TECHNO-EXPERIENTIAL DESIGN ASSESSMENT AND MEDIA EXPERIENCE DATABASE: A METHOD FOR EMERGING TECHNOLOGY ASSESSMENT

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ABSTRACT

This thesis evaluates the Techno-Experiential Design Assessment (TEDA) for social research on new media and emerging technology. Dr. Roman Onufrijchuk developed TEDA to address the shortcomings of current methods designed for studying existing technologies. Drawing from the ideas of Canadian media theorist Marshall McLuhan, TEDA focuses on the environmental changes introduced by a new technology into a user's life. I describe the key components of the TEDA methodology and provide examples of its use in several technology assessment applications. Specifically, I reflect upon my experiences developing the Media Experience Database used to organize and animate TEDA's analytical components. I discuss lessons learned while studying emerging technologies with TEDA, and provide recommendations for its future applications.

For Jean, continuing the conversation.

Between the conception

And the creation

Between the emotion

And the response

Falls the Shadow

The Hollow Men *T.S. Eliot*

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GLOSSARY

ARTEFACT is any product of human imagination or workmanship—culture—such as art, ideology, or technology. To be distinguished from biological, physical, or geographical phenomenon of nature.

EMERGING TECHNOLOGY are cultural artefacts currently under invention or development. They may be the product of a formal research and development program, independent discovery, or emerge from new cultural interactions within the social environment.

ENVIRONMENT provides the context, or situation, within which human activity takes place, including all natural, social, emotional, cultural, and material influences.

ETHOS PROTOCOL is a taxonomy of the relational opportunities and imperatives of human experience made up of Things, Self, and Others.

FIGURE/GROUND OSCILLATION is the process by which the research subject (figure) is compared with the environment (ground) it is a part of (*cf.* Gestalt psychology).

MEDIA EXPERIENCE DATABASE is a computer software application that uses the principles of TEDA to help a researcher organize, analyze, and report on research data.

MEDIA THEORY argues that the material properties of artefacts constitute an important role in social activity and organization.

METHOD is a systematic procedure that helps a practitioner work towards a defined goal.

RHETORIC is an art that systematically practices the invention and expression of the persuasive qualities of cultural artefacts.

STAKEHOLDER commissions or has a direct interest in the findings of research.

TECHNOLOGY, from the Greek *techné* (skill, art, or craft), is a cultural artefact produced by human industry and knowledge about a specialized subject.

TECHNO-EXPERIENTIAL DESIGN ASSESSMENT (TEDA) is an inductive method to use qualitative and quantitative data to systematically study the patterns of meaning and effect of emerging technology and services as they filter through daily life.

TETRAD is an analytical tool developed by Marshall McLuhan to test four universal principles of all cultural artefacts: enhancement, obsolescence, retrieval, and reversal.

THEORY is a set of ideas with an internal logic that can be used for the creation of new models or forms in the world.

INTRODUCTION

This thesis evaluates the Techno-Experiential Design Assessment (TEDA), a communication research methodology developed by Dr. Roman Onufrijchuk, and the Media Experience Database I developed to apply TEDA to social research on emerging technologies. TEDA was a response to some of the unique methodological challenges for studying new media and technologies. That is, how can we study things that are newly developed, currently under research, or still just products of the imagination? Why should we want to? Why would we want to pursue another method for such a purpose?

A method names things, it points, describes, connects, and provides options for action. Methods are tools that help us move forward. Different methods pursue different ends. My argument is that no single method is appropriate for discovering everything about all phenomenon. For example, there are differences between efficiency and satisfaction, instrumental and emotional experience, cause and consequence, event and meaning. Each of these are different events and phenomena to be studied in different ways.

It is a matter of practical significance that we live in an age of continually emerging technologies. The current pace of innovation has out-stepped any historical precedent as a confluence of economic, social, and technical motivators have increased filings to the U.S. Patent Office by 273% between 1952 and 1992, while between 1982 and 1992 product introductions in the U.S. increased by 234% (Daniels 1996). Lobbyists

promise that the sum of science and engineering, in technology's service, will be able to solve today's problems and prepare us for tomorrow's contingencies. A recent cover of *Wired* magazine echoes a familiar sentiment in the popular press when they proclaim, "Infinite Sushi! How robot fish farms will roam the oceans and feed the world" (Staff 2004).

The impacts of these technologies ripple through society, whether as efforts to harness and control it like the military industrial complex[1], or sobering reminders of its effects such as Rachel Carson's *Silent Spring* (1962)[2]. The very existence of a technology is material proof of a human willingness and ability to realize it. Whether a technology becomes popular or never leaves an inventor's basement, it is a glimpse of possible futures we may have. Each new technology, in either subtle or violent ways, creates a new environment, a new context, for social life.

At this point we can arrive at two conclusions. The first asks: So what?—the capabilities of a new technology can only make processes that are already in action more efficient. The technology doesn't matter. The second asks: What ways will culture organize around these new capabilities? What new service or disservice environments will be created? I argue for the latter—that for the purpose of studying the operation and effects of emerging technologies it is a useful starting point to study new forms of experience and social organization around new technologies.

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[1] Vannevar Bush's *As We May Think* (1945) is often credited with galvanizing this movement by speculating how science could help humans by automating knowledge manipulation to solve social problems—Bush's now famous *Memex*. U.S. President Dwight D. Eisenhower formally introduced this concept in a speech delivered on January 17, 1961, and can be heard at (http://www.earthstation1.com).

[2] Carson's book detailed the destructive consequences of DDT pesticide use and became one of the first voices of the modern environmentalist movement.

The long history of communication study suggests the importance of mediation. It has an undeniable materiality—it can force rearrangements. Whether as an extreme example such as the nuclear bomb, or slightly more subtle ones such as the telephone, technologies have the potential to alter social relations. This is, of course, only part of our complex social fabric which includes other cultural (i.e. political) and material (i.e. economic) interests, but is important to understanding artefacts that are emerging.

If a technology is emerging then it is difficult or impossible, by definition, to study the thing itself. This is the predicament. We cannot measure and quantify the application of something not yet used. We cannot live with the thing, and observe its subtleties in situated action. We cannot critique the thing we cannot describe. The contours, functions, materials, and services of emerging technologies are either unknown, or uncertain. Any certainty is probably the product of a corporate marketing campaign, but yet to be proven by the uncertain imperatives of social use. But if we can not look to the thing, then how can we proceed?

Francis Bacon (1561–1626) was concerned with systematizing methods of inquiry. He was the turning point to our modern scientific method and like so many prescient voices from the past, his echo still has an informative ring. Bacon argues that, "a man could give much thought to engines of war and battering rams such as the ancients possessed, but even if he went about it as hard as he could and spent a lifetime on it, he would never light on the discovery of cannon working by gunpowder" (1620/1994, p.199). Innovation is not through discovery alone, but must describe an artefact by its

effects. You could put all the research in the world into the catapult, but it will never become a cannon. Invention, Francis Bacon says, begins by describing effect.

How can we study the effects of an emerging technology? Traditional methods can do this with statistical survey, ethnography or by other techniques. But again, if the artefact under study is emerging, these other methods become challenging because we may not have a thing to study yet, or fully understand what it can do. This is amplified when dealing with combinations of technologies. For example, a cell phone is not just *one* thing, but a combination of technologies and services that may be pushed to interface with other technologies the developer never intended. These aggregates of existing technologies are often the location of startling innovation.

An effect is a consequence, change, or result. Within society we can study effects by looking for changes in the social environment. To do this, we need to map out the environment we want to measure the effect on. TEDA is designed to do this by providing a systematic model for questioning how emerging patterns of meaning and effect will evolve within the social environment.

Chapter one begins with a discussion of emerging technologies, defines what they are, suggests why they are important, and situates them as a subject for study. I provide a short discussion of the methodological traditions commonly associated with studying such phenomena, suggest some of the advantages and constraints of positivist, interpretive, and critical traditions, and discuss why they are not always suited to the study of emerging technologies. I argue that the communication theory of Marshall

McLuhan provides a useful starting point to study the environmental changes introduced by new technologies.

Chapter two describes the components of TEDA that have developed in response to the challenges of current methodological models, based on theoretical insights of communication theory. TEDA has three analytical components including McLuhan's *figure/ground oscillations* and *tetrads*, which are combined with the *Ethos Protocol* developed by Onufrijchuk. The second component of a TEDA study is the Media Experience Database I designed to aid data organization, coding, analysis, and allow reporting to adapt to the changing needs of research stakeholders. I describe my experiences developing this component of TEDA and discuss some of the lessons learned while trying to use a computer system to facilitate social research. Next, I provide an overview of how the analytical and technical components of TEDA work together as a unified research programme.

In the final chapter I describe how TEDA has been applied in the past few years on small research projects and a large-scale project called the New Media Experience Roadmap Program. The discussion of these cases demonstrates some of the challenges and opportunities for TEDA-based field research. I conclude with a discussion of the lessons learned while trying to apply the communication theory of McLuhan and Onufrijchuk with the database I developed, and deliver recommendations for continued emerging technology assessment with TEDA.

CHAPTER 1: THE CHALLENGE OF STUDYING EMERGING TECHNOLOGIES

The pace and scale of ***emerging technology*** *development has broad implications for society.* ***Current methods*** *provide rich data for existing technologies, but fail to provide useful insights about how new forms may integrate within daily life.* ***Marshall McLuhan*** *developed a theory to address these shortcomings and it provides the* ***theoretical foundation*** *for a new model to study emerging technologies.*

Contemporary Methods to Study Emerging Technologies

Many methods are used to study the operation and effects of technology in society. This diversity of perspective ensures a wealth of data, but sometimes obscures the intended uses of each methodological design. Each method is designed to suit a different purpose, and not all methods are suitable for all subjects of study.

Methods provide a structure for organizing data collection, analysis, and distribution. They help the researcher find the focus of a study by suggesting what questions to ask, and how to distil the data generated into knowledge that can be shared. Sometimes methods are precise blueprints, while at other times a general guide to study a particular research problem.

Before demanding from a disorganized world such a unity of emotional, intellectual, and political culture, we must first understand how far the emotional and intellectual are today interrelated... affinity between its methods of thinking and of feeling.
~Siegfried Giedion (1962, p.876)

The methods used to conduct research must be designed according to the questions they seek to answer. In fact, Aristotle originally organized the sciences according to the methods they used, precisely because of their influence over outcome (McKeon 1987, p. 3). Because of this, it is important to recognize why a method is appropriate to the questions asked, and how it might extend our knowledge of a particular field. Not only do methods have the potential to uncover new insights within particular subject matter, but also the tensions between practitioners and disciplines.

> *Science has done a grand job well; but well I know that Science cannot save us. Science can give us only the tools in the box, mechanical miracles that it has already given us. But of what use to us are the miraculous tools until we have mastered the humane, cultural use of them?*
> *~ Frank Lloyd Wright (1970, p.46)*

Today, a wide range of methods are used to study the operation and effects of technology in society. While there are many ways to divide them by qualitative, quantitative, experimental, or observational procedures, we can identify three primary categories based on their disciplinary mandate (Neuman 2000). Researchers can use *positivist* methods[3] such as surveys, *interpretive* methods such as ethnomethodology (Garfinkel 1967), or *critical* approaches such as feminism (Reinharz and Davidman 1992) or political economy. Each of these tends to different aspects of a research problem and has distinct advantages and limitations.

[3] Other terms and variations of positive social science include logical empiricism (Ayer 1956), postpositivism (Rescher 1977; Dewey 1938), naturalism (Quine 1964), and behaviourism (Watson 1919).

Positivist Methods

The purpose of positivist social science is to use "deductive logic with precise empirical observations of individual behaviour in order to discover and confirm a set of probabilistic causal laws that can be used to predict general patterns of human activity" (Neuman 2000, p.66). Positivism was popularized in the early 20th century as the social sciences attempted to gain credibility, and acceptability, in comparison with the natural sciences. It can be traced to Auguste Comte's *Course of Positive Philosophy (1835/1974)*, a six volume work that outlines many of the positivist principles still in use today. Other foundational texts for positivist social science include J.S. Mill's *A System of Logic* (1843/1965) and Emile Durkheim's *Rules of the Sociological Method* (1895/1964). Positivist methods like experiments, surveys (Alreck and Settle 2004), usability, and some types of psychology and cognitive science reflect the effort of the social sciences to duplicate the methods of the pure and applied sciences by isolating variables of study. Daily activity is moved to the laboratory or framed in ways that allow it to be quantified.

One strength of the positivist sciences is that by isolating the variables of a phenomenon they provide a way to generalize research findings to broader populations. When executed properly they obey the laws of "good" science: significance, theory-observation compatibility, generalizability, reproducibility, precision, rigor, and verification (Strauss and Corbin 1990, p.27). They also have an inherited credibility from the success of the natural sciences, providing them the most social acceptance of validity.

The types of data they provide about emerging technologies are usually numerical summaries of social phenomenon. For example, in *The Internet in Everyday Life*

(Wellman and Haythornthwaite 2002), Wellman provides a graphic depiction of the digital divide, demonstrating that while almost 59.75% of U.S. citizens and 45.71% of Canadians are frequent Internet users, only 0.49% of Indians and 2.08% of Chinese share the same privilege.

While these types of data are useful for understanding patterns of existing technology use, there are some unresolved problems with positive methods for evaluating technologically mediated experience. First, if the purpose is to "predict general patterns," how can these methods account for the diversity of cultural activity? Second, if the users of technology are only studied in statistically significant groups, how can the individuality of experience be adequately defined? Finally, if all of our actions are reducible to biologically determined functions that obey causal laws of nature, how can positivism account for the free will exercised in the appropriation of technology?

> *The genuine problem is to show how empirical propositions can be made at all about systems that, given different circumstances, might be quite other than they are*
> *~ Herbert Simon (in Buchanan 1995, p.42)*

Consistent with the natural sciences, positivism isolates inquiry to those parts of experience that researchers think are important to the project at hand. They are generalizable precisely because they lead off with a pre-determined theory or hypothesis that is deductively evaluated by numerical metaphors. This computational symmetry comes at the expense of all offensively irregular variables, variables that might contribute to how an artefact will function in society. The unique, unconventional, and exceptional cases are subjugated to the dominant centre.

While positivist methods are useful for testing cause and effect relationships and identifying broad trends in society, they are challenging for studying emerging technologies because we cannot isolate and quantify populations that are not yet statistically valid.

Interpretive Methods

Interpretive methods pursue the "analysis of socially meaningful action through the direct detailed observation of people in natural settings in order to arrive at understandings and interpretations of how people create and maintain their social worlds" (Neuman 2000, p.71). Interpretive method's origins are generally traced to German sociologist Max Weber (1904/1958) and philosopher Wilhem Dilthey (1883/1989) and later associated with the symbolic interaction movement at the University of Chicago in the 1920s and 1930s (see Faris 1969; Blumer 1969). Interpretive methods contrast positivist studies by providing a "thick description" (Geertz 1973) and in-depth analysis to the study of social phenomenon. Examples include phenomenology (Heidegger 1977; Gadamer 1976; Husserl 1931), ethnomethodology (Garfinkel 1967), constructionism (Berger and Luckmann 1966), Actor Network Theory (Latour 1993), and ethnography (Mead 1961).

Interpretive methods foreground the descriptive variables of social life. For example, ethnomethodology is focused on procedural aspects of "group members'" practices as they are revealed through daily activity. It discovers the overlooked commonplaces and unnoticed aspects of daily life. This has the advantage of studying populations in the "real" environments of everyday life. Interpretive methods also highlight the biases that context gives to research. By observing, or even living, in the

environment of social action, they are able to describe a broad range of events, including phenomenon that might not be statistically valid, but might impact the network of social action and meaning of everyday life.

> *Whether we think socially or biologically the essences established by errors are, within limits, true. The goddess Athena may be a figment of the imagination, but the culture which grew around this figure was not only true but enormously powerful. Athena was powerful even if she did not exist.*
> *~ Bruce Allsopp (1977, p.69)*

The types of data interpretive research provides about social life are descriptive and detailed. For example, the study *Going Wireless* (Palen, Salzman, and Youngs 2000) is a mixed method interpretive study about how nineteen new mobile phone users adjusted to their new communication capabilities during the first six weeks of use. Using observation, interview, and documentary data collection, the report observes that "subjects typically had narrow ideas for how they would use mobile telephony initially... subjects... rapidly modified their expectations" and "the handset (and, indirectly, the software) becomes the 'face' of the service-based technology because much of what constitutes service is invisible." Consistent with the interpretive paradigm, Palen focuses on defining the "life factors" that comprise the context of research participant's technology use practices.

Disadvantages of interpretive sciences includes several things: they are time consuming, difficult to generalize, often irreproducible, and poor at demonstrating broad patterns. They are also poor at abstracting social phenomenon for cross comparison. These limitations, combined with their comparatively short history of practice, has meant

that the perceived validity of the quantitative empirical sciences often triumphs in public discourse. Further, "direct detailed observations of people in natural settings" can be impossible with an emerging technology.

While interpretive methods are good at describing experience and social phenomenon within society, they are challenging for the study of emerging technologies because we cannot describe or observe the uses of a technology that does not yet exist.

Social Criticism

Social criticism is a "critical process of inquiry that goes beyond surface illusions to uncover the real structures in the material world in order to help people change conditions and build a better world for themselves" (Neuman 2000, p.76). The formal practice of critical social research is commonly traced back to Karl Marx (1867/1967) and The Frankfurt School (Benjamin 1968; Adorno 1981). Contemporary examples of social criticism, such as social construction (Winner 1986), political economy (Mosco 1996), and feminism (Smith 1990), add a critical dimension to the rich, but narrow, descriptions of interpretive research and contest the apolitical claims of positivism. These traditions challenge the autonomy of technology by arguing that technology is a political negotiation of interests. They often have the goal of affecting some type of change in society. These traditions share with interpretive sciences a respect for the biases of each researcher, but go one step further to critique the "real structures" of production and distribution of artefacts in society.

The philosopher does not have the privilege of abstaining from participation in the crises of his epoch
~ Paul Ricoeur (1965, p.xi).

The benefit of social criticism is that it gives voice to the inequalities that exist in the production and distribution of artefacts in society. This is a very real concern for anyone studying technology, particularly the development of new ones. All technologies are the product of existing social structures, and to varying degrees reflect the values of those individuals and institutions that develop them. Critical methods are useful for identifying those biases relevant to their subject matter, such as gender or economic class, and suggesting useful forms of social action to reconcile these inequalities.

The types of data social criticism provides are usually directed towards a description of the negotiated interests involved in technology use and development. For example, the feminist study *Urban Errands* (Jain 2002) noted "how mobility as a social and material system undergirds the use of new technologies such as cell phones." In this study, Jain used ethnography to gather data through interviews and two day-long ethnographies. The conclusions noted broad trends, such as "these [female] bodies have not only decorated, but have constituted the terms by which mobility and its potential have come to have meaning" (Jain 2002), as well as personal experiences such as, "Taz [study participant] had to constantly negotiate with mobility providers and compete with those others who may have been more able to shift the terms of negotiation in their direction (by being 'whiter', less burdened with packages, wealthier)."

The disadvantage of social criticism is that it tends to foreground its own agenda while predictably critiquing opposing views. It also leads the researcher with the

questions it asks. For example, in Urban Errands it is perhaps not surprising that researchers begin the study with the premise that "mobility and technology are co-constituted by gender." Like the positivist methods, social criticism tends to validate preexisting theories, or, at worst, anticipate their own findings. For the study of emerging technologies, the focus on "real structures in the material world" is problematic when those materials do not yet exist.

While critical methods are good for revealing the negotiated interests that influence technology's production and diffusion, they are challenging for the study of emerging technologies because we cannot critique what cannot be described.

A Bridge to Emerging Technologies

Emerging technology combines the direct impacts of material technologies with the uncertain potentials of nascent forms. The ultimate use of a technology is not forged in the laboratory with blueprint precision, nor in the emotional or logical critique of a text—it is impossible to ensure exactly how a new technology will function, or what other technologies it will be used in combination with. The uncertainty of how new technologies will ultimately develop is precisely because of the complexity of the social environment they will be used in. This environment includes social imperatives such as art and commerce, biological needs such as food and shelter, and natural conditions such as weather and geography. To quantify, interpret, or critique a technology's role within this environment is important, but is difficult with traditional methods when the material form and use of a technology is still being negotiated by society.

The positivist, interpretive and critical sciences each provide valuable methods for the study of social phenomenon. However, they each have limitations when it comes to applying that research to problems of emerging technologies. These are designs that either have not yet been developed, but are anticipated, or already exist, but are not popular enough to employ traditional research strategies to understand their uses and effects. Several questions stand out in the study of emerging technologies: How can we study a form or configuration that has not matured, or does not yet exist? How can we understand the potential opportunities and effects of emerging technology may have on our daily lives? What new constellations of meaning might emerge from the new technological environments we create?

If a technology is emerging, then we cannot study the "thing." If we did, we are only imposing our own assumptions and expectations on how it will be used, or worse, prejudicing ourselves about what the "thing" is. To focus on the technology is to extend existing models, rather than creating the space for new ones. The solution is to look at the evolving patterns of use and meaning—the consequences and effects of the technology.

To study the effects of a social artefact, in all its formal combinations (the "technology matrix"), we must study how technologies are used in *human* environments, when they are transformed from mechanical systems of parts and become animated by the organic structure of social life. This is the metaphysics, or ontology, of the study—the lived experience that places focus on the aspects of life that fall outside the domain of empirical reality. It requires a flirtation with first principles, because first principles

provide a space from which to begin the essential questions from which cause and effect cascade. As Bacon argued, methods of innovation are "not of things that are consistent with first principles, but of the principles themselves, not of probable reasons but of indications and directions for works" (Bacon 1994, p.19). "Probable reasons," are the proper domain of the sciences that prove causal laws. However, the development of "indications and directions" requires something entirely different, so long as it can be practiced by a systematic and efficient procedure—a method for emerging technology.

At the periphery of the dominant methods of the 20th century, a theory of technology emerged from Canadian communication research that provides a theoretical tradition useful to the study of emerging technologies. Communication provides a conception of technology that reflects its continual negotiation between social and environmental processes. In the work of Marshall McLuhan, it focuses on the dynamic relationship between user, technology, and environment. McLuhan's use of art, rhetoric, and social science has proven to be an inventive and useful starting point for a new model to study emerging technologies.

The Technology Theory of Marshall McLuhan

> *New technologies extend us into new environments in new configurations.*

Communication theory represents a fourth tradition to aid in the study of emerging technologies. In Canada this tradition emerged out of the media theory[4] of Harold Innis, who argued that "a medium of communication has an important influence

[4] Variations such as medium theory, media ecology (Postman 1985), and comparative media theory (Angus 2000) also exist. Each shares a focus on the sensual, cognitive, and environmental influences of media and technology on social relations.

on the dissemination of knowledge over space and over time and it becomes necessary to study its characteristics in order to appraise its influence in its cultural setting" (Innis 1964, p.33)[5]. These settings were important to study because their effects often went unexamined by mainstream press or scholarship as short-term political interests positively hype technology, while the more important negative consequences slowly emerge over time[6].

It has been argued by Onufrijchuk that "McLuhan had produced not only a body of theory, but also a 'systematic' one. This system, as McLuhan was first to acknowledge, was deeply indebted to Innis" (1993). He notes that, "what had begun as a reading of the rhetorical forms of cultural artefacts and environments, ...emerged into a full system in 1973. ...Beginning with the media and Innis, McLuhan was working backwards toward a general ontology of the material world" (1993). Each theorist made a unique contribution to the building of a "system" with which to study technological environments: "Innis saw the poetics of the relations between power and form in civilisation. McLuhan saw the poetics of the relation between form and culture" (1993).

The arts of communication and construction are arts of conjoining form and matter in the concreteness of experience and the individuality of existence.
~ Richard McKeon (1987, p.107)

[5] This definition should also distinguish the *media theory* of Innis and McLuhan from the contemporary *media effects* discourse. For example, media theory would look at how television condenses daily news into graphically rich 22-minute summaries. Media effects would focus on how the content, such as violent cartoons, would influence children to duplicate the violent acts they see.

[6] This distinguishes Innis, and later McLuhan, from the media theory of classicist Eric Havelock, who focused on ancient Greece to "present a unified picture of a crisis that occurred in the history of human communication" (Havelock 1986, p.1). Innis and McLuhan were concerned with understanding how technology and mechanization was influencing the development of contemporary cultures. See Innis's *Adult Education and Universities* for a succinct summary of this project, connecting ancient Greek and Canadian cultures of knowledge generation and transfer (1964, p.203).

McLuhan's goal was "to explain human behaviour under the impact of new technology" (Federman and De Kerckhove 2003, p.2) and provide a "perceptual code" to "see" or observe the trends and patterns that would otherwise go unnoticed in our studies of technology. McLuhan's theory focused on perceiving the changes technology introduce to the human environment. *Changes in environment make it possible to perceive the difference between one technology and another.*

McLuhan's work invites critique; it was often erratic and speculative. He was also inconsiderate of the economic and gender insights that are now commonly supported. Another Problem was McLuhan's refusal to embrace linear arguments, or even index his books. You had to "read it all," to understand it all—an elitist and impractical disposition for someone who was attempting to familiarize the average person with topics as diverse as Thomas Aquinas and contemporary comic books.

McLuhan did not approach the study of technology with any delusions about its positive potential and was decidedly sceptical about all technology—he could not even drive a car! McLuhan declared, "I am resolutely opposed to all innovation, all change, but I am determined to understand what's happening because I don't choose just to sit and let the juggernaut roll over me." (2003, p.101). While "anti-innovation" in many ways, he had a fascination with the internal logic of technology's form and function, and initially enrolled in the engineering program at the University of Manitoba (Gordon 1997, p.15). But while the physics of boat building had intellectual appeal, it did little to explain the workings of McLuhan's true love: the creation and expression of culture.

McLuhan's cultural studies were infamously eclectic. He was inspired by New Criticism (Richards 1966), classics (Havelock 1966), literature (Pound 1938; Joyce 1975), anthropology (Carpenter and McLuhan 1960), painting (Lewis 1915), music (Cage 1939), and architecture (Fuller 1938; Giedion 1962). Initially, McLuhan was an English professor who published traditional literary criticism (1964; 1969). Then, in 1951 he published *The Mechanical Bride* (1951), foreshadowing the deconstruction techniques that would become popular more than ten years later[7]. In *The Guttenberg Galaxy* (1962), McLuhan exhibited the historical sensitivity of his idol, Harold Innis, and began his formal efforts as a technology theorist. After this came a string of books in the 1960s that developed a theory of technology and "new patterns of human association" (1964, p.7)[8]. Also during the 1960s, McLuhan produced *The Medium is the Massage* (1967) with Quentin Fiore. This short book was a juxtaposition of aphorism and image that was dismissed by academics but praised, "from a design perspective, these books are landmarks in the integration of text, image, and layout... blurring the professional, commercial, and formal distinctions that constitute the hierarchies of publishing" (Lupton and Miller 1996, p.91). A year later, McLuhan and Fiore produced a spoken word long-play album by the same title (1968).

The breadth of McLuhan's thought and projects made him a suspicious figure to many. He was too poetically original and erratic for academics; too pedantic and removed

[7] *The Mechanical Bribe* explores the plurality of meaning and subtext that can be revealed in a text, such as advertising, in a way similar to the work of Jacques Derrida (1998) and later deconstructionists.
[8] Also see, (McLuhan and Fiore 1968; McLuhan and Papanek 1967; McLuhan and Parker 1968; McLuhan 1969).

(a staunchly conservative Catholic) to be considered an artist[9]. His reputation became a paradox he happily provoked to get people thinking critically about technology. McLuhan would cheekily jest, "do you find fault in my fallacy?"[10] Many of McLuhan's projects were about sparking debate, and providing the tools so that people would be critical of the world around them. For example, *City as Classroom* (McLuhan, Hutchon, and McLuhan 1977) was designed to be a high school textbook, *The Bad Trip* (1977) was a film made with urban planner Jane Jacobs to contest the Spadina Expressway in Toronto, and the tetrad he would later develop was meant to be a simple method for anyone to assess the impacts of technology.

McLuhan believed that provocative methods of technology assessment were required to ensure that we do not blindly follow the technological imperative, or "Narcissus Narcosis" as he metaphorically illustrated (1964, p.46)[11]. But with the information environment of computers and mass media, the solution was not generating "findings" or data as it was for previous generations: "survival and control will depend on the ability to probe and to question in the proper way and place" (1988, p. 239). McLuhan returned to the first principles of epistemological tradition to bridge the

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[9] McLuhan attended mass and communion every day and was influenced, though rarely publicly acknowledged, sources such as Teilhard de Chardin (1965) and Etienne Gilson (1941).

[10] Student and colleague David Staines remembers McLuhan asking, "Do you find fault in my fallacy?" or "is that a contradiction? Fine." McLuhan was not afraid of being wrong sometimes as his ideas went through stages of development. Often, Stains says, these ideas would get tested on an audience or in an interview like those collected his anthology *Understanding Me* (McLuhan 2003).

[11] Narcissus was a handsome youth of Greek mythology that fell in love with an image in a pool of water, not knowing it was his own likeness. He rejected all other suitors, including Echo the nymph, who shrivelled to dust so that only her voice remained, condemned to repeat only the words of others. Narcissus became McLuhan's metaphor for how people are captivated by their own technologies, which are nothing more than the extension of their own culture into a new form. Yet they never realize this, and become immobilized, spellbound by the technology.

methodological models developed to study *existing* social relations (positivist, interpretive, and critical) and move towards a model suited to the study of *emerging* technologies.

> *We can only create a sustainable future through careful attention to enduring traditions. We must learn from the past and carry forward what we have learned into new departures.*
> *~ Barry Berkus (2000, p.45)*

For McLuhan, new technology was not a mystical artefact of the future, noting, "the frequent and futile resort to futurism and archaism as strategies for encountering radical change... are habitual ways of avoiding the discontinuities of the present experience with their demand for sensitive inspection and appraisal" (1964, p.75). The solution was not to impose continuity or an artificial narrative. McLuhan's method perceived new technological forms and compilations by *systematically inquiring into the new arrangement of effects for forms that already exist.*

Building a Theory of Technology

McLuhan's theory of emerging technology developed through three stages. First, McLuhan developed a theory of *technology as a rhetorical figure.* Second, from this rhetorical program he focused on the changes imposed on a user's environment. Third, McLuhan outlined three *criteria* that a method must adhere to in the study of the rhetorical constitution of emerging technology environments.

Technology as Rhetorical Figure

Rhetoric was one of the deepest influences on McLuhan throughout his career. From his Ph.D. on the medieval rhetorician Thomas Nashe (1943), to the concluding

chapter of his final book, *Laws of Media* (1988), McLuhan was devoted to tracing the evolution of rhetorical methods to produce and assess culture. Rhetoric is the art of organizing expression for future effect and is part of the trivium of arts used to produce, decode, and debate Western Culture for nearly 1500 years[12]. McLuhan believed this ancient system still had value for the study of culture. Of these ancient arts, rhetoric is significant because it is the union of theory and practice into action (McLuhan 1987, p.510). Rhetoric concerns the *whole*—call it the *environment* (sum-total of influences), *psyche* (Gk. *psychá*, animating principle), or *soul* (total self). It is the methodological key to understanding all the artefacts of human expression, including technology[13].

> *True rhetoric is like medicine, and the rhetorician has to consider the natures of men's souls as the physician considers the natures of their bodies. Such and such persons are to be affected in this way, such and such others in that; and he must know the times and the seasons for saying this or that. This is not an easy task, and this, if there be such an art, is the art of rhetoric.*
> *~ Benjamin Jowett (1992)*

McLuhan argued all technology, "are speech, and they are translations of us, the users, from one form into another form: metaphors" (1988, p.116). McLuhan would not be alone in using language as a metaphor for technology (Certeau 1984), but for McLuhan, technology quite literally *is* a language. Language externalizes our cognitive

[12] The trivium are the arts and sciences of language and include *rhetoric* (transforming audience through speech), *grammar* (interpretation of text), and *dialectic* (reasoning the content of words by thought). Grammar and dialectic are concerned with words. Dialectic with developing ideal thought before speech, and grammar with the word outside the body. The difference between them is rhetoric, expression, or the organization of thought into word. Rhetoric is the resolution of theory and practice.

[13] Richard McKeon (1987) pursued the methodological potential of rhetoric for understanding social artefacts. *New Rhetoric* is a term sometimes used to describe the contemporary interest for rhetoric's role in the making and communication of knowledge (see Perelman 1994; Bakhtin 1994; Grassi 1980; Weaver 1994).

motivations, while technology is our effort to put the motivations to action. In language, and the traditions that have evolved around it, McLuhan saw something special. It was a bridge between our cognitive impulses, cultural environment, and mechanical creations[14]. And like language, technologies are culturally established, and their uses can be appropriated. Technology, as the product of *cultural,* not *scientific*, processes, belongs to the methods of cultural study, not the natural sciences that are used to explore and verify cause and effect relationships in the natural environment.

All life therefore comes back to the question of our speech, the medium through which we communicate with each other; for all life comes back to the question of our relations with each other.
~ Henry James (1905, p.10).

Technology and Environmental Change

***Environmental change** is the key to understanding the **difference** between one technology and another.*

McLuhan's media theory argues that the altered pace and scale of new technology environments can alter existing social relations. For example, the introduction of mobile phones creates new communicational spaces; e-mail opens new channels for global commerce; the automobile enables the suburb. The opening of *Understanding Media*, McLuhan's most popular work, summarizes this principle:

> In a culture like ours, long accustomed to splitting and dividing all things as a means of control, it is sometimes a bit of a shock to be reminded that, in operational and practical fact, the medium is the message. This is

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[14] McLuhan was not entirely on side with modern linguistics, observing "in the Middle Ages the scholastics tried to reduce language to logic, and today Chomsky and the linguists seem to be trying to reduce grammars to logic" (1987, p.473). He was concerned that the engineered linearity of logic would artificially force language, in reality a dynamic and discontinuous matrix, into a sequential row of logically organized boxes.

> merely to say that the personal and social consequences of any medium—that is, of any extension of ourselves—result from the new scale that is introduced into our affairs by each extension of ourselves, or by any new technology (1964, p.1).

"The medium is the message," means that the medium that transmits information has the power to exaggerate, reduce or distort the content, which has the potential to restructure the social environment[15]. Many misinterpretations have positioned the saying as a straw man argument for technological determinism. McLuhan would be perplexed by these charges because, he would argue, technology *is* culture. Technology embodies the organization of human values, beliefs, structures, mores, prejudices, and biology in particular ways. Technology does not direct the course of its own development, but once integrated into society, it has a powerful potential to bias some types of social activity and organization over others. As Winston Churchill said, "we shape our buildings, and thereafter our buildings shape us."

Media theory observes that different media and technologies create different environments or contexts for individual and social action. McLuhan suggested that this term was even exaggerated to emphasize the importance of the environment as the subject of study for emerging technology: "When I say 'the medium is the message', I suppress the fact that the user or audience or cognitive agent is both the 'content' and maker of the experience, in order to highlight the effects of the medium, or the hidden environment or ground of the experience" (McLuhan 1987p. 443). Deconstructed: the

[15] This famous aphorism is inspired from the opening lines of Innis's *Empire and Communication* (1950), which argues, "the significance of a basic medium to its civilization is difficult to appraise since the means of appraisal are influenced by the media, and indeed the fact of appraisal appears to be peculiar to certain types of media. A change in the type of medium implies a change in the type of appraisal and hence makes it difficult for one civilization to understand another" (McLuhan 1987, p.220).

medium is the technology used (e.g. car), the content is the user (e.g. driver), and the message is the changes the medium introduces to the content (e.g. gridlock, suburban communities). The driver's actions are enhanced and constrained in particular ways based on the unique properties of the technology being used. The focus becomes the consequence of the new technology environments: "all I am saying is that any product or innovation creates both service and disservice environments which reshape human attitudes" (1987, p.408). The new environment often goes overlooked or unnoticed because "these service and disservice environments are always invisible until they have been superseded by new environments" (1987, p.408).

This argument has interesting implications for a methodology to study technology and has subtle differences compared to positivist, interpretive, and critical methods. Next, I describe three methodological criteria that emerge from McLuhan's work to complete the theoretical foundation for a method to study new and emerging technologies.

Towards a System: Periphery, Pattern Recognition, Process, and Probe

Four themes were developed by McLuhan that provide a theoretical foundation for methods to study emerging technologies. First, methods must accommodate, or sometimes even focus, on the marginal, fringe, or outlying cases of social phenomenon. Second, pattern recognition of the events of the present, the grouping of effects, enabled the researcher to understand the changes of the future. Third, all environments and contexts of technology use are dynamic, changing over time, and our methods for the study of emerging technology must have the capacity to measure changing data and

report it in ways suited to the changing research problems that result[16]. Fourth, McLuhan's style of "probing" or questioning new technology environments was deliberate and has a key lesson: The focus when studying emerging technology should remain on how useful a study is for provoking indications and directions, not how well it supports or contests preexisting theories or expectations[17].

Theme One: The Periphery Today is the Centre of the Future

> *Methods for the study of emerging technology must probe the **unique, unconventional, or exceptional:** The periphery today is the centre of the future.*

The first theme in McLuhan's work that is useful for the study of emerging technologies is that sometimes the richest data may come from the most unique or outlying cases, the exception rather than the rule. This is because the uses of emerging technologies evolve into new environments and forms that have not yet been established or become mainstream.

McLuhan argues that the first way to perceive change in an environment is by changing perspective to an alternate or "anti-environment." The anti-environment is a perspective facilitating observations that would otherwise go unnoticed. It is the space where the conventional appears unique. For example, McLuhan felt that Canada was an anti-environment to the United States, and from there, observations could be made about

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[16] The proper way to study an emerging technology, McLuhan argued, was with a "paratactic procedure of juxtaposing without connectives." This method takes "the natural form of conversation or dialogue rather than of written discourse. In writing, the tendency is to isolate an aspect of some matter and to direct steady attention upon that aspect. In dialogue there is an equally natural interplay of multiple aspects of any matter. This interplay of aspects can generate insights or discovery. By contrast, a point of view is merely a way of looking at something. But an insight is the sudden awareness of a complex process of interaction. An insight is a contact with the life of forms" (McLuhan 1964).

[17] Note well: different subject require different methods, and we should not want, for example, the same plan of action for a known subject such as the medical sciences. Emerging technology requires a study of the potentials of form and effect.

United States life that would otherwise go unnoticed[18]. The anti-environment provides the distance needed for critical self reflection, and the perception of patterns that would otherwise consume us. McLuhan did not believe in prediction. However, he did maintain that we can "foretell the present" because all the effects are already happening, just to different degrees and in different spaces (Federman and De Kerckhove 2003, p.107)[19]. The anti-environment was the space from which this could be observed.

> *We wandered, scientist and artist, together into this our iron arena, we face together its strange confusions, its barbaric energies; and we must find our way out together. Together, I think, or not at all.*
> *~ Joseph Hudnut (1949, p.92)*

The second way to perceive change in an environment is through the "cultural outsider," or artist. Art is one of the most useful ways to understand the present because it is about "illustrating unities of form which exist where diversity is all that meets the eye" (1987, p.223). Art reminds us of the power of poetic insight, perceiving the unique in the commonplace. McLuhan felt a profound affinity for creative expression like that of the painter Percy Wyndham Lewis, and was keenly interested in Symbolist poets and

[18] McLuhan writes, "Canada as anti-environment to the U.S.A. is able to perceive many of the ground rules and operational effects of the American environment that are quite imperceptible to the U.S.A. If the U.S.A. has built its distant-early warning system in Canada for military use, let us observe that we can be of far greater use to the U.S.A. as an early-warning system in the social and political spheres generally" (1987, p.319).

[19] German philosopher Theodor Lipps (1851-1914) observed that all the sounds of a symphony were contained in the clang of a bell. McLuhan compares, saying "acoustically speaking an entire linguistic culture could be encoded acoustically in almost any phrase or pattern of that tongue" (McLuhan 1987, p.473).

authors[20], Edgar Alan Poe, ancient myth, avant garde artists such as B.P. Nichol, Glenn Gould, John Cage and the Fluxus artists[21]. These influences on his work cannot be overstated. In many ways McLuhan worked as an artist using poetics and aphorism as his medium (Kroker 1984, p. 19). This might explain the often patronizing and confused criticism he received from the academy: McLuhan was playing by different rules to achieve different goals.

Theme Two: Pattern Recognition

McLuhan argued that pattern recognition was a way to perceive the emerging uses of new technologies in society. While not qualifying as scientific proof and failing Popper's "empirical falsifiability" for scientific inquiry, patterns are useful to indicate emerging trends. Pattern recognition is an important component of McLuhan's inductive method, and a traditional part of rhetoric too. Aristotle defined the example (Gk. *paradeigma*, "pattern" or "model") as pattern: "I call the enthymeme a rhetorical syllogism, and the example a rhetorical induction" (Aristotle, 1356b, 26). But McLuhan observed the concept in more contemporary fields, including "a maxim from information theory: 'data overload equals pattern recognition'" (McLuhan and McLuhan 1988, p.107)[22]. But McLuhan didn't embrace patterns from the new field of information theory.

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[20] McLuhan believed that Symbolist poets such as Rimbaud, Mallarmé, James Joyce, T.S. Eliot, Ezra Pound, Yeats and others retrieved a conscious awareness about the power of language to direct our understanding of the world. These same techniques could be used to understand language when articulated as a technology (TV, Wi-Fi) since both are extensions of the human condition and conform to the same rules of expression.

[21] The Fluxus movement, sometimes compared to Dada, combined different artistic disciplines that shifted focus to the actions of the artist, such as through "action events." George Maciunas, John Cage, and Yoko Ono were proponents.

[22] An example of this is Stephen Wolfram's *A New Kind of Science* (2002), based on the pattern recognition of the mathematical properties of natural phenomenon.

In proportion as we desire a satisfactory pattern in life—a balanced and complete civilization—so we will desire to bring into that pattern the arts which enrich it.
Joseph Hudnut (1949, p.86)

True to his cultural studies background, McLuhan turned to artists, noting those that were "concerned with understanding changes that could be programmed" (McLuhan 1987, p.420). From Ovid, James Joyce, Ezra Pound, and T.S. Eliot, McLuhan observed that the "reconstruction of mental states and motives, was a basic pattern of culture." Methodologically, it was "the position of the Symbolist [poet] for whom effects minus causes constitute the challenge to pattern recognition." Designer Christopher Alexander argues for the unity of method and practice by the perception of patterns:

> if you try to understand the idea that you can create abstract patterns by studying the implications of limited systems of forces, and can create new forms by free combinations of these patterns—then, in the process of trying to create such diagrams of patterns for yourself, you will reach the central idea (in Buchanan 1995, p.61).

The central idea, according to McLuhan, was about more than raising awareness about only the negative effects of technology. He wanted a system to manage the effects of technology for the present and foreseeable future. Pattern recognition, especially of emerging trends from the fringe or periphery of society, enabled *imagining a better future and guiding the creative impulse in service of people at a human scale.*

Theme Three: Environment is Process, Not Container

Methods to study emerging technology must be dynamic to evolve with changing environments.

The third theme in McLuhan's work useful for the study of emerging technologies is that "in nature there are no figures at all—only a dynamic environment

mosaic that is discontinuous and diverse" (1988, p.23)[23]. It is from this discontinuous environment that all new technologies or activities emerge. This instability is not a bad thing, but precisely what gives opportunity for change. McLuhan called this *chiasmus (*Gk. *crossing, intersection).* "The action is where the gap is. It has always been thus. Change requires the resonant and abrasive interval" (1987, p.403). In response, our methods must, "draw attention to situations that are still in process, situations that are structuring new perception and shaping new environments" (1988, p.116). Methods to study emerging technologies must be able to reflect the dynamic nature of social environments, and be able to adapt to changing data patterns, as well as the changing research problems we develop in response to them.

> *Evolution and revolution are the result of the creative integration of noise into the system as a memory trace.*
> *~ Tony Wilden (1980, p.42).*

Theme Four: Probing Paradigms of Future Effort

> *Methods for the study of emerging technology must probe, explore, and discover: **paradox to provoke action.***

McLuhan was "interested in exploration and discovery rather than in debating and classifying" (1987, p.435). He embraced paradox and was almost antagonistic to rational or dialectic methods to study the social world. It's no wonder he created enemies with statements such as "the scientist rigorously defends his right to be ignorant of almost everything except his speciality" (1987, p.383).

[23] This insight was fundamental to his rejection of logic for understanding environmental processes. Logic, McLuhan argued, imposed a false linearity on the dynamic environment of human nature. This criticism is relevant when the goal of research is *indications and directions* for emerging artefacts.

Invention, discovery, and insight are creative modes of departure from accustomed circumstances of the commonplace to transform the customary or the unnoticed into novelties
~ Richard McKeon (1987, p.25).

McLuhan developed several styles of probe. The 'mosaic' approach, developed for *The Guttenberg Galaxy* (1962), was a technique to bring together the insights of over two hundred authors and works and synthesize them into a single commentary on the causes of change in society. A second technique was the 'iconic prose,' which "leaves the reader the task of manipulating the probe instead of merely adopting a pro or con view of what is being said" (1987, p.340). He wasn't arguing a case, but observing patterns.

Words beget words.
~ Francis Bacon (1620/1994, p.64).

McLuhan was acutely aware of the limitations of his probes and provocations: "Don't explore my statements. Explore the situation. Statements are expendable" (1987, p.176). What was important was whether or not the statements were useful for provoking exploration, for asking the non-obvious questions and expose the "commonplace" into "novelties". He warned against too much editorializing from the privileged perspective of the researcher: "My own avoidance of value judgments about the effects of technologies is based on practical experience. Such opinions simply derail all further discussion of the nature of technology" (1987, p.421). The proper way to argue for a negative effect is to describe it in action. As a successful example, McLuhan points to the work of Ruth S. Cowan (1988), who demonstrated how women's work has not decreased with the introduction of machinery to the home (McLuhan and McLuhan 1988, p.108).

Chapter Conclusion

Chapter one introduced emerging technology as a topic of study. The increasing pace and scale of research and development cycles and the resulting rapid introduction of products has created the need for a way to critically assess new innovations. However, emerging technologies have some unique methodological challenges that current models cannot fully address. The media theory of Marshall McLuhan is a foundation for a new methodological model for the study of emerging technology.

CHAPTER 2: DESCRIPTION OF THE TEDA METHOD

TEDA uses McLuhan's figure/ ground oscillation and tetrads to describe dynamic environments, and adds the Ethos Protocol to describe the context of daily life. I developed the Media Experience Database to manage this data and use TEDA components more efficiently during data coding, analysis, and reporting.

What is TEDA?

TEDA is a communication research methodology emerging from ideas in media theory (Innis 1950; McLuhan 1964), rhetoric (McKeon 1987)[24], and design (Buchanan 1995)[25] for studying how new technologies "fit"[26] within the personal and social network of relations of daily life. TEDA maps the observable and potential consequences of these technologies. It begins by studying human orientations to key activities of daily life based on research participants' reflections on experience. TEDA provides the means for researchers from various disciplines to access and make use of the descriptive and interpretive work performed in the social sciences.

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[24] Richard McKeon was not part of the original TEDA designs but has been influential in my own work. A contemporary of McLuhan, the two seem to have never connected each other's intellectual projects, though they shared many similarities. Both studied with the Philosopher of Thomism, Etienne Gilson (1964), had a central interest in new applications of rhetoric for the study of cultural artefacts, and McLuhan even used McKeon's translation of Aristotle's work for *Laws of Media* (1988).

[25] *Design*, as the "Design Assessment" part of TEDA's name implies, is an important consideration for understanding mediated experience. Technologies, as we interact with them, have a physical form that is *designed.* Rhetoric is a useful system for understanding the inventive and persuasive aspects of the design of technology (see Ehses 1989; Kinross 1989).

[26] As in the trinity from design of "form, fit, and function"; fit is harmony.

Development of TEDA

TEDA developed out of an awareness that no systematic procedure existed that addressed four core issues to communication study: relationship, expression, transformation, and context[27]. Though the field is ancient—if one traces it back to the sophists[28] and rhetoricians of ancient Greece—today, communication research tends to use the methods developed in other disciplines such as psychology, anthropology, or sociology. While suitable and rigorous for their respective topics of study, sometimes the goals of these other disciplines and communication are divergent. For example, the way sociology studies the collective behaviour may differ from that of the communication scholar studying the subjective meaning of an artefact.

> *During long periods of history, the mode of human sense perception changes with humanity's entire mode of existence. The manner in which human sense perception is organized, the medium in which it is accomplished, is determined not only be nature but by historical circumstances as well.*
> *~ Walter Benjamin (1968, p.222)*

Onufrijchuk (1993) identified that the development of a method to address issues specific to communication was begun by Harold Innis and McLuhan. Onufrijchuk (1998) then elaborated on this to include the specific tools used by McLuhan as be began to systematize communication and emerging technology study into, what McLuhan

[27] No "cannon" of ideas or literature exists to reflect the multiple personalities of communication research, however, (1) *relationship*, (2) *expression*, (3) *transformation*, and (4) *context* have emerged as consistent subjects of study for TEDA. This is based on what Robert Babe (2000) identified as central to a "Canadian School" of communication study, as well as work by Onufrijchuk.

[28] From about 550 B.C.E. sophists (Gk. *sophos*, "wise") travelled throughout Greece teaching and practicing arts of speech, thought, and living. The term grew to have duplicitous connotation—sophists often charged a high price for their services—but remained an important part of Athenian democratic system. Rhetoric grew out of this tradition.

titled, a "new science" in the subtitle to his posthumous *Laws of Media* (1988)[29]. Building on these theories, Onufrijchuk identifies the next step in the evolution of their ideas, and the genesis of TEDA: "Our task remains to extract from those poetics a system that, while remaining flexible, will better equip us to understand and anticipate the changes that await us, and those that we can create" (1993). Out of these studies, Onufrijchuk built an analytical model, including the Ethos Protocol, to extend the methodological contributions of Innis and McLuhan and make them more accessible and useful for contemporary communication studies.

My own work with TEDA began in the spring of 2002. From that point I have worked with it on numerous research projects, as described in chapter three, and presented it publicly, including numerous informal discussions with a variety of stakeholders, as well as conference presentations including *Creating Communicational Spaces* (Onufrijchuk and Schick 2003) and *Bridging Dimensions* (Schick 2003)[30].

Analytical Models of TEDA

TEDA uses three analytical models to structure research and a computer database to organize research data and support the process of collecting, coding, analyzing and reporting data (see Figure 2.1).

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[29] McLuhan did this in the tradition of Francis Bacon's *Novum Organum* (*New Science*) (1620/1994) and Giambattista Vico's *The New Science* (1744/1968).

[30] The paper *Methods for Technology, Culture, and Society Studies* (Schick and Onufrijchuk 2005) also began development at the *Bridging Dimensions* conference.

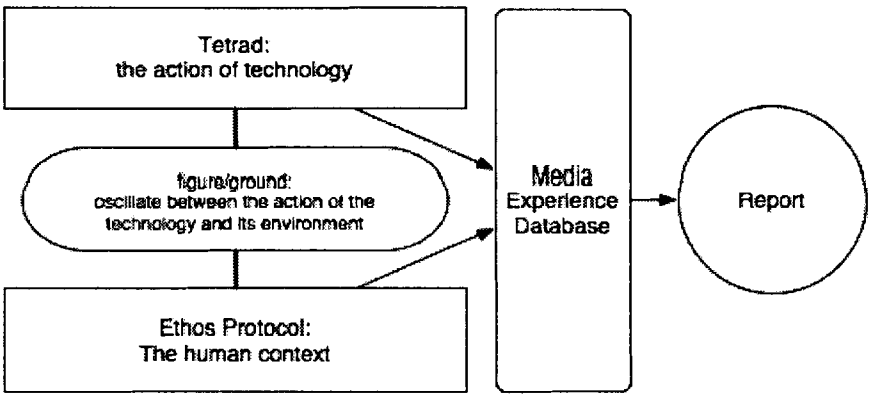

Figure 2.1 Model of TEDA's analytical and technical tools .

The first analytical model TEDA employs is a *figure/ground oscillation* between areas of attention and inattention to reveal the hidden, background, or unforeseen properties or consequences of a technology. The second model is McLuhan's *tetrad* to identify the evolutionary cycle of a medium or technology. The final analytical model is the *Ethos Protocol*, a taxonomy of human experience. Together, these models triangulate data analysis between synchronic (Ethos Protocol), diachronic (tetrad), and dialectic (figure/ground) observational patterns.

Figure/Ground Oscillation

The first analytical model that TEDA uses is Marshall McLuhan's *figure/ground oscillation*[31], or "Law of Situation" (McLuhan, Hutchon, and McLuhan 1977, p.166), which involves shifting attention between the technology under study (the *figure*) and the environmental conditions of its use (the *ground*). A figure is the area of attention, the focal point of perception. The ground is the much larger area of inattention that evades recognition. Ground always exists, but is only noticed when it emerges, as a figure. The

[31] The figure/ground analysis McLuhan used was first developed in the Gestalt psychology of Edgar Rubin (McLuhan and McLuhan 1988, p.5)

figure is not a discrete physical entity, but the product of human attention, since a "figure" is not a product of nature, but an artefact of human perception and recognition. Nature is "a dynamic environment mosaic" (McLuhan 1987, p.23) that we extract human meaning from. All figures emerge from the ground, and are replaced by another figure as attention shifts. For example, when you cross a street you focus on traffic (figure), but once safely across the cars are forgotten (become ground) and attention might shift to a sign in a store window (the new figure).

> *The mind, in short, works on the data it receives very much as a sculptor works on his block of stone. In a sense the statue stood there from eternity. But there were a thousand different ones beside it, and the sculptor alone is to thank for having extricated this one from the rest. Just so the world of each of us, howeverso different our several views of it may be, all lay embedded in the primordial chaos of sensations, which gave the mere matter to the thought of all of us indifferently. We may, if we like, by our reasonings unwind things back to that black and jointless continuity of space and moving clouds of swarming atoms which science calls the only real world.*
>
> *~ William James (in Nørretranders 1999, p.177)*

Using this model, the researcher must engage in repeated shifts of attention from the thing normally focused on—the figure—to the background against which, or context within which, it is framed—the ground. *Identify the ground, and you can anticipate what figures will emerge.*

Tetrads

Tetrads are the second analytical tool TEDA borrows from McLuhan. The tetrad, or "laws of media" as McLuhan also called them, are four questions used to probe the

potential uses, benefits, or negative consequences of an emerging technology (see Figure 2.2). McLuhan considered the tetrad the foundation for a heuristic science of human interaction with technology, asking, "what general, verifiable (that is, testable) statements can be made about all media" (1988: p. 7)? The tetrad was his attempt to make scientific statements that were accessible to the general public so they could critically reflect on technology.

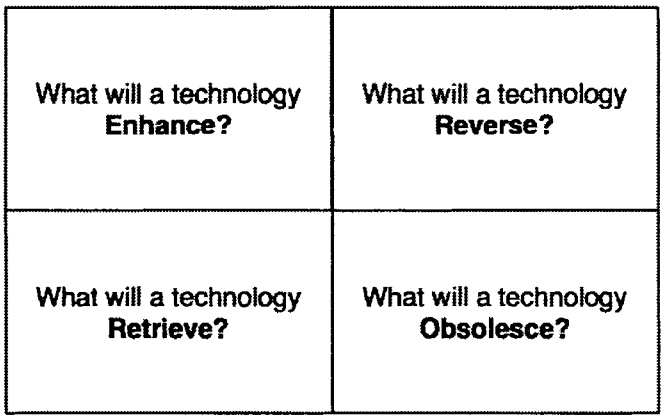

Figure 2.2 A simple tetrad showing its four components

The tetrad can be formatted as statements or questions. As questions: 1) What will a technology *enhance*? 2) What will this technology make *obsolete*? 3) How will this new technology *retrieve* previously forgotten technological forms or uses? 4) When pushed to its limit, how will the benefits of any technology "flip" or *reverse* into sources of irritation?

The four components of the tetrad distinguish it from what McLuhan called the "old three-legged sciences" that were based on a dialectic model that favoured the development of a figure without a corresponding ground. For example, Hegelian logic promotes the development of thesis and anti-thesis into synthesis – one emerges from

two. Alternately, the tetrad matches every figure with a ground during analysis. They cannot be separated[32]. "The laws of media in tetrad form belong properly to rhetoric and grammar, not philosophy. Our concern is etymology and exegesis" (1988, p. 128).

Tetrads illustrate a dynamic relationship between the properties of technological form. They are not linear or static, but radial and dynamic. McLuhan observed they are "not a sequential process, but rather four simultaneous ones. All four aspects are inherent in each artefact from the start" (1988, p.99) For example, when something is retrieved, it must at the same time render something else obsolete. When something is retrieved from past use or knowledge, it is doing so as an extension of the enhancement. The obsolescence of one form often leads to the reversal of another. Figure 2.3 illustrates this process for the radio (1988, p.172).

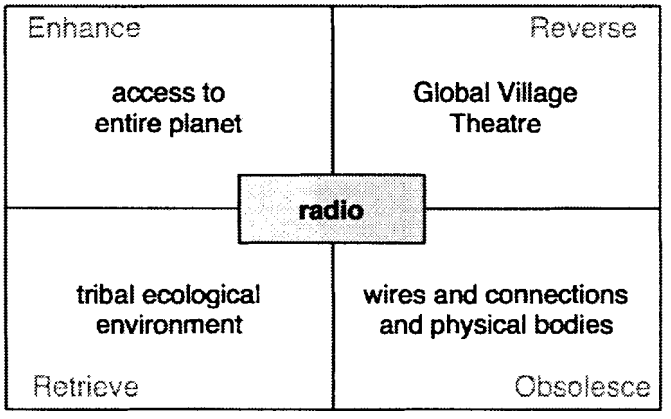

Figure 2.3 McLuhan's tetrad of a radio

Tetrads and figure/ground analytical tools are designed to work together (see Figure 2.4). Every tetrad contains two figures and two grounds as structurally inherent ratios, or, as McLuhan called it, the "logos-structure of each artefact." McLuhan argued

[32] McLuhan also likened the tetrad to Einsteinian four-dimensional space, which gives a "ground" of relativity to the three dimensions of space.

that oscillation between figures and grounds enabled tetradic analysis to perceive, sort and interpret the effects of any human artefact.

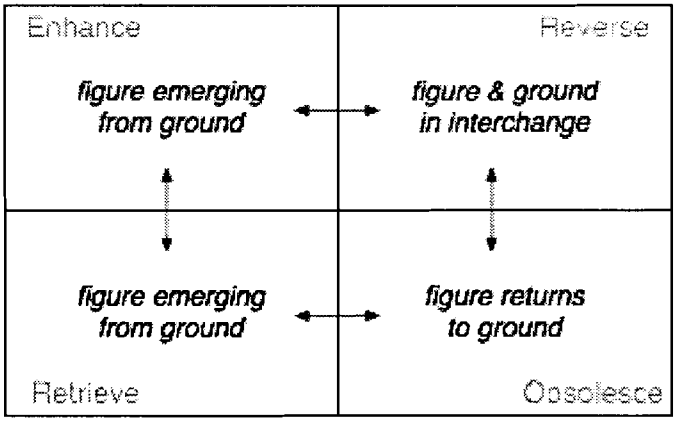

Figure 2.4 Relationship between the components of a tetrad

Work on TEDA has suggested that tetrads have many benefits, but when isolated from the broader context of human life they can overlook the ways a technology are used in relation to other social factors, such as health, leisure, or personal relationships. McLuhan's tools of analysis are useful for identifying the "figures" of technological development, but are poor at understanding how these will function within the much broader context of everyday life. A framework is required to "ground" the tetrads and compare data about human experience between different groups of people using similar technologies. For this we turn to the Ethos Protocol.

Ethos Protocol

The third analytical tool used in TEDA is the Ethos Protocol. It provides the researcher with a starting point to look for unnoticed, unforeseen, or unintended effects

of technology. The Ethos Protocol describes a basic ontology of human experience in the same spirit as the rhetorical concept of personal attributes, or "ethos"[33]:

> The Ethos Protocol provides us with a sketch of the way human experience is oriented, provides us with a way to speak about its specific cultural and social manifestations at any given time and by inserting a technology into the person's sphere of use, examine how this new medium will modify or condition potential experience or real experience of the constituents of life. (Onufrijchuk 2003).

TEDA identifies preexisting structures such as language, social systems, or gender expectations and enquires into how these are lived by individuals.

The Ethos Protocol assembles a set of constant characteristics of experience shaped by a life *course* in a life *world.* That is, some *thing* in some *place* at some *time* (see Figure 2.5).

The ethos protocol does this by looking at personal attributes (ethos) as a construct made up of social, material, and personal factors. These three—a *Self* in a world made up of *Things* and *Others*—provide the structure for all the data collection and analysis for TEDA. The categories are "orientations" because they describe the forces that pull us into certain kinds of relationships regardless of our place and social status. They direct attention or are sources that demand attention and effort. Each of the three broader domains of Self, Things, and Others divide into a set of eighteen categories, five each for Things and Others and eight for Self[34]:

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[33] Ethos is one of three types of persuasion in rhetoric, the other two being *pathos* (emotional) and *logos* (rational). Each of these comprise different components of TEDA, though the ethos component is the most fully tested with fieldwork.

[34] For a complete treatment of the categories, see Onufrijchuk (2005).

1. *Things* includes institutions and phenomena that appear to have a material or "objective" existence. Categories include *body*, *sustenance*, *material culture*, *chores and ordeals*, and *values*.

2. *Others* represents *family*, *social codes* of behaviour and institutions, *neighbouring*, *resources and exchange*, and *security*.

3. *Self* is broken into eight sub-categories including *personhood*, *conviviality*, *play*, *appetites*, *recreation*, *knowledge and media*, *life course*, and *projects*.

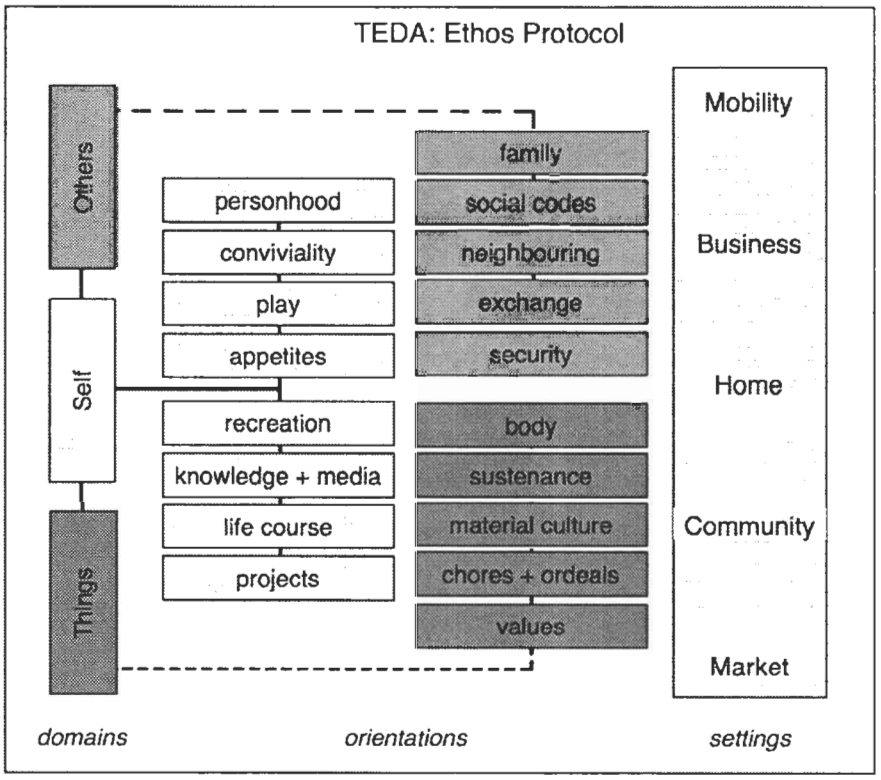

Figure 2.5 Diagram of the Ethos Protocol showing the orientations and settings

Settings is the first set of contextual categories we use. The settings are based partly on Ulf Hannerz's (1980) taxonomy of urban experience, and describe five spatial and temporal environments that provide the context for our daily activities. This allows for different circumstances and responses as a person moves through these settings and occupies them for various durations.

The categories are not a rigid matrix for categorizing experience, but they do provide a way to focus discussion and include a wide range of potential experience in any current, historical, or projected life course. The categories can be adapted to the needs of a client or research problem since the primary goal is that they are a *useful* way to direct questions and observations about technology use. They are also an effective way to ground the insights of the tetrads. By this process we are able to identify the intended and unforeseen uses of a technology and pair this insight with the projected evolution of that technology identified by the tetrad.

The Media Experience Database

During early field tests of TEDA, it became apparent that we needed a system to manage research data and make the figure/ground, tetrad, and Ethos Protocol analysis dynamic. I designed the Media Experience Database to fill this need and to enhance the theory of TEDA, not force the theory to conform to the technology. It has been used in several research projects, and continues to be developed to fulfil six goals:

1. Manage the large amounts of data collected during TEDA research;
2. code data electronically according to the figure/ ground, tetrad, and Ethos probes;
3. share findings with other projects contained in the same database;
4. make the data from figure/ground, tetrad, and Ethos Protocol probes dynamic;
5. analyze and present data in both qualitative (observation) and quantitative (numerical) summaries;
6. provide a presentation aid and takeaway (e.g. report) for research stakeholders.

To achieve these goals, I developed the Media Experience Database based on several design criteria. First, the system would have to be customizable to TEDA's needs.

This required functionality with different data formats such as audio, video, and extended sections of text. The selected technology would also have to connect with data existing in information environments such as MySQL[35] or other databases. This was necessary in order to share database contents once categories were established. It would also simplify expansion in the future. Security, cross-platform compatibility (PC/Mac), usability, and networking were also important factors. Flexibility was an important criteria in the early days of development due to our uncertainty about exactly how the database would function with the theoretical components of TEDA.

Several computer software packages are available for organizing social research data. Examples include N•Vivo™ (NU*dist™), ATLAS.ti™, QDA Miner™, QUALRUS™, CAQDES, SPSS™, TAMS Analyzer, and others[36]. Each has benefits and drawbacks, which I reviewed to determine which would be best for our purpose.

Many programs are priced beyond the scope of smaller research projects, including initial TEDA applications. It is also a challenge to find software that offers the level of customization required for building the Ethos Protocol categories without being overly complicated or having a daunting learning curve for the uninitiated. Many of the packages also restrict support to a limited range of multimedia formats, if any at all. Networking, interoperability with other database technologies, and cross-platform compatibility were other weakness of many packages.

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[35] MySQL is a popular open source database architecture based on a structured query language.
[36] Many of these have been developed for use with Grounded Theory (Strauss and Corbin 1990) or for generating and tabulating quantitative research data. See (SPSS Base 2004; N•Vivo 2004; HyperRESEARCH 2004; CAQDAS Networking Project 2004; ATLAS.ti 2004; NU*DIST 2004; Qualrus 2004; QDA Miner 2004; Weinstein 2004).

After careful review, I determined that it would be best to develop my own software for TEDA research and decided to use FileMaker® Pro as the underlying technology for the Media Experience Database[37]. FileMaker® Pro is a relational database that allows a custom visual interface to the content. A relational database was appropriate for TEDA's needs because I wanted to assign *values* ("attributes" in database speak) to different *records* ("units of analysis" in methodology speak)[38].

Components of the Media Experience Database

To use the Media Experience Database, the researcher first imports the research data and "codes" it according to TEDA categories, described later as part of the TEDA research process. These steps are accomplished by managing research data with the Media Experience Database interface, which has four "levels" of analysis.

Level one (see Figure 2.6) provides a space to describe the "setting" or context of the record. The first field is a *summary* of the record. This is usually a short, one sentence description of the general topic that was discussed. The next field coded is the *story*. This field is for narrative contained in the record. Stories can be used to illustrate the experience being described, like an archive of anecdotes. The final field is *technology*. This is a space to identify any specific technologies that are discussed in the record. For example, the main topic of research might be mobile phones, but if PDAs, bicycles, or Bluetooth™ are mentioned, they are noted here.

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[37] This was met with some surprise by outsiders to the project, with the implication being that only programmers could design software. This is untrue. Many tools exist that let researchers take control of his or her own work, and the pedagogical benefit of designing an application is a rewarding bonus.

[38] Another option is to use a more powerful database such as MySQL, which has many advantages, but I felt it added an unnecessary level of complexity for our needs.

Level two (Figure 2.7) codes for the *Settings* and *Orientations* of TEDA. First, the researcher accesses a drop down menu to select the Setting(s) referred to in the record. Multiple Settings may be selected. Next, the researcher goes through the categories of Thing, Self, and Other to check off which Orientations are appropriate to the record.

The third level (Figure 2.8) of coding is for the tetrad categories of *enhance, obsolesce, retrieve,* and *reverse*. The tetrad is only coded if discussed, implied, or revealed in the record. Likewise, not all of the four components of the tetrad will be filled in. This decision is left to the coder, and based on criteria defined at the beginning of the project and coder training. Again, only those components that are *useful*—providing indications and directions—should occupy the majority of the coder's time.

The fourth level (Figure 2.9) of the Media Experience Database is a space for any *notes* or *comments* the researcher may have about the record he or she is coding.

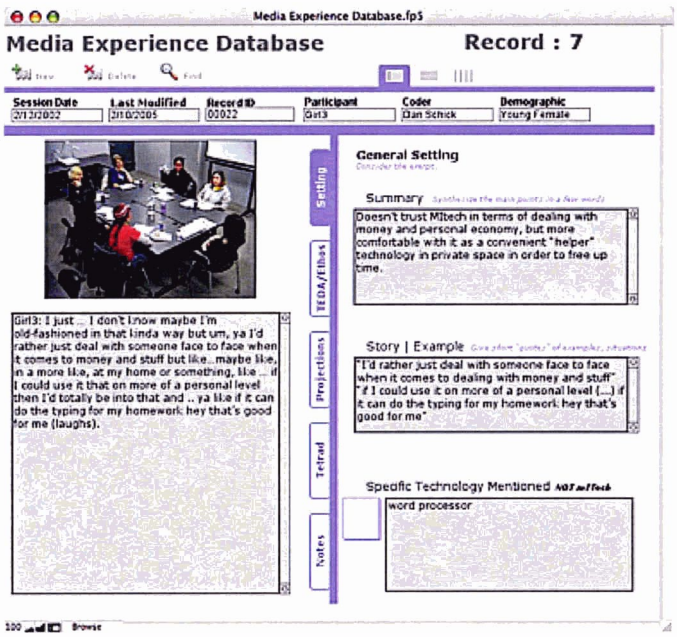

Figure 2.6 Level One of the MED: Independent variables
Screenshots (fig. 2.6 – 2.9, fig. 3.1) used by permission from FileMaker, Inc.

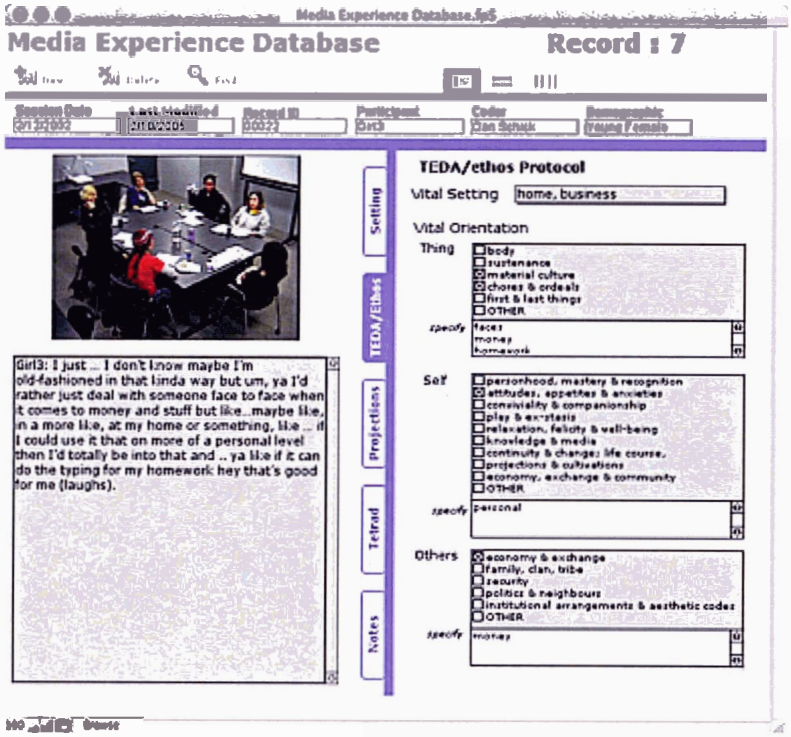

Figure 2.7 Level Two of the MED: Ethos Protocol

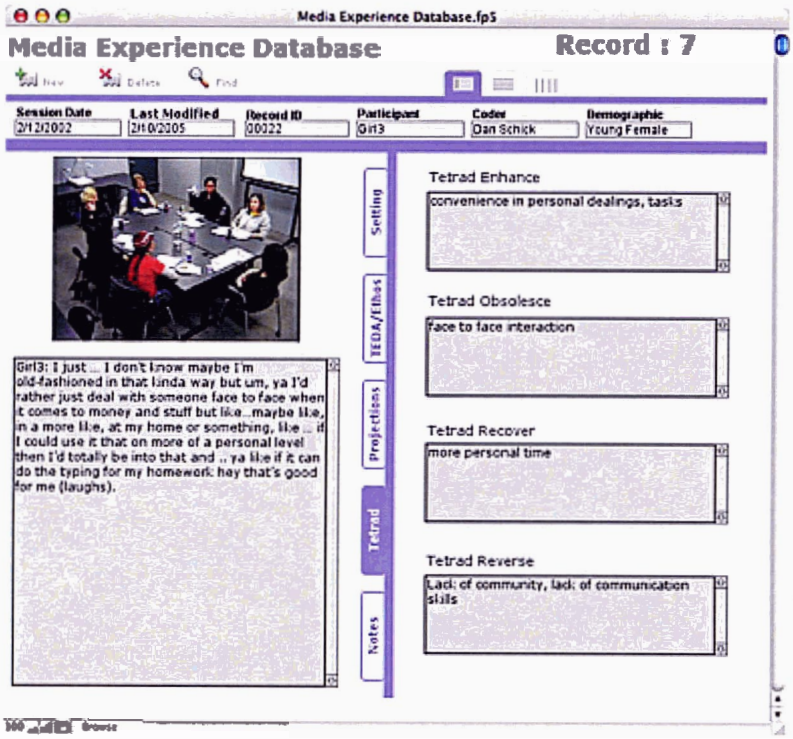

Figure 2.8 Level Three of the MED: Tetrad

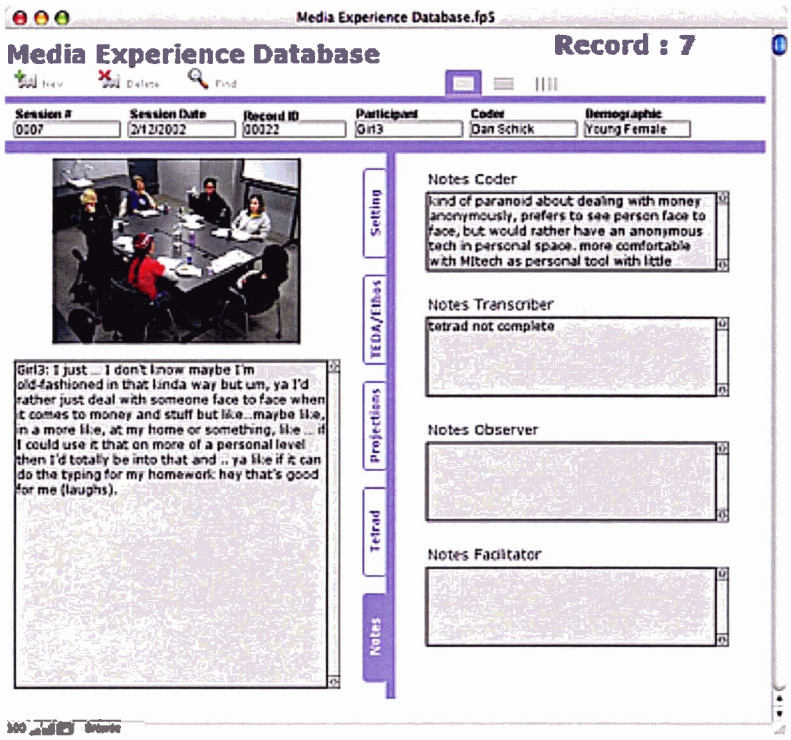

Figure 2.9 Level Four of the MED: Observation and Notes

Uses of the Media Experience Database

The Media Experience Database is useful in several ways. First, it makes the large amounts of data collected during TEDA research manageable. Like most information management computer software applications, the database provides the researcher with tools to archive, sort and retrieve many different types of data, such as text or video. Findings are accessible, and research stakeholders can experience the data in an accessible way. For example, instead of having to watch five hours of video to find the mention of RIM Blackberry™, they are able to locate, review, and then contextualize against the other data. This is accomplished by using basic database queries for keywords or coding criteria. The Media Experience Database has also been successful at animating most types of research data. During data analysis, figure/ground, tetrad, and Ethos Protocol categories can be compared in many different combinations.

Once the Media Experience Database was designed, it helped clarify TEDA's research process. Since many of the stages the researcher must go through involves the database, he or she begins at level one of the database and fills in the fields. The next section describes the order of these steps and some of the lessons learned while performing them.

The TEDA Research Process

TEDA's research process continues to evolve. It is iterative in execution and development, but five stages are consistently followed: Data collection, data organization, coding, analysis, and reporting.

Data Collection

The method used to collect data for TEDA assessment can vary depending on what is appropriate to the field environment and research problem. Examples of methods used to date are documentary research, focus groups, and interviews[39]. When coding the data, different analytical tools are conducive to different types of data. For example, figure/ground patterns accommodate qualitative and quantitative data, tetrads are most useful with qualitative descriptions, and the Ethos Protocol categories can contain data of any type. Using the Media Experience Database, each of these data types should be compatible.

[39] The spirit of TEDA interviews reflects the ancient Greek word *zetetic*, from the Pyrrhonists, or "seekers" that used the zetetic method to reveal unknown values by direct investigation, and Zetetic Philosophy that aspires to "continual enquiry after Truth" (Arthur Stanley, in Oxford English Dictionary). More rigorous than *poking around*, but less ominous than *interrogation*.

Data Organization

Interview transcription is required to take advantage of the textual query and sort capabilities of the database. This is one of the slowest stages in the research since full transcriptions with student transcribers require 3-4 hours for every hour of interview time. The next step is to edit the audio/video material into units of analysis, or "discourse units" (Have 2004, p.85). Early in the Media Experience Database's development I experimented with what would constitute one of these "units." It was a challenging process that reading a few conversation analysis texts (Hutchby and Wooffitt 1998) earlier on might have helped solve. However, the process provided a clearer idea of TEDA's unit of analysis, usually where one person expresses one idea about one thing. *Lexia* is a term that represents the units of a TADA analysis. As Roland Barthes defined it, "a series of brief, contiguous fragments... units of reading" that are "the best possible space in which we can observe meanings" (1970, p.13).

The next step in the research process is to edit any video that has been taken. I chose to edit[40], rather than "tag" or "mark,"[41] the complete video session for several reasons. Editing was fast, worked well with the database (keeping file sizes small), helped data archival (no problems when using computer operating systems with two gigabyte file size limits), improved speed on slower computers, provided quicker file transfer when working over a network, and let me remove some records from the database while leaving others, which could be necessary if one research participant did not grant clearance for his or her likeness to be used. Editing was performed with the Apple QuickTime Pro™

[40] Editing involves cutting media into segments, or altering the order or sequence of the media.
[41] Tagging or marking media could involve marking points in a media segment, but not altering the media's sequence. An example is an edit decision list, or marking timecode.

player and AppleScript™[42] was used to move and batch rename the roughly 250 files generated by each two-hour interview.

With interview sessions transcribed and video edited, the next step is to populate the database. FileMaker® Pro has a relational structure with "records" as the basic unit of the database, with each record containing several "fields" which contain a particular type of information specific to the record. The Media Experience Database contains records that correspond to the discourse units of each interview. A two-hour interview might consist of 250 records, each containing descriptive data such as date, record ID, coder name, video, and transcript. Working with the video is quick and efficient, taking roughly 20 minutes to input every 10 min of interview. Inputting the text from the transcriptions is more challenging and takes roughly 40 minutes for every 10 minutes of interview. I am considering ways to simplify or automate this stage of the process, but it has been interesting to note how much easier the video is to work with than the text.

Data Coding

After the database is populated, each record is "coded," that is, the record is assigned a value for each category of the Ethos Protocol. Standardized categories allow records to be compared with each other, as well as cross-referenced to material from other data sources. For example, if a record contains the video of a woman describing how she uses short message service (SMS) on her mobile phone at home to contact her children it would be coded like this: `device=telephone; orientation=family;`

[42] AppleScript™ is a scripting language for Apple™ Macintosh computers to automate processes for a single application, or between programs. It is like telling the computer, "please move this highlighted text from my text editor, open FileMaker Pro, create a new record, and add the text to the record."

`setting=home`. Early versions of the Media Experience Database included a wide range of fields for coders to experiment with. Because of the sheer number of fields it was taking 5-10 minutes to complete each record, or about 3 days to code every two-hour interview. Later applications reduced the number of fields and coding time has dropped considerably.

Data Analysis

After coding, the researcher begins data analysis. Analysis is contingent upon the research question or hypothesis the researcher is interested in pursuing. For the majority of its analysis, TEDA uses the Ethos Protocol to categorize data. This is a departure from other methods, such as Grounded Theory (Strauss and Corbin 1994), which rely on category generation to provide insight into the phenomenon of study. Both approaches have advantages and disadvantages, but the consistent use of Ethos Protocol categories provide a consistency to the data that allows it to be compared not only internally between samples, but to the data generated in other research projects. This lessens the need to have a specialized knowledge about a topic in order to generate effective categories. For example, the researcher's analysis of a field he or she is not familiar with might not only be misinterpreted, but could imply findings that are not representing the data very effectively. It also saves time in having to generate a new set of categories for every project.

When you cut into the present, the future leaks out
~ William S. Burroughs

Analysis should reveal something of the *entelechy* of an artefact, or "the conceptual essence of a thing" (Onufrijchuk 1993). The entelechy is the "vital force" an artefact embodies when it is animated within social environments, as opposed to the positivist deduction that treats the human organism according to the logic of a mechanism[43]. For example, when a new technology is introduced into a social environment it is not an appendage, added on like a trailer hitch to a car, but transformative to the entire system, like introducing a foreign chemical to the body. The human and the artefact are engaged in a relationship with each iteratively shaping the other.

Data Reporting

The report is the final and most important stage of the TEDA research process. Research problems, protocols, data, and findings only have value if they are effectively shared with relevant stakeholders, preferably in a language or format that is comprehensible by a broad range of disciplines. Final reports can take many forms, including paper report, user-operable Media Experience Database, charts and other graphic visualizations, or presentations.

Experience to date suggests that TEDA findings are best communicated in presentation to stakeholders. There are several reasons for this. First, it is sometimes a confusing task to explain that you are not doing human factors, usability, or ethnographic research on technology. Clarifying this is a challenge for every TEDA application and communicating the uses and limitations of TEDA is important.

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[43] It is this "vital force" that the "Vital Matrix" begins to map out. The Vital Matrix is the name for the grid that is produced when the eighteen categories of the Ethos Protocol are matched to the five Vital Settings. Putting data into this grid can begin to suggest areas of attention or inattention within an environment, or help visualize the development of service or disservice environments. The patterns that emerge from such an analysis might also suggest the "vital medium" acting within a given environment (Lingis 1998, p.27).

Presentations allow stakeholders to question and discuss what is being reported. They are not confined to reading a paper report that provides only the "top ten reasons youth love SMS," but rather can explore patterns of meaning as they develop for the whole research problem. Ideally, TEDA is an iterative process for researchers and stakeholders.

The Ethos Protocol categories, which initially highlight unexpected areas of attention or inattention, are reduced and a second round of analysis targets those areas that stakeholders believe will be the most valuable to pursue. A new hypothesis can be tested against the data since the coding identifies instances of attention not specifically limited to the initial research question. This is essential for identifying the "ground" that McLuhan argued essential to critical analysis. *During a presentation the researcher can perform interpretation of the data based on research questions brought up during the meeting, or can sort the data using independent variables not included in the research brief.* Finally, as the Ethos Protocol uses standardized language, researchers from multiple disciplines can adapt the template to their on-going technology experience research.

When the presentation is over, the researchers are able to write a report that reflects the discussion from the meeting. Each stakeholder's input can be addressed, explored further by the researchers, and then distributed in a paper or electronic document that is refined to meet the reported needs of the people involved, not the initial academic impressions of the researchers. Researchers can even distribute copies of the Media Experience Database to share with stakeholders. The Ethos Protocol makes it easy to explore new interpretations of the research findings.

Chapter Conclusion

In this chapter I have introduced the main components of TEDA. Beginning with the analytical tools, I discussed McLuhan's figure/ground oscillation technique as well as tetrads. Figure/ground is a method of analysis focusing on altering perception between the subject of study and the environment of its use. Tetrads are a way to make analysis dynamic—change with the research question—to capture the four simultaneous developmental patterns of all technologies (enhancement, obsolescence, retrieval, reversal). The third analytical component I discussed was the Ethos Protocol, a taxonomy of the basic orientations of user experience and the settings they may take place in. The Media Experience Database was introduced as a technical tool that can be used to invoke substantial research data in dynamic patterns based on the theoretical categories of TEDA. After discussing how the database was designed, I described the methodological process for TEDA research.

CHAPTER 3: FIELD STUDIES, DISCUSSION, AND RECOMMENDATIONS

Several research projects have used TEDA since the spring of 2002. I have learned many lessons from these applications, and based on these experiences, there are several recommendations for future uses of TEDA, and the Media Experience Database.

TEDA Field Studies

Several projects have used TEDA since the spring of 2002. I begin by briefly describing TEDA applications for several technology research and development organizations, as well as community and government groups. I then provide a more detailed discussion of the New Media Experience Roadmap Program, which was a larger application of TEDA that included extensive use of the Media Experience Database. These projects provided the opportunity to test TEDA with respect to the methodological process, opportunities, challenges, and usefulness it affords the study of emerging technologies. Working with TEDA in field research has also helped situate it with other methods in the positivist, interpretive, and critical traditions, providing the chance to evaluate how they may compliment and extend each other.

The most recent application of TEDA is the *Mobile MUSE* project sponsored by Heritage Canada. Mobile MUSE studies the development of innovative applications for mobile communications technologies. The Ethos Protocol has been used in two research areas. First, the Ethos Protocol provides a guide to tagging and coding examples of

relevant projects involving mobile communication technologies. Second, the Ethos Protocol provided the themes for interviews on new technology prototypes with project designers and engineers. This project is ongoing.

Research in collaboration with one multi-national corporation included *The Social Dynamics of Personal Media Management*. This was a three-phase project researching the social dynamics of personal media management to propose how current systems can be improved or extended and report on how young people relate meaning to media. TEDA was used for the focus group protocol.

Research in collaboration with a medium-sized technology firm included *The Use and Administration of Personal Wireless Devices*. This project used TEDA to examine the user experience of a specific technology. The goal was to develop a better understanding of the deliberate and unintended uses by different groups of people. TEDA was used for the interview protocol, and the Media Experience Database was used for coding and analysis.

For a large telecommunications and data company I was involved in *Entertainment Services Segment Insights*. This three-phase project investigated sociological and anthropological consumer insights—how people use their technologies—from a needs and adoption perspective. TEDA was used in interviews to identify the unmet needs of different groups with current services.

TEDA has also been proposed for policy assessment. *The Whistler Forum Study on Youth and Democracy in Canada* was conceived as a "living lab" to study the political and democratic attitudes of young Canadians. With a focus on the Squamish-Whistler-

Pemberton Corridor for its economic and demographic diversity, the goal of the project was to study how young people were using new information technologies to engage civil society, and what new political forms they saw emerging. The project was never started, but discussions about it challenged us to imagine how TEDA could be used to identify the value of civic engagement and identify the most important dimensions of these experiences with respect to current structures and institutions.

The most comprehensive application of TEDA to date has been the *New Media Experience Roadmap Program* (NMERP) carried out at the New Media Innovation Centre from fall 2002 to spring 2003. This project brought together researchers from various disciplines to map the development cycles and user expectations of emerging technologies and the "content applications" possible for a "mobile lifestyle." It was modelled on industry, design, and technology roadmaps by individuals or organizations such as Ideo[44], Jesse Games Garrett (2002), Anthony Ulwick (1999), Donald Norman (2004), and academic studies such as Grant McCracken's *Plenitude* (1997).

TEDA was used as NMERP's primary method for data gathering, coding, analysis, and often in presentations. The Ethos Protocol and Media Experience Database were used to meet NMERP's three primary needs: First, scope potential unforeseen needs and anxieties, second, construct "directional scenarios" for design and engineering teams to work with and, third, refine and focus the questions driving technology roadmapping as a whole. It was on this project that many elements of TEDA and the

[44] Ideo is a design firm based in San Francisco focused on innovation processes within organizations.

Media Experience Database were developed and the scope and duration of the project provided a suitable environment to test them.

Lessons Learned from the Field Studies

Data Collection

Data collection for most of the field trials was done in focus groups and group interviews. The interviews typically consisted of six to eight people, which were recorded with a video camera or in-room video recording system. Recording interviews with digital video allowed for easy transfer to my computer or a network where video would be archived, backed up, and then organized for transcription.

The transcription process was one of the most difficult aspects of the research to organize and execute. Finding transcribers is not always easy, especially when budgets are low, and the quality is important since so much of the final analysis, especially when using database queries, depends on the accuracy of the data input. Initially, there was a lot of frustration with the transcriptions because of how long it was taking, by both transcribers and the researchers waiting for the data. Early attempts were taking 2 days to code 42 minutes of interview. Poor audio and inflexible applications were blamed (Ralon 2002). I recompressed the videos at a higher bitrate and wrote an AppleScript™ that automated control of the QuickTime™ player from within Microsoft Word™. This sped up the transcribing process, but it was still a time consuming part of the research process.

Data Analysis

The Ethos Protocol functioned as a way to segment daily life to aid the development of patterns within a data set, as well as compare findings between research

studies. In this way, the categories were useful, providing a starting point for the researcher to work from, without having to start from scratch every time. It was also a way to get teams of coders working together. It was a potentially debilitating challenge to have graduate and undergraduate students working individually with the data, but then have the data come together to form common themes. There was the potential for so many interpretations and vocabularies that the data could have been unusable. The Ethos Protocol rallied everyone around a common set of themes that were useful.

Data Reporting

One lesson learned while reporting findings is that while the Ethos Protocol categories are useful to organize data, the tetrads were best received by research stakeholders as a way to understand findings[45]. There seems to be something provocative about the tetrads. They are temptingly simple—just four little questions—but can deliver rich data with broad implications.

Learning from Positivist, Interpretive, and Critical Traditions

One of the methodological challenges for studying emerging technologies is that the "what" of the study—the thing or phenomenon under examination—is often difficult to define. This is sometimes due to the fact that the "what" might not even exist yet, or

[45] For example, I gave a presentation to a designer, engineer, marketer, and administrator from a medium-sized technology firm. I had a written report they were reviewing. At one point, the engineer commented that in the tetrads, we reported, "broadband wireless connections retrieve the need for cable connections." "Why is that?" he asked. I hadn't performed that part of the analysis, because we often worked in large teams, so I didn't have a clue. Rather than shrug with uncertainty, I was able to open the Media Experience Database on my laptop and find the answer. Using keywords, I found the record that contained this particular tetrad. Then, moving to the first level of analysis, I played the video of a system administrator describing how broadband wireless connections were encouraging software developers to write software programs so large, that he needed a cable connection to run system updates on the software. The narrowband wireless was fine for user data, but still inadequate for downloading the software itself or updates.

that it is recently introduced into a new environment. In this case, the research attains a more circumspect or speculative tone, and the goal is not the validation of causal laws, or the interpretation of social acts, but the indication and direction for future works. Chapter one discussed some of the limitations of existing methods for such a research problem. In this situation, the question is, *how can we systematically study emerging patterns of meaning and effect of technology use?* TEDA is designed to address this, but in balanced assessment, every effort can contribute to and learn from the example of other methodological procedures.

> *Men never stop abstracting Nature until it becomes potential matter, without form; and, on the other hand, never cease from dissecting Nature until they arrive at the atom, things which, even if true, can be of little help to the welfare of mankind.*
> *~ Francis Bacon (1620/1994, p.75)*

Many methods may contribute to further development of TEDA. Some have developed in highly specialized fields, such as emerging disease research (Goldberg 1997; Waltner-Toews 2001) and cognitive science (Danesi 1995)[46], which may provide case studies, or serve as "periphery" cases suggesting new trends in methodology design. More general methods and theories also exist that might help TEDA. Grounded theory (Strauss and Corbin 1994) has evolved into a mature method with accompanying computer database tools. Actor-network theory (Latour 1993) provides an account of how all the elements of the human environment may be modelled, including human and

[46] Danesi's work in cognitive science is finding renewed value in the work of Giambattista Vico (1968) who built upon Bacon's study of the "text" of Nature and identified a new subject of study in the cultural artefacts, or "texts" of humans: "that the world of civil society has certainly been made by men, and that its principles are therefore to be found within the modifications of our own human mind" (McLuhan and McLuhan 1988, p.221).

technological artefacts. Conversation analysis (Hutchby and Wooffitt 1998) may be looked at for cues to establishing rigour in the coding of textual passages (i.e. interview transcripts). Experience design is an emerging field that combines work in several disciplines with a concern for managing and directing the environments of human activity. Information design (Tufte 2001) may help with the reporting and communication of TEDA research findings in ways understandable by the broadest range of stakeholders. Organization and knowledge management (Holsapple 2004; Engelbart 1992) ties business and information technology research to provide models for the management and circulation of knowledge within organizations. Philosophy of technology (Grant 1969; Feenberg 1999) situates human-created artefacts within the broader structures of the social and individual environments. Science and technology studies (Bijker, Hughes, and Pinch 1989) foregrounds the important role social relations and negotiated interests play in the conception and evolution of technology design. Feminism (Berg and Lie 2001) provides theory and case studies of technology use with a sensitivity for the subjective meanings and objective realities of how technology is experienced by discrete groups in society. More popular discourses around technology and society studies such as Barabâasi's *Linked* (2002) and Gladwell's *The Tipping Point* (2000) or marketing (Alreck and Settle 2004), can be equally provocative examples for the design of methods to study emerging technologies.

While each of these methods and practices can inform the future development of TEDA, it is necessary to return to an evaluation of the theoretical foundation of TEDA.

The next section compares TEDA to McLuhan's methodological criteria for the study of emerging technologies based on the lessons learned from the field studies.

Revisiting McLuhan's Criteria for the Study of Emerging Technologies

The criteria McLuhan developed for a method to study emerging technologies, discussed in chapter one, have been useful theories to inform the development of TEDA. They are useful to assess TEDA in fulfilling McLuhan's methodological goals to study emerging technologies.

1) Does TEDA allow us to describe the complete environment of technology use?

The first theme of McLuhan's work was the need to examine the periphery or most outlying cases for studying emerging technologies. TEDA addresses McLuhan's use of "cultural outsiders," in two ways. First, by interviews conducted with people outside the expected demographic. For example, during the New Media Experience Roadmap Program we talked with people from creative industries. For another project I interviewed a group that had no experience managing digital media. Both these sessions created an "anti-environment" by providing the perspective of people either not using a technology, or using it in ways other than they were intended.

The second way that TEDA analyzed the ideas and efforts of cultural outsiders was the development of a "speculative fiction protocol." As part of the New Media Experience Roadmap Program, Onufrijchuk organized a group to read and code the projections of key science fiction writers such as Philip K. Dick[47]. Because this data was

[47] Dick wrote *Blade Runner* (1968), *A Maze of Death* (1973), and other influential titles.

coded according to the Ethos Protocol the data would be able to be compared with the data that was gathered from the group interviews being run at the same time. The result, it was hoped, would be to run searches in the Media Experience Database and compare the speculative fiction with field data. This was one of the most interesting and potentially innovative applications of the database and Ethos Protocol together.

2) Is TEDA successful at providing pattern recognition?

Pattern recognition, the second theme, is an important part of McLuhan's theory for understanding the uses and effects of emerging technologies. Studying patterns in society is a well developed strategy in quantitative traditions such as surveys, and qualitative traditions. For example, ethnomethodology searches for observable patterns that reveal the normative rules governing members. Emerging from this, conversation analysis provides a rigorous system to contrast the more time-bound and context sensitive approach of ethnomethodology. Each of these offers lessons for successfully interpreting the meaning of these patterns. How does TEDA compare? TEDA begins by asking about the forms of human life in the field of relations that make up the social environment. To reveal the patterns in these relations, the *Ethos Protocol is a schematic for mapping the background of daily life—the human condition as a source of patterns of relation and meaning.*

3) Does TEDA animate data to reflect a dynamic environment?

The third theme of McLuhan's work discussed was the idea that the human environment is process, dynamic, and constantly changing. McLuhan's solution to this was the tetrad, which is an analytic tool to illustrate the four simultaneous patterns of

emerging technology development: enhancement, obsolescence, retrieval, and reversal. Tetrads have been a successful part of TEDA. Stakeholders have enjoyed them, coders have been effective at describing them, and they seem to have captured useful data about dynamic environments. However, as part of the Media Experience Database, we have done tetrads a slight disservice by applying them only to fragments of discourse, documents, and observation. To overcome this limitation of the Media Experience Database, tetrads should be applied to groups of discourse. This is part of a wider range of problems associated with the fragmentary nature of the database, addressed in the recommendations.

4) Are TEDA's findings useful indications and directions for emerging technologies?

Emerging technologies are complex phenomenon to study precisely because they have not yet assumed a final form, in a stage of transition, or are waiting to be conceived. Definite conclusions are premature. It is better, McLuhan has argued, to provide poetic (constructive) insight and provoke debate. TEDA has been styled as a method for describing the environment of technology use, the "fit" of a technology into a user's life. As such, its subject matter is, just as it was for McLuhan, provoking critical discussion about emerging technology among a wide range of stakeholders and providing developmental scenarios based on field data. If integrated into a complete development plan this can work well at the beginning of the development cycle. As this process evolves and more variables are clarified (e.g. design, use, demographics, manufacturing), more generalizable information is possible.

Recommendations for Future Practice

In this section I present thirty recommendations for future TEDA work. The most detailed recommendations are for the Media Experience Database. Recommendations are organized according to their relevance to logistic, interface, coding, analysis, and reporting components of TEDA and the Media Experience Database.

Logistic Recommendations for the Media Experience Database

1. *Clarify the value of transcription.* Transcripts are a time consuming and labour intensive stage of document analysis. While they certainly help, it would be good to do a thorough assessment of just how useful they are. For example, if the Ethos Protocol categories are adequate, or if adding a few simple categories could alleviate the need for transcriptions, that would save a lot of time. The video record remains.
2. *Test the use of QuickTime™ reference files.* The Media Experience Database currently uses separate video files for every record. This requires editing interview sessions into smaller sections. This has many advantages, as I discussed in chapter two. However, I think that using *reference files* might be a better solution. This would require one video file of the complete interview session. Then, "referenced" videos are created from that. Reference files do not contain any actual video data, but are links to certain parts of the original video file. My reason for suggesting this for future projects is the use of one video file allows more flexibility for reassembling the interview session. There is an emerging need to view records in relation to each other, in groups. Reference files would allow collections of records to be reassembled seamlessly, while maintaining the integrity of the shorter records for more specific analysis.

3. *Automate importing data into the Media Experience Database.* The content of some fields is automated. For example, the date, coder name, record ID number are all automatically filled out. However, automating the process of inserting transcripts and video would be useful. AppleScript™ should be able to help with this, and closer inspection of *FileMaker® Pro's* AppleScript™ libraries will clarify to what extend the scripting language can be used to automate the database.

4. *Simplify naming conventions* to accommodate operating systems that have trouble with punctuation, long file names, periods in names, or require extensions for all file types. There has been some trouble with cross platform compatibility due to the incompatibility of files strictly because of the formatting of their names.

5. *A better way to work with transcripts.* They take too long to add, especially since FileMaker® Pro imports them with their formatting which creates discontinuity. One solution might be to keep transcripts whole and reference internal links to a text document (similar to referenced video), such as XML tags. This could also allow the database to work with other document types.

6. *Transcribe directly into FileMaker® Pro.* This would be a short term solution for saving time with importing data into the database. It would also simplify matching video content with its matching transcript. It would also allow the coder to determine if a record warrants transcription, or if it can be left only as a video.

Interface Recommendations for the Media Experience Database

7. *More intuitive "levels" of coding* would help the Media Experience Database adjust to the scope of different research projects while maintaining the integrity of the database. For example, on one research project it might be determined that only the tetrad and device fields are useful. An interface can be designed that only contains these fields, making it clearer for the coder and stakeholders viewing the interface. Later, if it is determined that coding for the Ethos Protocol would add value, a more complete interface can be used. The information in the database stays the same, but what is viewable is the only thing that changes. I have done

this on previous projects and it worked very well (see Figure 3.1). However, switching between the different interfaces is currently awkward; providing buttons in the interface would be a good solution.

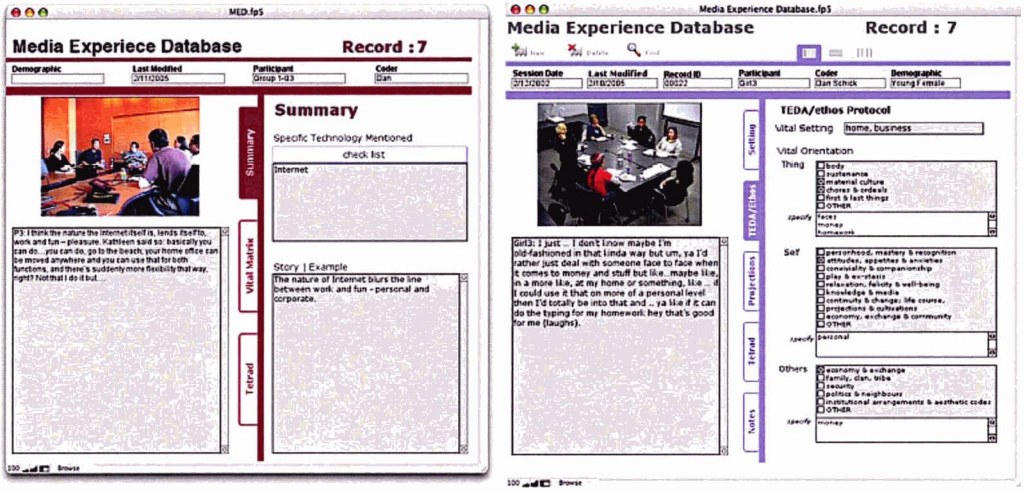

Figure 3.1 Simple and complex interfaces: Each interfa(ın display different amounts of data for the same record

8. *Online help, pop-ups, help balloons, or other reminders and suggestions* embedded into the database interface would be useful for coders and anyone not intimately familiar with TEDA components. This is important for definitions of the Ethos Protocol, tetrads, and other non-intuitive elements. It is also necessary when working with a constant flow of new student coders.

9. *Better tab navigation* would allow coders to more quickly move through the interface. This function is built into FileMaker® Pro and should be applied more systematically.

10. *Auto-sizing fields* for large and small screens would help, especially for the transcript field, where the content is of an indeterminate length. On smaller computer screens (1024x768 pixels and under), the coder cannot read the complete transcript and code at the same time because the dialogue box automatically closes. The solution is to decrease font size, enlarge the window, or force the window to expand to fit the text. By adjusting to fit the content, coders and analysts will be able to see all the content they are working with without

having to scroll inside a box. It will also benefit users with larger screens, which are not currently being fully exploited.

11. *Web accessibility needs to be tested.* This function is built into FileMaker® Pro and it would be useful to include Web requirements into the design specifications.

12. *Cross-platform display needs to be tested.* Some systems display fonts at larger sizes, skewing the alignment of fields. The use of fixed, rather than relative typefaces, should help.

13. *Standardize between radio buttons and drop-down lists* for attribute selection. Some fields, such as *Ethos Protocol*, use drop-down lists. Others, such as *devices* (noting if a specific technology is mentioned in the record) use radio buttons. This confused some coders and could be standardized.

14. *Continuity between the radio button screens and main interface.* Currently, they have a very different look and feel, and are sometimes difficult to navigate back from, giving the impression they are somehow "different" from the rest of the database. Coders need to be reassured they can easily get back to the main interface from any screen.

Coding Recommendations for TEDA and the Media Experience Database

15. *Clarify the unit of analysis.* This is one of the methodological challenges that TEDA still needs to address. It is often confusing what exactly a coder should be describing or interpreting. For example, in a group interview, sometimes an individual expresses personal ideas, assumptions about a group, or projections about a future experience. The data is gathered in a group, but the experience is most often individual. By questioning the context of technology experience, TEDA is a powerful tool for describing human-technology interaction. But to be "good science" it needs further clarification about what it is measuring, and what exactly it is describing.

16. *Group records into "sets" that can be coded separately.* There is currently no way to code the overall flow of the conversation in the Media Experience Database. For example, over a series of twenty records the mood in a room can go from light and creative to dark and sarcastic. With the records completely broken down into bits, there is no way to illustrate this broader continuity of ideas. The database contains broad (collections of transcriptions), and narrow (individual records containing "chunks" or "lexia"), but needs a "middle" level of analysis. Records should be grouped into sets when appropriate. This makes up the "ground" of the expression we are coding for. For example, a research participant might express support for something, but everyone else in the room might express displeasure through body language, words, or other means. This "feeling" in the room can have significant influence on the speaker's content and should be noted in the coding.

17. *Reference the level of data being coded, like primary, secondary, tertiary, etc.* This will be useful if the Media Experience Database is expanded to include more documentary sources of information. For example, coding reports from other institutions would allow the researcher to search for results including both interview (primary) and third party findings (secondary), or refine the search to only one or the other.

18. *Coding Paralanguage has been suggested by many coders.* These shrugs and gestures, as well as expressions from the group like sustained laughter or groaning. Coding for them might help coding for the "ground" of a record.

19. *Standardize the "devices" field.* This is a somewhat problematic section when working with large groups of coders since the definition of a technology can vary. Initially, I had the coders fill in this section as they proceeded through each record. The result is a mix of duplicates, repeats, and alternate names for the same technologies. For example, "cell", "mobile", "Cell", and "cell phone" all appear for the same thing. This is a problem when a database search will only turn up the term that is specifically requested. In hindsight, I should have provided coders with clear rules for inputting this data. In future, this section should be

defined beforehand, with the majority of categories already input so that coders only have to select the appropriate value, as they do for most other fields in the database.

20. *Inter-coder reliability needs to be tested.*

21. *Support figure/ground coding.* Currently, the Media Experience Database captures the figures of expression in interviews. In the future, it would be useful to add a second layer of coding, a "ground" for the database's "figure," so that we can readily detect the shifts in agreement and interest that are vital to group interactions. It captures isolated responses, and the continuity of thought processes suffers. This is a challenge if trying to detect shifts in perspective from one record to the next.

22. *Standardize the terms used by different coders.* A dictionary should be developed so coders have a reference for what terms are appropriate to describe different fields. An auto-complete feature would help with this (when the computer automatically finishes words typed in). There is also an issue with capitalization; some coders capitalize terms and others don't, but the database treats each as a separate term.

Recommendations for Data Analysis with the Media Experience Database

23. *Figure/ground needs to be a constant presence in coding and analysis.* A button, colour guides, or split screens could be used to switch between modes of figure and ground.

24. *Integration of figure/ground, tetrad, and Ethos Protocol* is still challenging. While each can be coded separately, connecting them during analysis is not always intuitive. This is an example of an area where more theoretical development could help improve practice.

25. *Keywords in tetrads might help their comparison.* For example, the Ethos Protocol provides common themes for orientations of experience. A similar set of categories would help reveal *patterns* of tetrads.

26. *Search and query instruction will help simplify how exactly a researcher should be using the Media Experience Database for data analysis.* This could be supported by the design of interfaces specifically for data analysis, rather than only the coding screens that currently exist.

Reporting and Presentation Recommendations for TEDA and the Media Experience Database

27. *Visualization techniques* have been experimented with, including the dynamic integration of Vital Matrices (combining more than one Vital Matrix), but efforts have so far been preliminary. This is an area that has rich possibilities, and research being done in other fields is demonstrating the use of data visualization. Examples include work by Charles Minard (1781-1870), Mark Lombardi (1951-2000), and Ben Shneiderman (2002).
28. *Create exportable versions of the Media Experience Database* that can be given to stakeholders. TEDA is at its best when used in iterative research cycles, and giving the tools to stakeholders to search the database adds to this process.
29. *Develop a presentation protocol.* A guide for how to facilitate the presentations would help experienced and new researchers make use of the data generated by TEDA and the Media Experience Database.
30. *Create more compelling way to describe findings from tetradic analysis.* Tetrads work well as boxes, and have been successful tools for stakeholders, but communicating their simultaneity and dynamic nature would add to their effectiveness. McLuhan envisioned the tetrad as "waves" of effects—continuous and dynamic—and it would be nice to capture this with TEDA data.

Chapter Conclusion

In this chapter I provided a summary of TEDA field studies of emerging technologies. Based on this field experience, I discussed some of the lessons learned

during the four stages of data collection, coding, analysis, and reporting. With these lessons in consideration, I revisited McLuhan's criteria for description, animation, and usefulness to describe how TEDA, as a new methodological model, reflects the theoretical framework developed by McLuhan to overcome the limitations of previous models. I concluded this chapter with a list of recommendations for future applications of TEDA and development of the Media Experience Database for the study of emerging technologies.

CONCLUSION

Only the simplest formulae can escape contradiction. Emerging technology is not one of these. Shadow falls everywhere and the most profound conclusions can never exceed "maybe." It is a sphere of activity that contains every essence of our experience and contradictions of being human. This uncertainty can be alarming, and the inevitable failure to reconcile it leads to the fragmentation of experience until it can be rationalized: Reduced to a simple formula.

Emerging technology is an important field of study. As these new forms integrate into the fibre of our daily lives, there is an increased need to not only understand their causes, but also consequences. This task poses some unique methodological challenges, which are important to recognize so the appropriate methods can be used for this subject of study. We cannot begin with the assumption that one method should take precedence for all things, nor should methods be badges to signal ideological allegiance.

The methods used for a study must be designed to meet the needs of the subject at hand: emerging technology. The positivist methods isolate and reduce to prove cause and effect, but how can we put something into a laboratory or isolate variables for something that does not yet exist? Interpretive and descriptive methods excel at articulating our relationships with depth and sensitivity, but how can we describe social processes among actors that are not yet involved? Critical methods call attention to the

negotiation of interests that colour all facets of our lives, but how can we begin to criticize new forms that we cannot yet describe?

The future is not a found object that we only need to prepare for. Our decisions today have ultimate impact on the shape of tomorrow. Marshall McLuhan was driven to provide the tools necessary for people to think critically about the technologies they use. He remains a problematic figure, but while guilty of many academic demerits, he established a theoretical foundation for the study of emerging technologies. Perhaps (but not certainly) he placed too much emphasis on the effective powers of technology, or faith in the new sciences of a bicameral mind. The goal throughout his career was to encourage critical assessment, and by that account, he was successful in his time. The more useful legacy today is the theory and methodological tools he developed to realize this critical assessment. The experience of TEDA suggests that McLuhan is a useful starting point for developing a holistic, and systematic, way to study emerging technology.

TEDA is an effort to retreat from the particularizing of experience and animate the descriptions of the periphery. It is a method to invoke the substantive questions of a research problem and imagine how new designs might factor into our increasingly sped-up world of evolving technology. McLuhan's figure/ground and tetrad deliver pattern recognition and constantly changing relationships. The Ethos Protocol is a map of the way human experience is oriented, and provides a way to describe its specific cultural and social forms by inserting a technology into the user's environment (as opposed to a laboratory). With it, we describe the broad effects of emerging technology and reassemble

them into a more inclusive representation of the web of relations and meaning that makes up the environment of future experience. It is the fit of future technology in everyday life.

TEDA is not a ready-made solution, waiting for the cellophane wrap to be removed. TEDA is in the first steps of learning a different way to walk. It is not by any presumed "newness" or originality that TEDA's value is considered. Rather, TEDA represents a unique combination of parts, the whole of which intends to have value for the systematic study of emerging technology. The field studies presented in chapter three suggest this is true.

TEDA exists unfixed, still in transition and development. This contributes to the challenge of providing simple definitions and explanations of its scope and uses. But this volatility also provides the greatest opportunity for change, and the potential for future development is truly exciting. For TEDA, one of the largest efforts will involve complementing the Ethos Protocol with pathos (emotional) and logos (reason) categories. For the Media Experience Database, much work remains to be done to address the recommendations in chapter three.

This thesis is a starting point for these efforts. It has compared the analytical tools of other methods, explained the theoretical foundation, and described the analytical tools of the TEDA methodology. While most of my discussion focused on the Media Experience Database I developed to complement TEDA, many of these insights are relevant to the broader discourse about the study of emerging technology. It is an important subject, and can now claims an emerging method.

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