a one-size-fits all model for thinking about technology transfer and its sets of practices. Rather I analyzed one model for the ways in which language constructed the discourse of technology transfer as a situated, highly rhetorical activity.

Given these parameters, my study was limited in a couple of ways. For one, I was not able to interview each of the five university research directors that came under the umbrella institute. Even though I wanted to do so, I was discouraged by the administrative specialist for ETAC and the ITI. At the time of my interviews, relations among the ITI university research directors were tense. When I asked the administrative specialist for permission to interview these directors, I got the sense that she thought my presence might make the situation worse. I had to respect her wishes.

The data were also limited in that the interviews were interpreted accounts, reflecting on the situation, and my analysis is an interpretation of those accounts. These interpretations are but one of many possible interpretations of the ITI and the cultural principles that saturate its history. Furthermore, the story I told about the ITI was undoubtedly shaped by my own experiences and interests. But for any researcher, that shaping is both inescapable and
interesting. Without such vested interests, we would all be telling the same story. Clifford (1983) argued that the authority of the research has to do with the persuasive power of the text to present itself as a valid representation of a culture. My own representation of the ITI is most certainly fashioned as a written account. But, we cannot escape our own subjectivities and experiences. As Cintron (1997) claimed, ethnographic knowledge is constituted through and through by ethos (p. 4). Rather than try to push them aside, these subjectivities make the account. In other words, the account is intersubjective or coming out of the dialectical activity of ethnographer and participants. “We live in a relational world, not a foundational one; hence, reality is not grounded in any particular place but in many places so than an ethnographer’s statements have a multiplicity of origins and not a single origin called the culture or community ‘under investigation’” (Cintron, 1997, p. 386). The slipperiness of the field site and the account of it resist observation as a stable object from within or without.

Nonetheless, I believe the results of this study have much to offer, particularly at a time when public universities are increasingly pressured to partner with industry to research and commercialize new technologies. The results should help us begin a critical discussion about what we take for granted in technology transfer as a discourse that is by no means neutral or without interest. Although many in technology transfer have discussed the implications of Mode 2 on university practices, few have considered how Mode 2 fits into the discourse as a rhetorical structure for understanding science and technology. After all, Mode 1 is a fully institutionalized practice, structured by practices closely tied to promotion and tenure policies. While many recognize that the primacy of Mode 1, they also foresee Mode 2 as a sphere of increasing influence. In 2004, Slaughter & Rhoades, (2004) called Mode 2 the “new economy” for universities, moving from a public good/learning regime to an academic
capitalist knowledge/learning regime (p. 7). But how does such a change in regime take place? Who or what authorizes the grounds of such a transformation? Although Gibbons et al. (1994) and others praise Mode 2 for its seeming transparency in including more actors in the process, this case study shows that such transparency is not without interest. Furthermore the tensions the ITI faced raise important questions about models that value partnerships with actors who have different and even antithetical goals and objectives. What happens to our ideas about creativity and exploration? Can a middle ground be negotiated?

**Future Work**

In the future, I plan to continue to study local instances of technology transfer. As Stephen Doheny-Farina (1992) argued in his book *Rhetoric, Innovation, Technology*, technology transfer is highly rhetorical and contingent on the experiences and worldview of those involved (p. 7). Case studies, or slices of experiences, give us a way to frame research questions that come from praxis or doing. Praxis is what Lather (1991) called the creative activity through which we make the world: “through dialogue and reflexivity, design, data and theory emerge, with data being recognized as generated from people in a relationship” (p. 72). From these relationships, researchers can begin asking questions about what the work is doing. The following are three areas of research that I see as important trends in technology transfer:

*University partnerships*. At the time of my study, the university institute in my case study was a “virtual” construct in the process of developing a research agenda and suite of services for potential industry partners and entrepreneurial start-up companies—no intellectual property exchanged hands, no technologies were involved. Although this case
study has implications for the ways in which technology transfer is conceptualized, future work might include case studies of university institutes/research centers at different stages of development. Questions might include:

- How do these organizations differ in the ways they define technology transfer?
- Are the rhetorical figures changing?
- Are there certain patterns and variables for articulating technology transfer to various stakeholders?

Such an analysis can point to how such local instances fit into larger sets of practices in the field as whole. Furthermore, I am curious about whether “economic development” will continue to organize discussions about Mode 2. As I have argued, this metaphor focuses on an end result in the linear model. My question is whether a new metaphor will emerge to reflect the more networked and diffuse practices of Mode 2 knowledge production.

*Pedagogical concerns.* Technology transfer is about people interacting in relationships and the communication strategies used to negotiate and renegotiate those relationships. In their publication called *The Engineer of 2020: Visions of Engineering in the New Century*, the National Academy of Engineering (2004) discussed the various contexts of engineering practice and the need to engage multiple stakeholders, including interdisciplinary and globally diverse team members, public officials, and a global customer base. They noted “good engineering will require good communication,” stating that the increased imperative for accountability necessitates an “ability to communicate convincingly and to shape the opinions of other engineers and the public” (p. 55). In such publications, the engineering field recognizes the need for effective communication strategies across spheres of activity, not only as a functional skill but as a tactical one as well.
Since 2000, the Accreditation Board for Engineering and Technology (ABET) has outlined a broad range of student outcomes. To receive accreditation, colleges and universities offering degree programs in engineering, computing, technology, and applied science must document that they have met these standards. The following criteria include skills related to teaching technical and professional communication:

(a) an ability to apply knowledge of mathematics, science, and engineering

(b) an ability to design and conduct experiments, as well as to analyze and interpret data

(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

(d) an ability to function on multidisciplinary teams [emphasis added]

(e) an ability to identify, formulate, and solve engineering problems

(f) an understanding of professional and ethical responsibility

(g) an ability to communicate effectively

(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

(i) a recognition of the need for, and an ability to engage in life-long learning

(j) a knowledge of contemporary issues

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (ABET, 2008, p. 23).

Technology transfer in this instance is not only about helping students develop the skills needed in their jobs, but also to understand the broader societal context of their work and
their ethical responsibilities. Our research tradition in rhetoric and professional communication has much to contribute toward a dialogue about ways to achieve these goals. In particular, I am interested in technology transfer and technical communication as a set of multi-literacies, encompassing functional, rhetorical, and critical literacies—skills students need to assess the perspectives and practices in a given situation. As Selber (2004) said, “for better or worse, computer environments have become primary spaces where much education happens” (p. 3). English studies need to lead the way in conceptualizing student literacy not only in functional, but also in rhetorical and critical terms. Case studies in technology transfer can lead to increased dialogue about how communication technologies act as interfaces for understanding and negotiating meaning, power, and authority.

**Public policy.** In September 2008, the IEEE Central Iowa hosted a Washington lobbyist at their monthly meeting to discuss public policy, including current legislation in Congress about STEM education funding and patent reform, and the ways engineers can communicate effectively with elected leaders. This example indicates two trends in technology transfer: the need for increased dialogue across the public and private sectors and the need to understand the communication strategies needed to engage in that dialogue. Although the ITI actors did engage in a dialogue across these sectors, my access was limited to mostly reflections about those interactions. In the future, I hope to have the opportunity to shift that focal point, to not only see but to also participate more fully in that interaction. Specifically, I am interested in these questions:

- What rhetorical devices are used in the interaction between those in the sciences and engineering with governmental agencies?
• How does the sciences and engineering understand scientific literacy, particularly in relation to ‘outside’ audiences?

• How are communication technologies used in the dialogue across sectors?

Because technologies are increasingly embedded in our daily lives, analyzing the rhetorical grounds of the intellectual interchange between the sciences and engineering and public policy officials can lead to a better understanding of scientific literacy and ways to effectively engage in public discourses.

Implications

In technology transfer, communication is often pinpointed as the one of the problems relating to the valley of death. In technical communication, the question is often one of how to make complex information available to different people with different needs. Indeed as Coppola (2006) said, “technology transfer and technical communication have been intertwined since the time when homo erectus created tools and needed to talk about their use” (p. 286). Beginning in the 1990s, however, those interconnections took on a new prominence with Williams and Gibson’s (1990) Communication Perspectives in Technology Transfer and Doheny Farina’s (1992) Rhetoric, Innovation, Technology. Both understood technical communication as highly rhetorical and criticized the limited views of technology transfer and the communication environment as one-dimensional—everyone speaks the same language and has the same goals.

In technical communication, that one-dimensional and uni-directional environment is epitomized in Shannon and Weaver’s transmission theory of communication and its ‘conduit’ metaphors. Their Mathematical Theory of Communications reflected a post-World War II era
of rapid growth and production in the United States as well as the increasing importance of telecommunication. They theorized that technical writers take information, encode it, and then send it to a receiver. Upon receipt, the receiver decodes the information. Like telephone lines, however, noise and static can interrupt the information’s transfer. In this conceptualization, the quality of the communication is measured by the “clarity” of the transmission. As Doheny-Farina (1992) pointed out, this model works to reduce uncertainty in technology transfer—all that is needed is the right message encoded with the right symbols and delivered with the right capacity of the channel to handle the information.

As a highly sophisticated rhetorical activity, technology transfer is not one-dimensional or uni-directional. Rather, it is constituted by competing interests, motives, and values. The danger of information transfer models such as Shannon and Weavers is that they tend to neutralize the process of negotiated meaning by embedding mistaking meaning as a transferable. In 1979, Miller (1979) argued that technical communication is a humanistic discipline. But in identifying with this conception, many scholars in technical communication have marginalized and dismissed transmission models. As Slack et al. (1993) noted, within technical communication, Shannon and Weaver's model for communication “has been extensively critiqued and maligned such that it is nearly requisite to begin any introductory text on communication theory with an explanation and rejection of it” (15).

One of the more interesting aspects of my case study was the use of metaphors that follow the information transfer model. The participants used the linear model to describe the ITI’s goals and purpose to internal and external audiences, building “bridges” to perceived “barriers.” As Coppola (2006, 2007) said, the predominant metaphors in technology transfer today are “bridges and barriers,” calling for a new metaphor to describe the process. Indeed
as Doheny Farina (1992) argued, the key to understanding collaboration is to understand how individuals mediate differing worldviews, saying the process is one of “negotiation and sharing of perspectives, values, language, knowledge, and so forth. It is not an exchange of objectified pieces of information but a development of relationships. Effective collaboration is not just shared information; it is shared relationships” (p. 10). But even though many in rhetoric and technical communication dismiss linear models of communication, the metaphors persist. In my study, I wanted to understand the power of this metaphor to organize worlds of action.

The results of this case study extend the work of Doheny-Farina and Coppola by examining the ways in which rhetorical devices, including the linear model, are used as visualization technologies for thinking through and stabilizing the relationships that constitute the transfer. In this case, the linear model as a rhetorical figure worked to simplify a complex situation by providing coordinates that allowed participants to “see” how and where they fit. As such, the model embodies a set of arguments. As Miller (1979) said, “science understood as argument asks for assent, for an act of will on the part of the audience” (p. 616). As rhetorical actors, these figures epitomize habits, rules, and resources, articulating an interpretation of the situation and making the abstract concrete. As Longo (2007) stated, metaphor “serves as a language tool to help people understand a new technology in terms of something that is already known” (p. 253). In this case study, rhetorical figures reactivated the technology transfer metaphor by providing markers for success at the same time as it constituted a contested ground over the value of those markers and its linguistic market. The contest was over the meaning of the metaphor.
APPENDIX A: INTERVIEW QUESTIONS

General Questions

1. How did you become interested and involved in ITI?

2. What is the vision of the ITI?

3. What are the challenges facing the ITI?

4. What are your goals for the Institute over the next six months? Over the next 5 years?

5. How is the ITI model the same or different from other research institutes?

Communication Materials

1. Who do you see as its audience for its marketing materials?

2. What is the communication message?

3. What do you want to see in the mission statement?
REFERENCES


